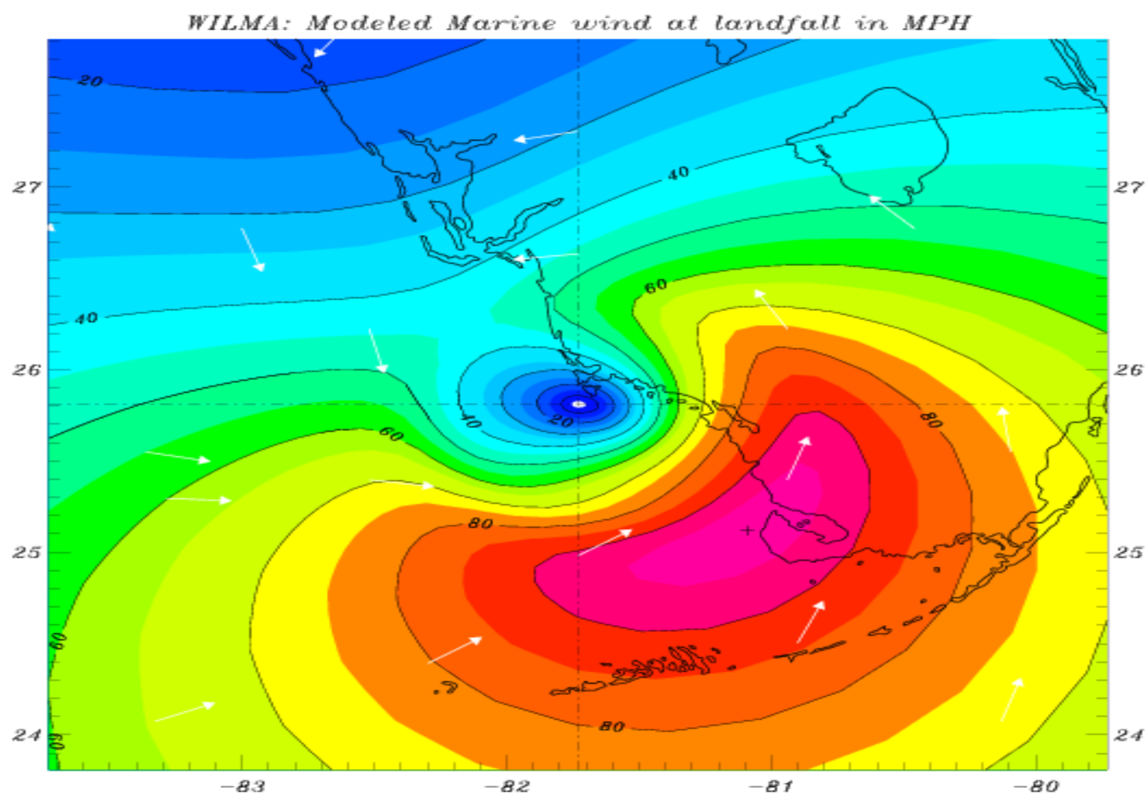
FLORIDA
PUBLIC HURRICANE LOSS MODEL 7.0

Submitted in compliance with the 2017 Standards of the
Florida Commission on Hurricane Loss Projection Methodology
Submitted on May 13, 2019



Hurricane Model Identification

Name of Hurricane Model: Florida Public Hurricane Loss Model

Hurricane Model Version Identification: V7.0

Interim Hurricane Model Update Version Identification:

Hurricane Model Platform Name and Identifications:

Interim Data Update Designation:

Name of Modeling Organization: Florida International University

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Date: May 13, 2019

May 13, 2019

Chair, Florida Commission on Hurricane Loss Projection Methodology
c/o Donna Sirmons
Florida State Board of Administration
1801 Hermitage Boulevard, Suite 100
Tallahassee, FL 32308

Dear Commission Chairman:

I am pleased to inform you that the revised version of -7.0 of Florida Public Hurricane Loss Model is ready for review by the Commission. The FPHLM model has been reviewed by professionals having credentials and/or experience in the areas of meteorology, engineering, actuarial science, statistics and computer science; for compliance with the Standards, as documented by the expert certification forms G1-G7.

Enclosed are 7 bound copies of our submission, which includes the summary statement of compliance with the standards, the forms, and the submission checklist.

Please contact me if you have any questions regarding this submission.

Sincerely,

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Director, Laboratory for Insurance, Economic and Financial Research
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Statement of Compliance and Trade Secret Disclosure Items

The Florida Public Hurricane Loss Model -7.0 is intended to comply with each Standard of the 2017 Report of Activities released by the Florida Commission on Hurricane Loss Projection Methodology. The required disclosures, forms, and analysis are contained herein.

The source code for the loss model will be available for review by the Professional Team.

Hurricane Model Submission Checklist

A. Please indicate by checking below that the following has been included in your submission documentation to the Florida Commission on Hurricane Loss Projection Methodology.

Yes	No	Item
X		1. Letter to the Commission
X		a. Refers to the signed Expert Certification forms and states that professionals having credentials and/or experience in the areas of meteorology, statistics, structural/wind engineering, actuarial science, and computer/information science have reviewed the model for compliance with the standards
X		b. States model is ready to be reviewed by the Professional Team
X		c. Any caveats to the above statements noted with a detailed explanation
X		2. Summary statement of compliance with each individual standard and the data and analyses required in the disclosures and forms
X		3. General description of any trade secret information the modeling organization intends to present to the Professional Team and the Commission
X		4. Hurricane Model Identification
X		5. Seven (7) Bound Copies (duplexed)
X		6. Link emailed to SBA staff containing all required documentation that can be downloaded from a single ZIP file
X		a. Submission document and Form A-1, Zero Deductible Personal Residential Hurricane Loss Costs by ZIP Code in PDF format
X		b. PDF submission file supports highlighting and hyperlinking, and is bookmarked by standard, form, and section
X		c. Data file names include abbreviated name of modeling organization, standards year, and form name (when applicable)
X		d. Form S-6 (Hypothetical Events for Sensitivity and Uncertainty Analysis), if required, in ASCII and PDF format
X		e. Forms M-1, Annual Occurrence Rates, M-3, Radius of Maximum Winds and Radii of Standard Wind Thresholds, V-2, Hurricane Mitigation Measures and Secondary Characteristics, Range of Changes in Damage, V-4, Differences in Hurricane Mitigation Measures and Secondary Characteristics, A-1, Zero Deductible Personal Residential Hurricane Loss Costs by ZIP Code, A-2A, Base Hurricane Storm Set Statewide Hurricane Losses (2012 FHCF Exposure Data), A-2B, Base Hurricane Storm Set Statewide Hurricane Losses (2017 FHCF Exposure Data), A-3A, 2004 Hurricane Season Losses (2012 FHCF Exposure Data, Form A-3B, 2004 Hurricane Season Losses (2017 FHCF Exposure Data), A-4A, Hurricane Output Ranges (2012 FHCF Exposure Data), Form A-4B, Hurricane Output Ranges (2017 FHCF Exposure Data), A-5, Percentage Change in Hurricane Output Ranges (2012 FHCF Exposure Data), A-7, Percentage Change in Logical Relationship to Hurricane Risk, A- 8A, Hurricane Probable Maximum Loss for Florida (2012 FHCF Exposure Data), and A-8B, Hurricane Probable Maximum Loss for Florida (2017 FHCF Exposure Data), in Excel format
X		Form V-3, Hurricane Mitigation Measures and Secondary Characteristics, Mean Damage Ratios and Hurricane Loss Costs (Trade Secret Item), Form V- 5, Differences in Hurricane Mitigation Measures and Secondary Characteristics, Mean Damage Ratios and Hurricane Loss Costs (Trade Secret Item), and Form A-6, Logical Relationship to Hurricane Risk (Trade Secret Item), in Excel format if not considered as Trade Secret

Yes	No	Item
X		7. All hyperlinks to the locations of forms are functional
X		8. Table of Contents
X		9. Materials consecutively numbered from beginning to end starting with the first page (including cover) using a single numbering system, including date and time
X		10. All tables, graphs, and other non-text items consecutively numbered using whole numbers, listed in Table of Contents, and clearly labeled with abbreviation defined
X		11. All column headings shown and repeated at the top of every subsequent page for forms and tables
X		12. Standards, disclosures, and forms in *italics*, modeling organization responses in non-italics
X		13. All graphs and maps conform to guidelines in **II. Notification Requirements A.4e.**
X		14. All units of measurement clearly identified with appropriate units used
X		15. All forms included in submission appendix except Trade Secret Items. If forms designated as a Trade Secret Item are not considered as trade secret, those forms are to be included in the submission appendix
X		16. Hard copy documentation identical to electronic version
X		17. Signed Expert Certification Forms G-1 to G-7
X		18. All acronyms listed and defined in submission appendix

B. Explanation of "No" responses indicated above. (Attach additional pages if needed.)

Florida Public Hurricane Loss Model 7.0		May 13, 2019
Model Name and Identification	Modeler Signature	Date

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GENERAL STANDARDS

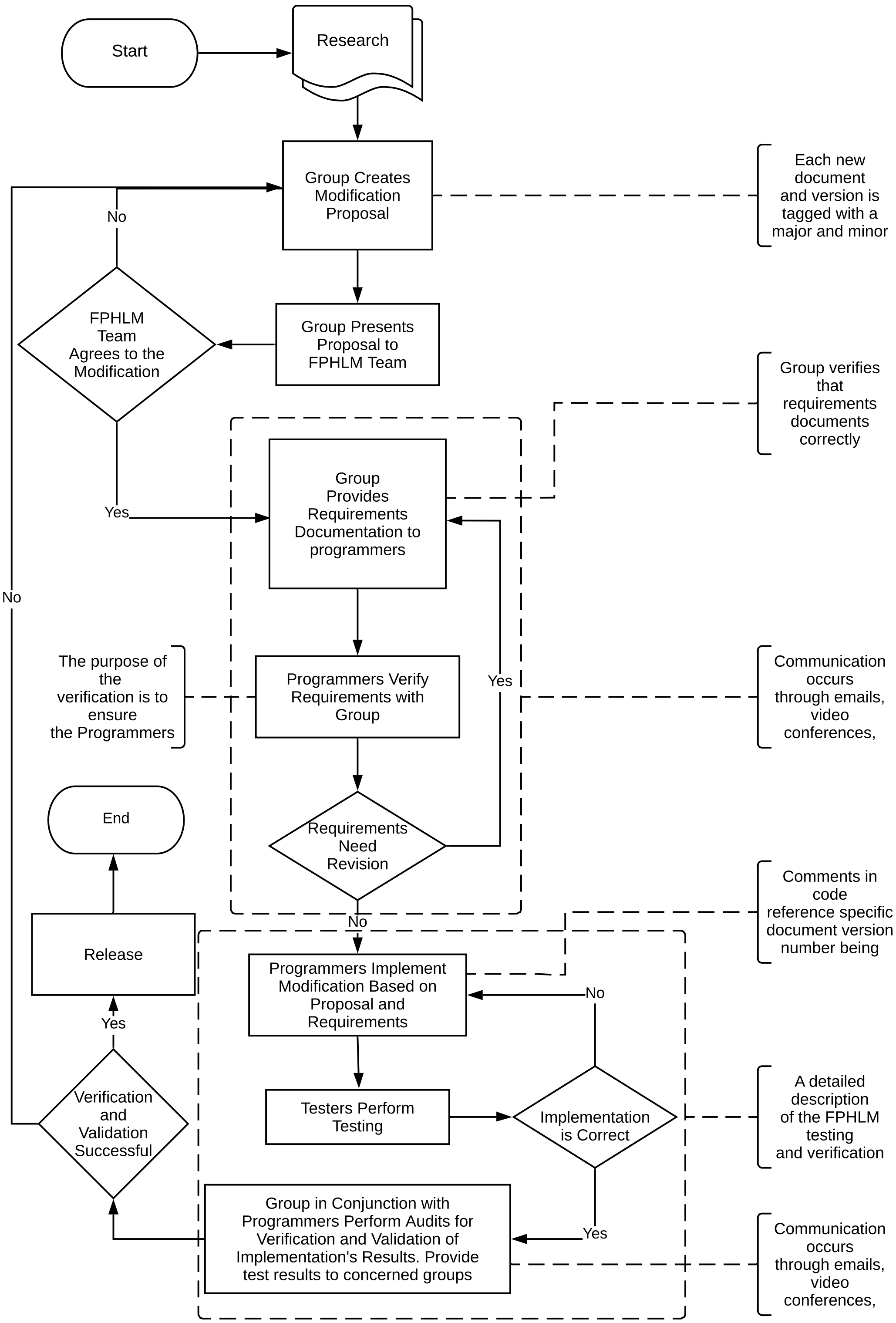
G-1 Scope of the Hurricane Model and Its Implementation

A. The hurricane model shall project loss costs and probable maximum loss levels for damage to insured residential property from hurricane events.

The Florida Public Hurricane Loss Model estimates loss costs and probable maximum loss levels from hurricane events for personal lines and commercial lines of residential property. The losses are estimated for building, appurtenant structure, contents, and additional living expense (ALE).

B. The modeling organization shall maintain a documented process to assure continual agreement and correct correspondence of databases, data files, and computer source code to slides, technical papers, and modeling organization documents.

The FPHLM group members follow the process specified in the flowchart of in order to assure continual agreement and correct correspondence of databases, data files, and computer source code to slides, technical papers, and FPHLM documents.



FPHLM Team: All members of the FPHLM
Groups: Meteorology, Engineering, Statistics, Actuarial, and computer Science

Figure 1. Process to assure continual agreement and correct correspondence

C. All software and data (1) located within the hurricane model, (2) used to validate the hurricane model, (3) used to project modeled hurricane loss costs and hurricane probable maximum loss levels, and (4) used to create forms required by the Commission in the Hurricane Standards Report of Activities shall fall within the scope of the Computer/ Information Standards and shall be located in centralized, model-level file areas.

All software and data used to validate the model, project insured loss cost and PML, and create forms required by the Commission are centrally maintained in the model hardware infrastructure and easily accessible by appropriate team members, and comply with the Computer/Information Standards.

Disclosures

1. Specify the hurricane model version identification. If the hurricane model submitted for review is implemented on more than one platform, specify each hurricane model platform. Specify which platform is the primary platform and verify how any other platforms produce the same hurricane model output results or are otherwise functionally equivalent as provided for in the "Process for Determining the Acceptability of a Computer Simulation Hurricane Model" in VI. Review by the Commission, I. Review and Acceptance Criteria for Functionally Equivalent Hurricane Model Platforms.

The model name is Florida Public Hurricane Loss Model (FPHLM). The current version identification is -V7.0.

2. Provide a comprehensive summary of the hurricane model. This summary should include a technical description of the hurricane model, including each major component of the hurricane model used to project loss costs and probable maximum loss levels for damage to insured residential property from hurricane events causing damage in Florida. Describe the theoretical basis of the hurricane model and include a description of the methodology, particularly the wind components, the vulnerability components, and the insured loss components used in the hurricane model. The description should be complete and must not reference unpublished work.

The model is a very complex set of computer programs. The programs simulate probable future hurricane activity, including where and when hurricanes form, their tracks and intensities, their wind fields and sizes; how they decay and how they are affected by the terrain along the tracks after landfall; how the winds interact with different types of residential structures; how much they can damage roofs, windows, doors, interior, and contents, etc.; how much it will cost to rebuild the damaged parts; and how much of the loss will be paid by insurers. The model consists of three major components: wind hazard (meteorology), vulnerability (engineering), and insured loss cost (actuarial). It has over a dozen subcomponents. The major components are developed independently before being integrated. The computer platform is designed to accommodate future subcomponents or enhancements. Following is the description of each of the major components and the computer platform.

Meteorology Component

Hurricane Track and Intensity

The storm track model generates storm tracks and intensities on the basis of historical storm conditions and motions. The initial seeds for the storms are derived from the HURDAT database. For historical landfalling storms in Florida and neighboring states, the initial positions, date of year, intensities, and motions are taken from the track fix 36 hours prior to first landfall. For historical storms that do not make landfall but come within 62 sm (100 km) of the coast, the initial conditions are taken from the track fix 36 hours prior to the point at which the storm first comes within 62 sm of the coast (threat zone) and has a central pressure below 1005 mb. Small, uniform random error terms are added to the initial position, the storm motion change, and the storm intensity change. The initial conditions derived from HURDAT are recycled as necessary to generate thousands of years of stochastic tracks. After the storm is initiated, the subsequent motion and intensity changes are sampled from empirically derived probability distribution functions over the model domain (Figure 2).

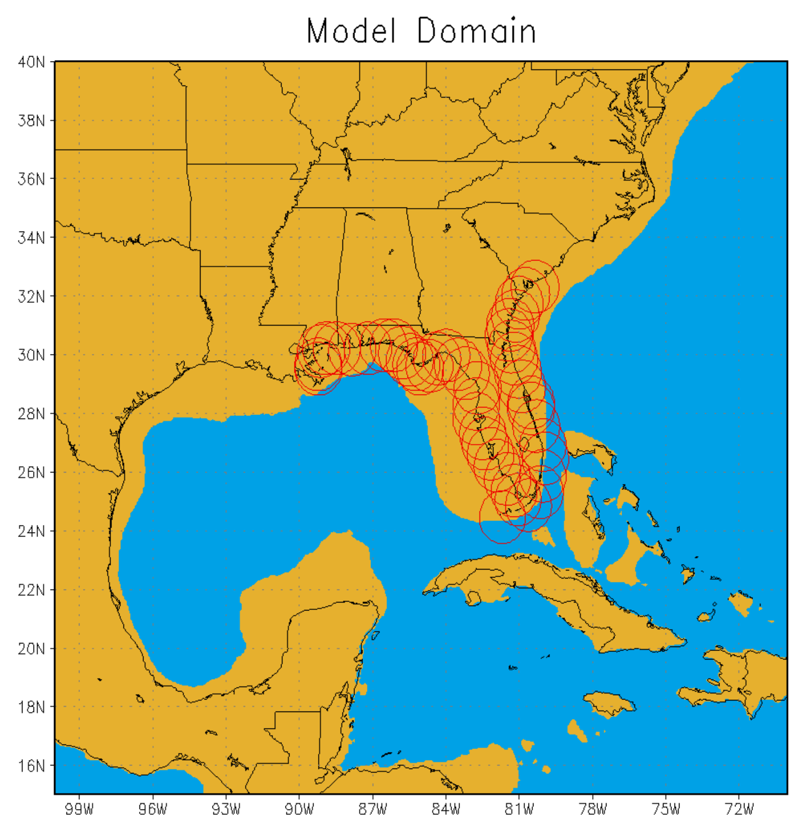


Figure 2. Florida Public Hurricane Loss Model domain. Circles represent the threat zone. Blue color indicates water depth exceeding 656 ft (200 m).

The time evolution of the stochastic storm tracks and intensity are governed by the following equations:

$$\Delta x = \frac{c\cos(\theta)\,\Delta t}{\cos(y)}$$

$$\Delta y = c\sin(\theta)\Delta t$$

$$\Delta p = w\Delta t$$

where (x, y) are the longitude and latitude of the storm, (c, θ) are the storm speed and heading (in conventional mathematical sense), p is central pressure, w is the rate of change in p, and Δt is the time step. The time step of the model is currently one hour. The change in storm speed and direction $(\delta c, \delta\theta)$ are sampled at every 24-hour interval from a probability distribution function (PDF). The intensity change after the initial 24 hours of track evolution is sampled every six hours to capture the more detailed evolution over the continental shelf (shallow water). From the 24-hour change in speed and heading angle, we determine the speed and heading angle at each one-hour time step by assuming the storm undergoes a constant acceleration that gives the 24-hour sampled change in velocity. For changes in pressure, we first sample from a PDF of relative intensity changes, δr, for the six-hour period and then determine the corresponding rate of pressure change, w. The relative intensity is a function of the climatological sea surface temperatures and the upper tropospheric 100 mb temperatures. The PDFs of the changes $(\delta c, \delta\theta, \delta r)$ depend on spatial location, as well as the current storm motion and intensity. These PDFs are of the form

$$PDF(\delta a) = A\,(\,\delta a, a, x, y\,)$$

where a is either c, θ, or r and are implemented as discrete bins that are represented by multi-dimensional matrices (arrays), $A(l,m,i,j)$. The indices (i,j) are the storm location bins. The model domain (100W to 70W, 15N to 40N) is divided into 0.5-degree boxes. The index m represents the bin interval that a falls into. That is, the range of all possible values of a are divided into discrete bins, the number of which depends on the variable, and the index m represents the particular bin a is in at the current time step. As with a, the range of all possible values of the change in a are also discretely binned. Given a set of indices (m,i,j), which represent the current storm location and state, the quantity $A(l,m,i,j)$ represents the probability that the change in a, δa, will fall into the l'th bin. When A is randomly sampled, one of the bins represented by the l index, e.g. l', is chosen. The change of a is then assigned the midpoint value of the bin associated with l'. A uniform random error term equal to the width of bin l' is added to δa, so that δa may assume any value within the bin l'.

The PDFs described above were generated by parsing the HURDAT database and computing for each track the storm motion and relative intensity changes at every 24- and 6-hour interval, respectively, and then binning them. Once the counts are tallied, they are then normalized to obtain the distribution function. For intensity reports for which pressure is not available, a wind pressure relation developed by Landsea et al. (2004) is used. In cases where there is no pressure report for a track fix in the historical data but there are two pressure reports within a 24-hour period that includes the track fix, the pressures are derived by linear interpolation. Otherwise the pressure is derived by using the wind-pressure relation. Extra-tropical systems, lows, waves, and depressions are excluded. Intensity changes over land are also excluded from the PDFs. To ensure a sufficient density of counts to represent the PDFs for each grid box, counts from nearest neighbor boxes, ranging up to 2 to 5 grid units away (both north-south and east-west direction), are aggregated. Thus, the effective size of the boxes may range from 1.5 to 5.5 degrees but are generally a fixed size for a particular variable. The sizes of the bins were determined by finding a compromise between large bin sizes, which ensure a robust number of counts in each bin to define the PDF, and small bin sizes, which can better represent the detail of the distribution of storm motion characteristics. Detailed examinations of the distributions, as well as sensitivity tests, were done. Bin sizes need not be of equal width, and a nonlinear mapping function is used to provide unequal-sized bins. For example, most storm motion tends to be persistent, with small changes in direction and speed. Thus, to capture this detail, the bins are more fine-grained at lower speed and direction changes.

For intensity change PDFs, boxes which are centered over shallow water (defined to be less than 656 ft deep, see Figure 2) are not aggregated with boxes over deeper waters. Deeper waters may have significantly higher ocean heat content, which can lead to more rapid intensification [see, for example, Shay et al. (2000); DeMaria et al. (2005); Wada and Usui (2007)].

In Figure 3 we show a sample of tracks generated by the stochastic track and intensity model.

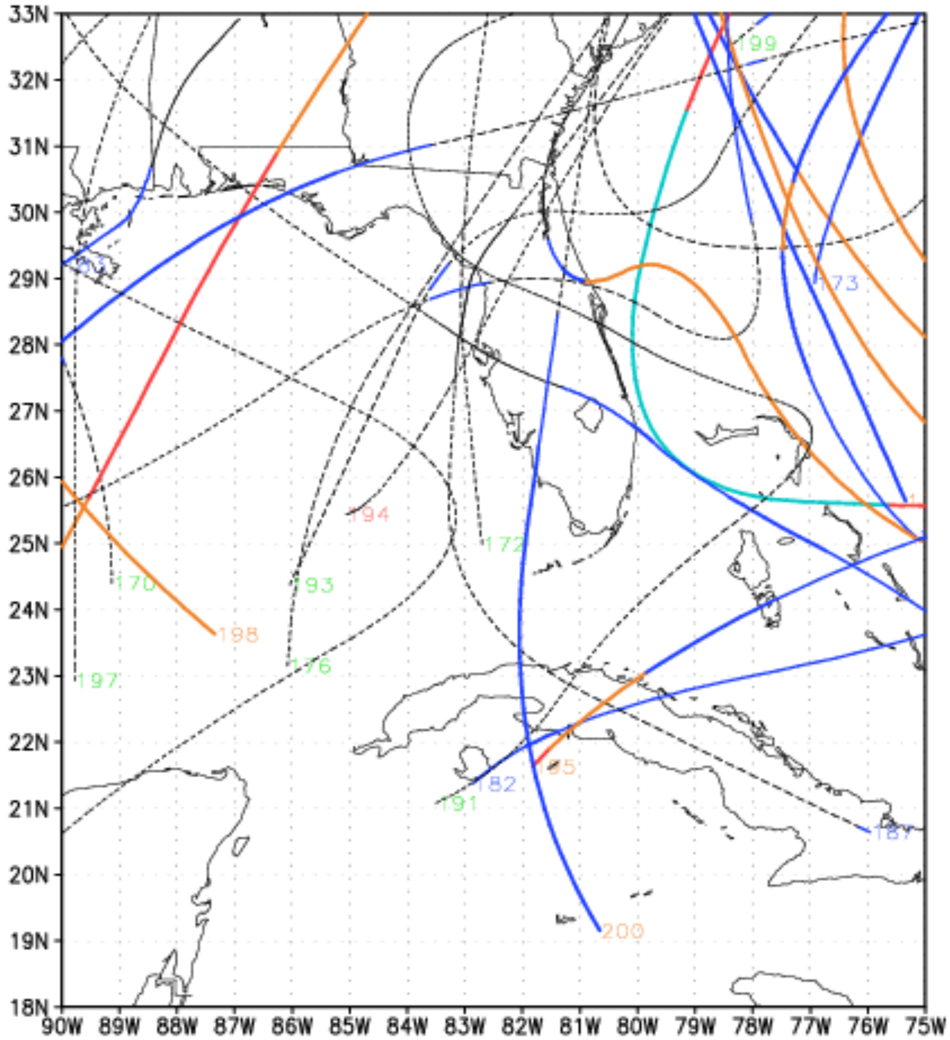


Figure 3. Examples of simulated hurricane tracks. Numbers refer to the stochastic track number, and colors represent storm intensity based on central pressure. Dashed lines represent tropical storm strength winds, and Cat 1-5 winds are represented by black, blue, orange, red, and turquoise, respectively.

When a storm is started, the parameters for radius of maximum winds and *Holland B* are computed and appropriate error terms are added as described below. The *Holland B* term is modeled as follows:

$$B = 1.74425 - 0.007915\,Lat + \ 0.0000084\,DelP^2 - 0.005024 Rmax$$

where *Lat* is the current latitude (degrees) of the storm center, *DelP* is the central pressure difference (mb), and *Rmax* is the radius of maximum winds (km). The random error term for the *Holland B* is modeled using a Gaussian distribution with a standard deviation of 0.286. Figure 4 shows a comparison between the Willoughby and Rahn (2004) B dataset (see Standard M-2.1) and the modeled results (scaled to equal the 116 measured occurrences in the observed dataset). The modeled results with the error term have a mean of about 1.38 and are consistent with the observed results. The figure indicates excellent agreement between model and observations.

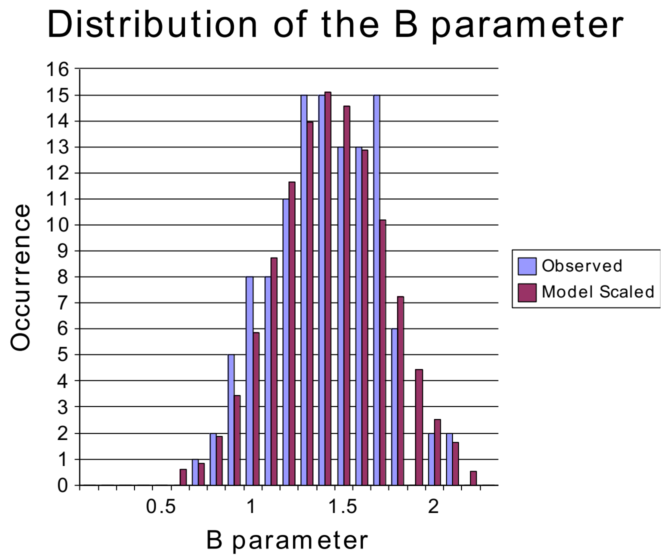


Figure 4. Comparison between the modeled and observed Willoughby and Rahn (2004) B dataset.

We developed an *Rmax* model using a landfall *Rmax* database, which includes more than 100 measurements for storms up to 2012. We have opted to model the *Rmax* at landfall rather than the entire basin for a variety of reasons. One is that the distribution of landfall *Rmax* may be different than that over open water. An analysis of the landfall *Rmax* database and the 1988–2007 DeMaria extended best track data shows that there appears to be a difference in the dependence of *Rmax* on central pressure (*Pmin*) between the two datasets (Demuth et al., 2006). The landfall dataset provides a larger set of independent measurements, more than 100 storms compared to about 31 storms affecting the Florida threat area region in the best track data. Since landfall *Rmax* is most relevant for loss cost estimation and has a larger independent sample size, we have chosen to model the landfall dataset.

We modeled the distribution of *Rmax* using a gamma distribution. Using the maximum likelihood estimation method, we found the estimated parameters for the gamma distribution, $\hat{k} = 4.76$ and $\hat{\theta} = 5.41$. With these estimated values, we show a plot of the observed and expected distribution in Figure 5 . The *Rmax* values are binned in 5 sm intervals, with the *x*-axis showing the end value of the interval.

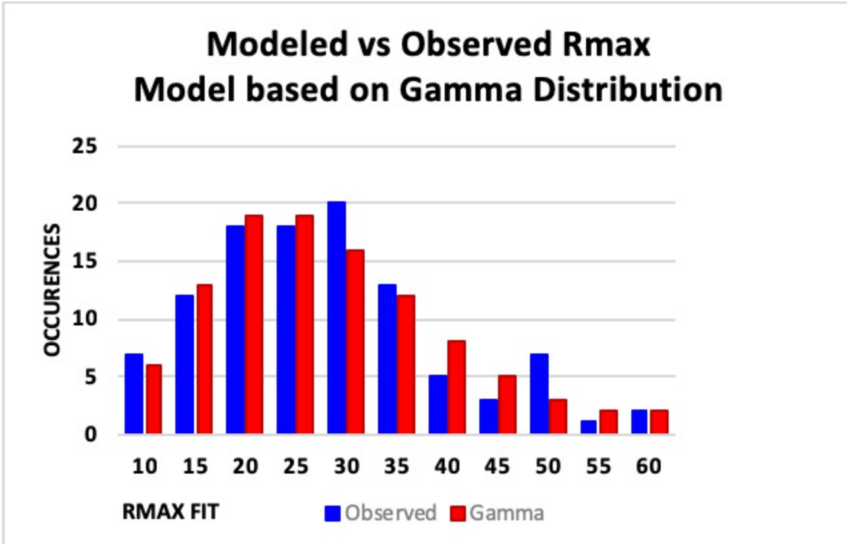


Figure 5. Observed and expected distribution for Rmax. The x-axis is the radius in statute miles, and the y-axis is the frequency of occurrence.

An examination of the *Rmax* database shows that intense storms, essentially Category 5 storms, have rather small radii. Thermodynamic considerations (Willoughby, 1998) also suggest that smaller radii are more likely for these storms. Thus, we model Category 5 (*DelP*>90 mb, where *DelP*=1013-*Pmin* and *Pmin* is the central pressure of the storm) storms using a gamma distribution, but with a smaller value of the θ parameter, which yields a smaller mean *Rmax* as well as smaller variance. We have found that for Category 1–4 (*DelP*<80 mb) storms there is essentially no discernable dependence of *Rmax* on central pressure. This is further verified by looking at the mean and variance of *Rmax* in each 10 mb interval. Thus, we model Category 1–4 storms with a single set of parameters. For a gamma distribution, the mean is given by $k\theta$, and variance is $k\theta^2$. For Category 5 storms, we adjust θ such that the mean is equal to the mean of the three Category 5 storms in the database: 1935 No Name, 1969 Camille, and 1992 Andrew. An intermediate zone between *DelP*=80 mb and *DelP*=90 mb is established where the mean of the distribution is linearly interpolated between the Category 1–4 value and the Category 5 value. As the θ value is reduced, the variance is likewise reduced. Since there are insufficient observations to determine what the variance should be for Category 5 storms, we rely on the assumption that variance is appropriately described by the rescaled θ, via $k\theta^2$.

A simple method is used to generate the gamma-distributed values. A uniformly distributed variable, a product of the random number generator that is intrinsic to the FORTRAN compiler, is mapped onto the range of *Rmax* values via the inverse cumulative gamma distribution function. For computational efficiency, a lookup table is used for the inverse cumulative gamma distribution function, with interpolation between table values. Figure 6 shows a test using 100,000 samples of *Rmax* for Category 1–4 storms, binned in 1 sm intervals and compared with the expected values.

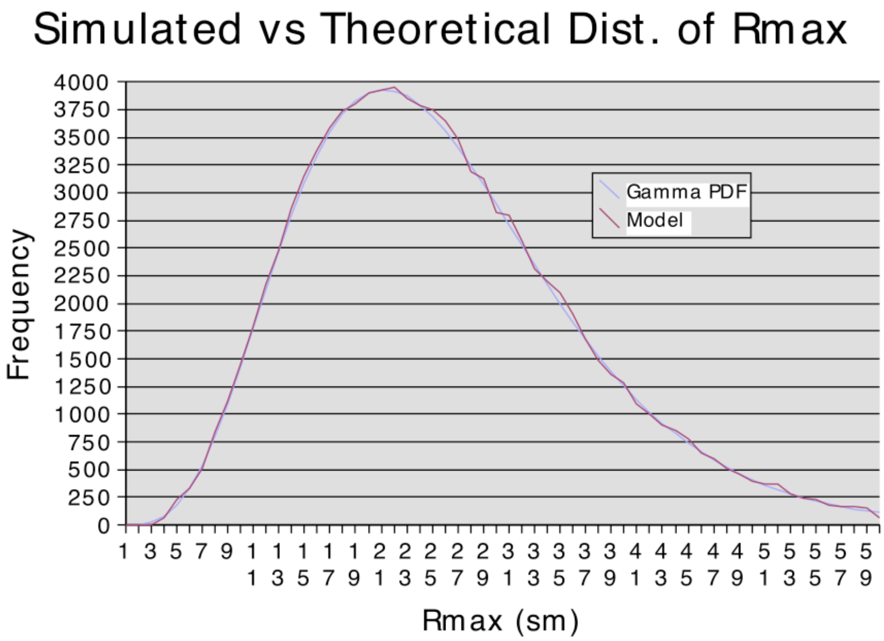


Figure 6. Comparison of 100,000 Rmax values sampled from the gamma distribution for Category 1-4 storms to the expected values.

For Category 5 and intermediate Category 4–5 storms, we use the property that the gamma cumulative distribution function is a function of (k,x/θ). Thus, by rescaling θ, we can use the same function (lookup table), but just rescale x (*Rmax*). The rescaled *Rmax* will still have a gamma distribution but with different mean and variance.

The storms in the stochastic model will undergo central pressure changes during the storm life cycle. When a storm is generated, an appropriate *Rmax* is sampled for the storm. To ensure the appropriate mean values of *Rmax* as pressure changes, the *Rmax* is rescaled every time step as necessary. As long as the storm has *DelP* < 80 mb, there is in effect no rescaling. In the stochastic storm generator, we limit the range of *Rmax* from 4 sm to 120 sm.

Storm landfall and decay over land are determined by comparing the storm location *(x,y)* with a 0.6 sm resolution land-sea mask. This land mask is obtained from the U.S. Geological Survey (USGS) land use cover data, and inland bodies of water have been reclassified as land to avoid spurious landfalls. Landfall occurs every time the storm moves from an ocean point to a land point as determined by this land mask. During landfall, the central pressure is modeled by a filling model described in Vickery (2005) and is no longer sampled from the intensity change PDFs. The Vickery (2005) model basically uses an exponentially decaying, in time, function of the central pressure difference with the decay coefficients varying by region on the basis of historical data. The pressure filling model also takes into account the speed and size of the storm. When the storm exits to sea, the land-filling model is turned off and sampling of the intensity change PDFs begins again. A storm is dissipated when its central pressure exceeds 1011 mb.

Wind Field Model

Once a simulated hurricane moves to within a threshold distance of a Florida ZIP Code, the wind field model is turned on. The model is based on the slab boundary layer concept originally conceived by Ooyama (1969) and implemented by Shapiro (1983). Similar models based on this concept have been developed by Thompson and Cardone (1996), Vickery et al. (1995), and Vickery et al. (2000a). The model is initialized by a boundary layer vortex in gradient balance. Gradient balance represents a circular flow caused by balance of forces on the flow whereby the inward directed pressure gradient force is balanced by outward directed Coriolis and centripetal accelerations. The coordinate system translates with the hurricane vortex moving at velocity *c*. The vortex translation is assumed to equal the geostrophic flow associated with the large-scale pressure gradient. In cylindrical coordinates that translate with the moving vortex, equations for a slab hurricane boundary layer under a prescribed pressure gradient are

$$u\frac{\partial u}{\partial r} - \frac{v^2}{r} - fv + \frac{v}{r}\frac{\partial u}{\partial \phi} + \frac{\partial p}{\partial r} - K\left(\nabla^2 u - \frac{u}{r^2} - \frac{2}{r^2}\frac{\partial u}{\partial \phi}\right) + F(c,u) = 0 = \frac{\partial u}{\partial t}$$

$$u\left(\frac{\partial v}{\partial r} + \frac{v}{r}\right) + fu + \frac{v}{r}\frac{\partial v}{\partial \phi} - K\left(\nabla^2 v - \frac{v}{r^2} + \frac{2}{r^2}\frac{\partial u}{\partial \phi}\right) + F(c,v) = 0 = \frac{\partial v}{\partial t}$$

where *u* and *v* are the respective radial and tangential wind components relative to the moving storm; *p* is the sea level pressure, which varies with radius (*r*); *f* is the Coriolis parameter, which varies with latitude; ϕ is the azimuthal coordinate; *K* is the eddy diffusion coefficient; and *F*(*c*,*u*), *F*(*c*,*v*) are frictional drag terms. All terms are assumed to be representative of means through the boundary layer. The motion of the vortex is determined by the modeled storm track. The symmetric pressure field *p*(*r*) is specified by the Holland (1980) pressure profile with the central pressure specified according to the intensity modeling in concert with the storm track. The model for the *Holland B* pressure profile and the radius of maximum wind are described above. The wind field is solved on a polar grid with a 0.1 *R*/*Rmax* resolution. The input *Rmax* is adjusted to remove a bias caused by a tendency of the wind field solution to place *Rmax* one grid point radially outward from the input value.

The marine surface winds from the slab model are adjusted to land surface winds using a surface friction model. The FPHLM includes the ability to model losses at the "street level." To incorporate this feature, the treatment of land surface friction in the model has been enhanced to provide surface winds at high resolution and to take advantage of recent developments in hurricane boundary layer theory. The 10-minute winds from the slab model are interpolated to a 1 km (0.62 sm) fixed grid covering the entire state of Florida at every time step to obtain a wind swath for each storm. Surface friction is modeled using an effective roughness model (Axe, 2004) based on the Source Area Model of Schmidt and Oke (1990) that takes into account upstream surface roughness elements. The surface roughness elements are derived from the Multi-Resolution Land Characteristics Consortium (MRLC) National Land Classification Database (NLCD) 2011 land cover/land use dataset (Jin et al., 2013) and the Statewide 2004-2011 Florida Water Management District land use classification data (available from the Florida Department of Environmental

Protection). The effective roughness elements are computed for eight incoming wind directions on a grid of approximately 90 m (295 ft) resolution covering the entire state of Florida.

For modeling losses at the ZIP Code level, the effective roughness elements are aggregated over the ZIP Code by a weighted summation of the roughness elements according to population density determined from census block data. The methodology for converting marine winds to actual terrain winds is based on Powell et al. (2003) and Vickery et al. (2009). This method assumes that wind at the top of the marine boundary layer is similar to the wind at the top of the boundary layer over land, and a modified log-wind profile is then used to determine the wind near the land surface. The winds are computed at various height levels that are needed for the vulnerability functions for residential and commercial residential structures.

The effect of the sea-land transition of hurricane winds coming onshore is modeled by modifying the terrain conversion methodology of Vickery et al. (2009). This modification is based on the concept of an internal boundary layer (IBL) (Arya, 1988) that develops as wind transitions from smooth to rough surface conditions. Winds above the IBL are assumed to be in equilibrium with marine roughness. In the equilibrium layer (EL), defined to be one-tenth of the IBL, the winds are assumed to be in equilibrium with the local effective roughness. Between the EL and IBL the winds are assumed to be in equilibrium with vertically varying step-wise changes in roughness associated with upstream surface conditions. This concept of multiple equilibrium layers is similar in philosophy to the method prescribed by the Engineering Sciences Data Unit (ESDU). The coastal transition function produces wind transitions that are very close to the ESDU and modified ESDU values reported in Vickery et al. (2009).

Vulnerability Component: Personal Residential Model

The engineering component performs several tasks: (1) it estimates the physical damage to exterior components of typical buildings, including roof cover, roof decking, walls, and openings; (2) it assesses the interior and utilities damage and contents damage due to water penetration through exterior damage and defects to interior walls, ceiling, doors, etc.; (3) it combines the exterior and interior damage to estimate the building and content vulnerabilities; (4) it estimates additional living expenses; and (5) it estimates the appurtenant structure vulnerability (Johnson et al., 2018; Pita et al., 2016, 2012; Pinelli et al., 2003a, 2003b, 2004a, 2004b, 2005a, 2005b, 2006, 2007a, 2007b, 2008a, 2008b, 2009a, 2010a, 2011a, 2011b, 2012; Cope, 2004; Cope et al., 2003a, 2003b, 2004b, 2005; Gurley et al., 2003, Torkian at al., 2011, 2014).

Exposure Study

Personal residential single-family home buildings (PRB), either site built (Figure 7) or manufactured (Figure 8), are categorized into typical generic groups with similar structural characteristics, layout, and materials within each group. These buildings can suffer substantial external structural damage (in addition to envelope and interior damage), including collapse under hurricane winds. The approach to assessing damage for each of these building types is to model the building as a whole so that interactions among components can be accounted for. The models are intended to represent the majority of the PRB's in Florida.

An extensive survey of the Florida building stock was carried out to develop a manageable number of building models that represent the majority of the Florida residential building stock. The modelers analyzed several sources of data for building stock information. One source was the Florida Hurricane Catastrophe Fund (FHCF) exposure database. Another source was the Florida counties' property tax appraisers' databases. Although the database contents and format vary county to county, many of these databases contain the structural information needed to define common structural types. Each of the 67 counties were contacted to acquire their tax appraiser database, producing new information from 33 counties. This collection of new data coupled with the existing data from an additional 18 counties yielded a total of 51 counties. These 51 counties account for approximately 97% of Florida's population. The residential buildings in each county database were divided into single-family residential buildings and mobile homes.

County property tax appraiser (CPTA) databases contain large quantities of building information, and it was necessary to extract those characteristics related to the vulnerability of buildings to wind. The available building characteristics vary from county to county and include some combination of the following: exterior wall material, interior wall material, roof shape, roof cover, floor covering, foundation, opening protection, year built, number of stories, area per floor, area per unit, and geometry of the building. The parameters important for modeling are roof cover, roof shape, exterior wall material, number of stories, year built, and building area. For each of these categories, the authors extracted statistical information. The dependency between critical building characteristics was also investigated. For example, it was found that roof shape and area of the building are strongly dependent on the year built. The survey statistics were calculated for different eras to account for the correlation between various factors and year built.

Figure 7. Typical single-family homes (Google Earth).

Figure 8. Manufactured homes (Google Earth).

The modelers divided Florida into four regions: North, Central, South, and the Keys. Geography and the statistics from the Florida Hurricane Catastrophe Fund (FHCF) provided guidance for defining regions that would have a similar building mix. For example, North Florida has primarily wood frame houses while South Florida primarily has masonry houses. Figure 9 shows the regions. Each county for which data were available is shaded. Databases representing the 2014 tax roll are shaded in green. Databases collected prior to 2014 are shaded in yellow (Michalski, 2016).

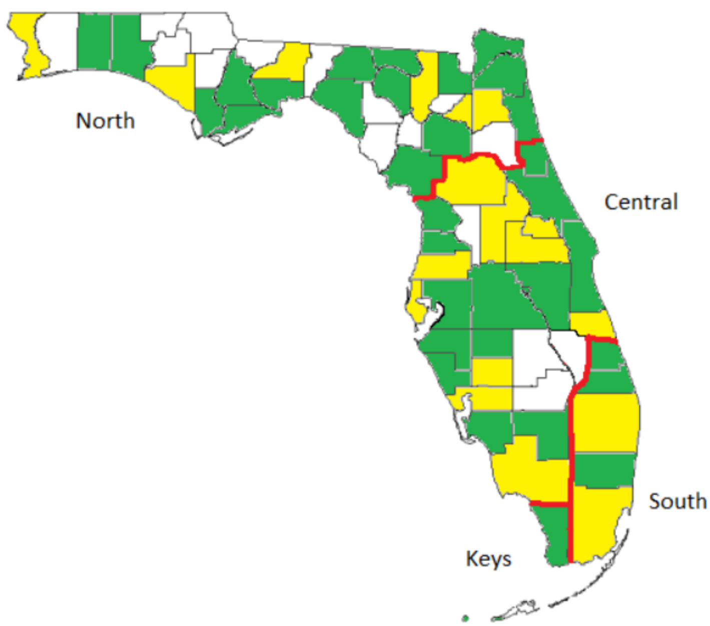


Figure 9. Regional Classification of Florida with the corresponding sample counties (shaded).

Structural types are delineated by a combination of four characteristics: number of stories (either one or two), roof cover (either shingle, tile, or metal), roof shape (either gable or hip), and exterior wall material (either concrete blocks or timber). Statistics were computed for each structural type in every sampled county. Weighted average techniques were used to extrapolate the results to the remaining counties in each region.

Building Models

Site-Built Home Models

In addition to a classification of building by structural types (wood or masonry walls, hip or gable roof), it was also necessary to classify the buildings by relative strength to reflect changes in construction practice over many years. The vulnerability team has developed strong, medium, and weak strength models for each site-built structural type to represent relative quality of original construction as well as post-construction mitigation. The weak and medium models have additional variants that reflect historical building practices, roof retrofits, and reroofing of existing structures as mandated by the newer building standards. The strong model has two variants to delineate code requirements that are regionally dependent. One strong variant reflects inland and wind-borne debris region (WBDR) construction, and another (stronger) variant reflects construction in the high velocity hurricane zone (HVHZ).

Both the WBDR and the HVHZ are defined in the Florida Building Code (FBC, 2010):

- WIND-BORNE DEBRIS REGION: Areas within hurricane-prone regions located:
- Within 1 mile (1.61 km) of the coastal mean high water line where the ultimate design wind speed Vult is 130 mph (58 m/s) or greater; or
- In areas where the ultimate design wind speed Vult is 140 mph (63 m/s) or greater.
- HIGH VELOCITY HURRICANE ZONE: Broward and Miami-Dade counties

Since the definition of WBDR is linked to the most current wind map in the FBC, its boundaries are not static, and can evolve with changes in the wind speed maps adopted by the FBC. In particular, it was revised in the 2010 edition of the FBC, effective March 2012. The FPHLM has implemented both the pre-2010, and the post 2010 boundaries of the WBDR. Consequently, a building might be assigned to a different WBDR depending on its year built (pre or post 2012).

The three strength categories are based on the same model framework, in which strength is represented by the capacities assigned to the modeled building components. For example, the strong models differ from the weak models by stronger assigned capacities for roof-to-wall (r2w) and stud to sill connections, garage pressure capacity, cracking capacity of masonry walls, gable end walls, decking and shingle capacities. The medium models differ from the weak models by increasing the strength of the roof-to-wall connections (toe nails vs. clips), roof decking capacity (nailing schedule), and masonry wall strength (un-reinforced vs. reinforced).

Any given strong, medium, or weak model may be altered by additional mitigation or retrofit measures individually or in combination. For example, from the base weak model, additional models were derived to represent historical building practices and mitigation techniques. The modified weak W10 model accounts for the use of tongue-and-groove plank decking in pre-1960s buildings. These buildings tend to exhibit higher deck strength capacities than the buildings with the plywood decking implemented in the base weak model, referred to as W00 (Shanmugam et al., 2009).

A modified medium model M10 was adopted that reflects the use of oriented strand board (OSB) decking with staples in the 1980s and pre-Andrew 1990s. This was considered an adequate alternative to nailed plywood at the time. It was, however, weaker in terms of wind resistance and was assigned a weaker deck attachment capacity than the standard medium model.

Additionally, retrofitted weak W01 and medium M01 models were derived from the base weak and medium models. They represent the case in which a structure has been reroofed and the decking re-nailed according to current code requirements. On the basis of the average lifespan of a roof, reroofing would be required periodically throughout the structure's lifetime and would result in an increase in the deck attachment capacity and shingle ratings to meet current building code requirements. The deck attachment capacities of these models were therefore upgraded to produce the retrofitted weak W01 and medium M01 cases. The roof cover was also upgraded to rated shingles (Pinelli et al., 2012).

The base, retrofitted and modified versions of the weak and medium models were developed in order to provide a fine model resolution of quality of construction for homes constructed prior to 1994 and a portion of the homes prior to 2002. Weak and medium models represent approximately 80% of the existing single-family residential inventory in Florida, and are described in Table 1.

Two basic variations of the strong model represent construction quality for the remaining approximately 20% of the single-family residential inventory. The base strong model, S00, represents modern construction in locations inland, as well as the WBDR that is not overlapping the HVHZ. The base strong model, S02, is the S00 variant with single straps and metal roof on a strong deck, for inland and WBDR. The difference in strong models between inland, S00 or S02, and WBDR, S00-OP or S02-OP, is due to the presence of metal shutters in WBDR. This base strong model incorporates modern requirements for nailing schedules, roof to wall connection products, masonry reinforcing, and roof shingle products and installation methods. The second strong model, S01, has upgrades to the capacity for roof cover, roof decking and roof to wall connections to reflect additional code requirements for HVHZ construction. The strong models are described in Table 2.

All models may be run without opening protection, with plywood opening protection, or with metal panel shutter opening protection installed, with increasing protection respectively.

The distribution of the weak, medium and strong model variations with respect to year built will be presented later in Table 7 and in the discussion of the models' distribution in time.

	Weak			Medium		
	W00 (base)	**W01 (retrofitted*)**	**W10 (modified**)**	**M00 (base)**	**M01 (retrofitted*)**	**M10 (modified***)**
Roof to wall	Weak	Weak	Weak	Medium	Medium	Medium
Stud to sill	Weak	Weak	Weak	Medium	Medium	Medium
Roof cover	Weak	Strong	Weak	Weak	Strong	Weak
Roof deck	Weak	Strong	Strong	Medium	Strong	Weak
Wall	Weak	Weak	Weak	Medium	Medium	Medium
Gable end	Weak	Weak	Weak	Weak	Weak	Weak
Garage	Weak	Weak	Weak	Weak	Weak	Weak
*retrofitted refers to re-roof and re-nailed decking, occurring post-1993 for HVHZ and Monroe, and post-2001 for everywhere else. No other retrofits are included. **modified weak (W10) refers to the base weak model with stronger decking to reflect the use of plank decking ***modified medium (M10) refers to the base medium model with weak decking to reflect the use of staples and/or OSB						

Table 1. Weak and Medium Models

	S00 or S02 Strong - inland	**S00-OP or S02-OP Strong - WBDR**	**S01 Strong - HVHZ**
Roof to wall	Strong	Strong	Upgraded Strong
Stud to sill	Strong	Strong	Strong
Roof cover	Strong	Strong	Upgraded Strong
Roof deck	Strong	Strong	Upgraded Strong
Wall	Strong	Strong	Strong
Gable end	Strong	Strong	Strong
Garage	Strong	Strong	Strong
Shutters	no shutters	metal	metal

Table 2. Strong Models

Manufactured Homes Model

On the basis of the exposure study, it was decided to model four manufactured home (MH) types: (1) pre-1994—fully tied down, (2) pre-1994—not tied down, (3) post-1994—Housing and Urban Development (HUD) Zone II, and (4) post-1994—HUD Zone III. The partially tied-down homes are assumed to have a vulnerability that is an average of the vulnerabilities of fully tied-down and not tied-down homes. Because little information is available regarding the distribution of manufactured home types by size or geometry, it is assumed that all model types are single-wide manufactured homes. The modeled single-wide manufactured homes are 56 ft x 13 ft, have gable roofs, eight windows, a front entrance door, and a sliding-glass back door.

Damage Matrices

Exterior Damage

The model accounts for a number of construction factors that influence the vulnerability of single-family dwellings, including classification (site-built or manufactured home), size, roof shape, location, age, and a variety of construction details and mitigation measures. The effects of mitigation measures such as code revisions and post-construction upgrades to the wind resistance of homes (e.g., new roof cover on an older home, shutter protection against debris impact, braced garage door, re-nailed roof decking, etc.) are accounted for both individually and in combination by selecting the desired statistical descriptors of the capacities of the various components. Thus the comparative vulnerability of older homes as built, older homes with combinations of mitigation measures, and homes constructed to the new code requirements can be estimated.

The vulnerability model uses a component-based Monte Carlo simulation to determine the external vulnerability at various wind speeds for the different building models. The approach accounts for the resistance capacity of the various building components, the wind-load effects from different directions, and associated uncertainties of capacity and loads to predict exterior damage at various wind speeds. The simulation relates probabilistic strength capacities of building components to a series of three-second peak gust wind speeds through a detailed wind and structural engineering analysis that includes effects of wind-borne debris. Damage to the structure occurs when the loads from wind or flying debris are greater than the components' capacity to resist them. The vulnerability of a structure at various wind speeds is estimated by quantifying the amount of damage to the modeled components. Damage to a given component may influence the loads on other components, e.g., a change in roof loading from internal pressurization due to a damaged opening. These influences are accounted for through an iterative process of loading, damage assessment, load redistribution, and reloading until convergence is reached. The flow chart in summarizes the Monte Carlo procedure used to predict the external damage. The random variables include wind speed, pressure coefficients, debris impact, and the resistances of the building components (roof cover, roof sheathing, openings, walls, connections).

The damage estimations are affected by uncertainties regarding the behavior and strength of the various components and the load effects produced by hurricane winds. Field and laboratory data that better define these uncertain behaviors can thus be directly included in the model by refining the statistical descriptors of the capacities, load paths, and applied wind loads.

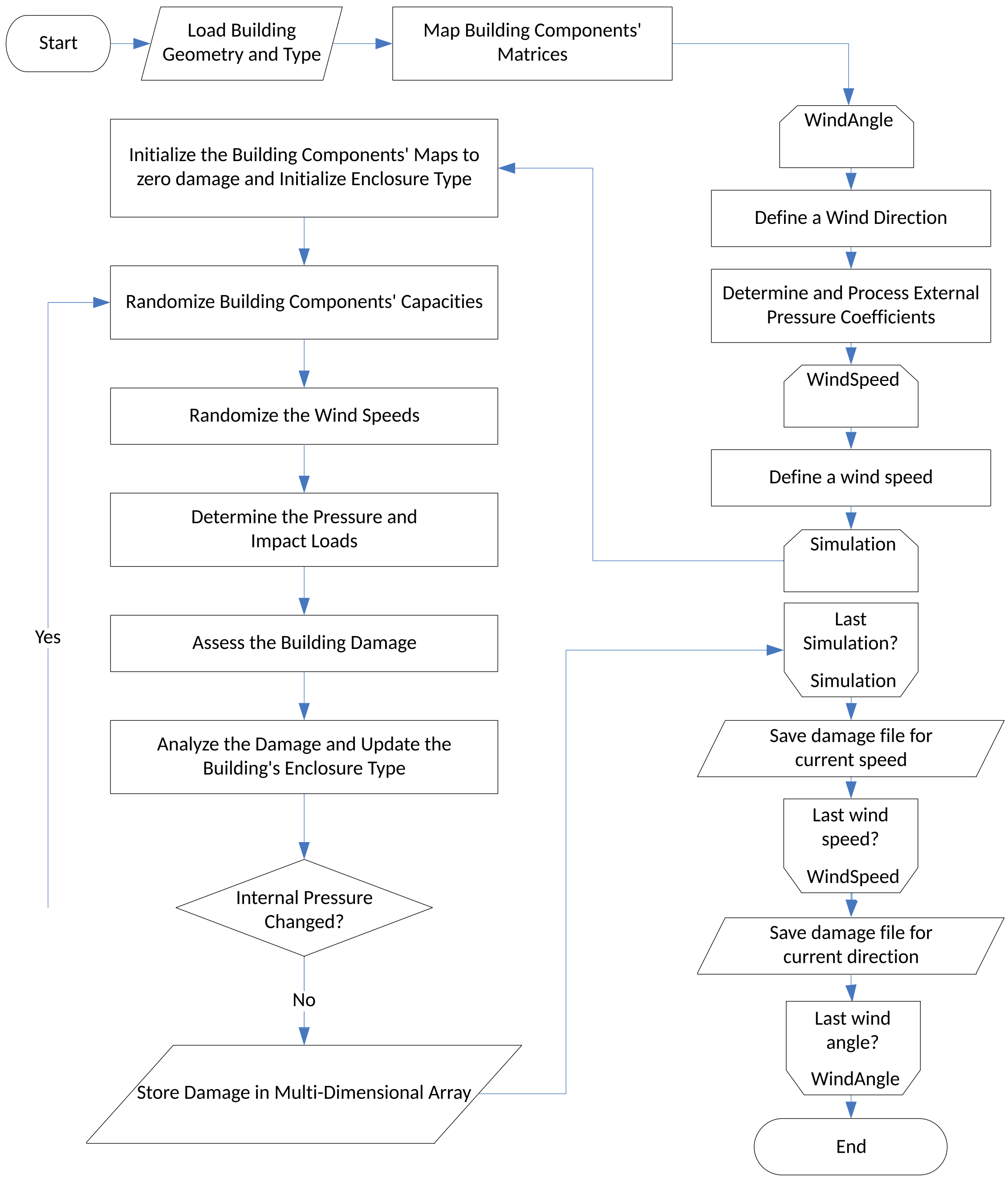


Figure 10. Monte Carlo simulation procedure to predict external damage.

The output of the Monte Carlo simulation model is an estimate of physical damage to structural and exterior components of the modeled home. The results are presented in the form of a damage matrix, where each row presents the output of an individual simulation. The 15 rows of this matrix (Table 3) correspond to damage to 14 components, and the internal pressure of the building upon completion of that simulation (column 11). A separate matrix is created for each peak three-second gust wind speed between 50 and 250 mph in 5 mph increments (50, 55, …, 250 mph) and for each wind angle between 0 and 315 degrees in 45-degree increments. A description of the values in each of the nine columns of the manufactured home damage matrix is given in Table 4. Note that internal pressure is not included as an output from the manufactured home model (Table 4). Changes in internal pressure due to breach are accounted for and utilized to quantify damage, but the final internal pressure value is not needed as an output.

Col#	Description of Value	Min Value	Max Value
1	% failed roof sheathing	0	100
2	% failed roof cover	0	100
3	% failed roof to wall connections	0	100
4	# of failed walls	0	4
5	# of failed windows	0	15
6	# of failed doors	0	2
7	y or n failed garage	0 = no	1 = yes
8	y or n envelope breached	0 = no	1 = yes
9	# of windows broken by debris impact	0	15
10	% of gable end panels broken	0	100
11	internal pressure	Not defined	Not defined
12	% failed wall panels – front	0	100
13	% failed wall panels – back	0	100
14	% failed wall panels – side	0	100
15	% failed wall panels – side	0	100

Table 3. Description of values given in the damage matrices for site-built homes

Col #	Description of Value	Min Value	Max Value
1	# of failed windows (out of 8 for single wide)	0	8
2	# of broken windows that were broken by impact load case	0	8
3	# of failed doors (front and back = 2 total)	0	2
4	% of roof sheathing failed	0	100
5	% of roof cover failed	0	100
6	% of wall sheathing failed	0	100
7	# of failed roof to wall connections (out of 58)	0	58
8	sliding (0 = no sliding, 1 = minor sliding, 2 = major sliding)	0	2
9	overturning (0 = not overturned, 1 = overturned)	0	1

Table 4. Description of values given in the damage matrices for manufactured homes.

Interior and Utilities Damage

Once the external damage has been calculated for a given Monte Carlo simulation, the internal, utilities, and contents damages to the building are then extrapolated from the external damage. For the interior and utilities of a home, there is no explicit means by which to compute damage. Damage to the interior and utilities occurs when the building envelope is breached, allowing wind and rain to enter. Damage to roof sheathing, roof cover, walls, windows, doors, and gable ends present the greatest opportunities for interior damage. For manufactured homes, sliding and overturning are additional factors.

Interior damage equations were derived as functions of each of the external components. These equations are developed primarily on the basis of experience and engineering judgment. Observations of homes damaged during the 2004 hurricane season helped to validate these predictions. The interior equations are derived by estimating typical percentages of damage to each interior component, given a percentage of damage to an external component. The interior damage as a function of each modeled component is the same for both site-built and manufactured homes.

To compute the total interior damage for each model simulation, all values in the damage matrices are converted to percentages of component damage. The interior equations are applied to each component, one at a time. The total interior damage for each simulation is the maximum interior damage value produced by these equations. The maximum value is used instead of a summation to avoid the possibility of counting the same interior damage more than once. That is, once water intrusion from one breach of the envelope has thoroughly damaged any part of the interior, further water intrusion from other sources will not increase the cost of the damage of that part.

Utilities damage is estimated on the basis of interior damage. A coefficient is defined for each utility (electrical, plumbing, and mechanical), which multiplies the interior equations defined for each component. As in the case of interior damage, the maximum value is retained as the total damage. The utilities coefficients are based on engineering judgment. In both site-built and manufactured homes, it is assumed that electrical damage occurs at half the rate of interior damage (0.5). Plumbing damage is set to 0.35 of interior damage for site-built homes and for manufactured homes. Mechanical damage is set to 0.4 of interior damage for site-built homes and for manufactured homes.

Contents Damage

As with the interior and utilities, the contents of the home are not modeled by Monte Carlo simulations. Contents damage is assumed to be a function of the interior damage caused by each failed component that causes a breach of the building envelope. The functions are based on engineering judgment and are validated using actual claims data.

Additional Living Expenses

Additional Living Expense (ALE) coverage covers only expenses actually paid by the insured. This coverage pays only the increase in living expenses that results directly from the covered damage and having to live away from the insured location. The value of an ALE claim is dependent on the time required to repair a damaged home and the surrounding utilities and infrastructure.

The equations and methods used for manufactured and residential homes are identical. However, it seems logical to reduce the manufactured home ALE predictions because typically a faster repair or replacement time may be expected for these home types. Therefore, an ALE multiplier factor of 0.75 was introduced into the manufactured home model.

Vulnerability Matrices

The estimates of total building damage result in the formulation of vulnerability matrices for each modeled building type. The flowchart in summarizes the procedure used to convert the Monte Carlo simulations of physical external damage into a vulnerability matrix.

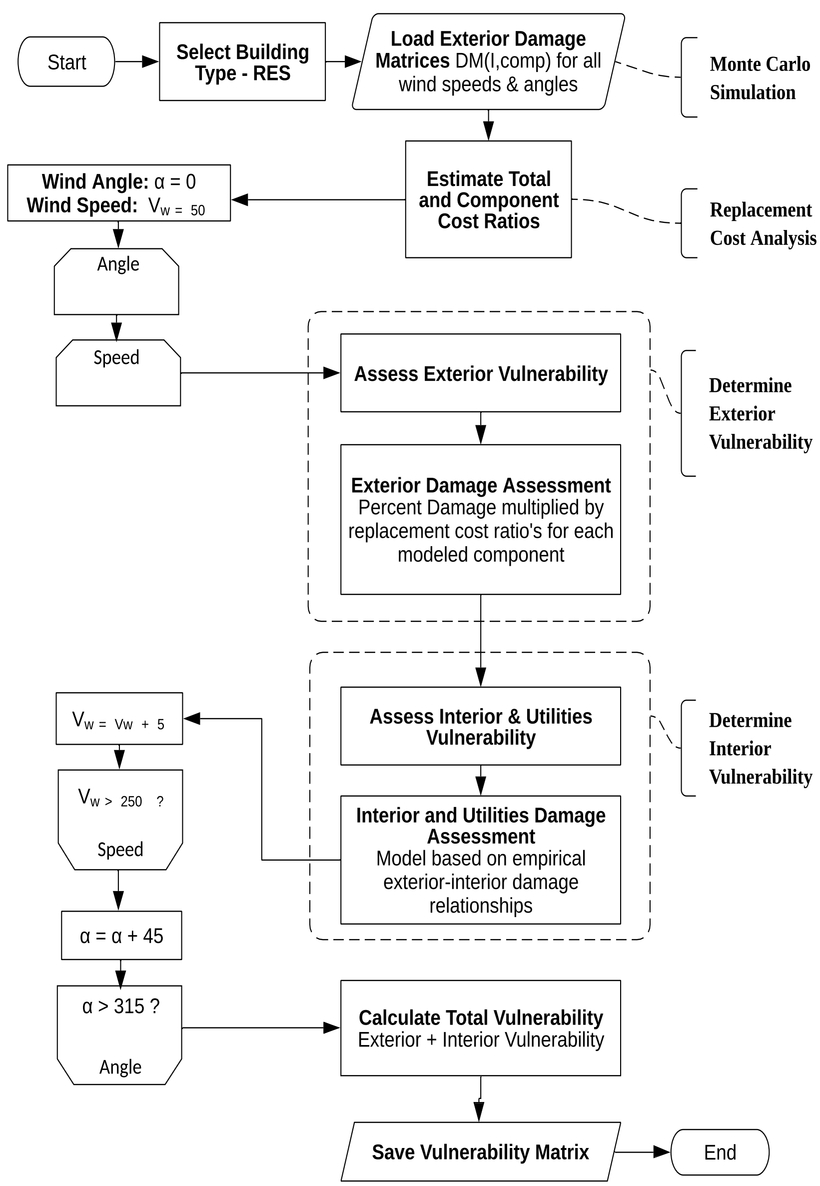


Figure 11. Procedure to create vulnerability matrix.

For each Monte Carlo model, 2000 simulations are performed for each of 8 different wind angles and 41 different wind speeds. This is 2000 x 8 x 41 = 656,000 simulations of external damage per model, which are then expanded to cover interior, utilities, and contents damage, plus ALE, as explained above.

Knowing the components of a home and the typical square footage, the cost of repairing all damaged components is estimated using cost estimation resources [e.g., RSMeans Residential Cost Data (RSMeans, 2008a) and RSMeans Square Foot Costs (RSMeans, 2008b) and Construction Estimating Institute (Langedyk & Ticola, 2002)] and expert advice. These resources provide cost data from actual jobs based on estimates and represent typical conditions. Unmodeled nonstructural interior, plumbing, mechanical, and electrical utilities make up a significant portion of repair costs for a home.

Replacement cost ratios provide a link between modeled physical damage and the corresponding monetary losses. They can be defined as the cost of replacing a damaged component or assembly of a home divided by the cost of constructing a completely new home of the same type. The sum of the replacement cost ratios for all the components of a home is greater than 100% because the replacement costs include the additional costs of removal, repair, and remodeling.

An explicit procedure is used to convert physical damage of the modeled components to monetary damage. Since the replacement ratio of each modeled component is known, the monetary damage resulting from damage to a component expressed as a percentage of the home's value can be obtained by multiplying the damaged percentage of the component by the component's replacement ratio. For example, if 30% of the roof cover is damaged, and for this particular home type the replacement ratio of roof cover is 14%, the value of the home lost as a result of the damaged roof cover would be 0.30 x 0.14 = 4.2%. If the value of this home were $150,000, the cost to replace 30% of the roof would be $150,000 x 0.042 = $6,300. In addition, the costs will be adjusted as necessary because of certain requirements of the Florida building code that might result in an increase of the repair costs (for example, the code might require replacement of the entire roof if 30% or more is damaged).

After the simulation results have been translated into damage ratios, they are then transformed into vulnerability matrices. A total of 4356 matrices for site-built homes is created for different combinations of wall type (frame or masonry), region (North, Central, or South), subregion (high wind velocity zone, wind-borne debris region, or other), roof shape (gable or hip), roof cover (tile or shingle), window protection (shuttered or not shuttered), number of stories (one or two), and strength (base weak W00, modified weak W10, retrofitted weak W01, base medium M00, modified medium M10, retrofitted medium M01, or strong (base S00, stronger S01 for HVHZ, S02 with single straps and metal roof on a strong deck).

The cells of a vulnerability matrix for a particular structural type represent the probability of a given damage ratio occurring at a given wind speed. The columns of the matrix represent three-second gust wind speeds at 10 m, from 50 mph to 250 mph in 5 mph bands. The rows of the matrix correspond to damage ratios (DR) in 2% increments up to 20%, and then in 4% increments up to 100%. If a damage ratio is DR= 15.3%, it is assigned to the interval 14%<DR<16% with a midpoint DR=15%. After all the simulations have been counted, the total number of instances in each damage interval is divided by the total number of simulations per wind speed to determine the percentage of simulations at any damage state occurring at each speed. These percentages are the conditional probabilities of occurrence of a level of damage, given a certain wind speed. A partial example of a vulnerability matrix is shown in Table 5.

Damage\Wind Speed (mph)	47.5 to 52.5	52.5 to 57.5	57.5 to 62.5	62.5 to 67.5	67.5 to 72.5
0% to 2%	1	0.99238	0.91788	0.77312	0.61025
2% to 4%	0	0.00725	0.0806	0.21937	0.36138
4% to 6%	0	0.00037	0.001395	0.007135	0.0235
6% to 8%	0	0	0.000125	0.000375	0.0025
8% to 10%	0	0	0	0	0.000375
10% to 12%	0	0	0	0	0.000375
12% to 14%	0	0	0	0	0.000625
14% to 16%	0	0	0	0	0.0005
16% to 18%	0	0	0	0	0.000125
18% to 20%	0	0	0	0	0.00012
20% to 24%	0	0	0	0	0.00025
24% to 28%	0	0	0	0	0

Table 5. Partial example of vulnerability matrix.

An important plot derived from the vulnerability matrix is the vulnerability curve. The vulnerability curve for any structural type is the plot of the mean damage ratio vs. wind speed. The model can also generate fragility curves (the probability of exceedance of any given damage level as a function of the wind speed) for each vulnerability matrix, although these curves are not used in the model.

Similar vulnerability matrices and vulnerability curves are developed for contents and ALE, one for each structural type. The whole process is also applied to manufactured homes.

Weighted Vulnerability Matrices

Building vulnerability matrices were created for every combination of region (Keys, South, Central, and North), construction type (masonry, wood, or other), roof shape (gable or hip), roof cover (tile or shingle or metal), number of stories (one or two), shutters (with or without), and subregion (inland, wind-borne debris region, or high velocity hurricane zone). However, in general, there is little information available in an insurance portfolio file regarding the structural characteristics and the wind resistance of the insured property. Instead, insurance companies rely on the Insurance Services Office's (ISO) fire resistance classification. Portfolio files have information on ZIP Code and year built. The ISO classification is used to determine if the home is constructed of masonry, timber, or other. The ZIP Code is used to define the region and subregion. The year the home was built is used to assist in defining the strength to be assigned to the home.

Region, subregion, construction type, and year built are determined from the insurance files. This leaves the roof shape, roof cover, and shutter options undefined. From the exposure study of 51

Florida counties (Michalski, 2016), the distribution of number of stories, roof shapes, and roof cover by age per region can be extrapolated. For each age group, we define a weighted matrix for each construction type in each county belonging to a region and subregion. The weighted matrices are the sum of the corresponding vulnerability model matrices weighted on the basis of their statistical distribution. For example, consider a masonry home built in the wind-borne debris region of central Florida in 1990. The exposure study indicates that 66% of such homes have gable roofs, 85% have shingle roof cover, and 20% have window shutters. Weight factors can be computed for each model matrix based on these statistics. For example, the Central Florida, gable, tile, no shutters, masonry matrix would have a weight factor of 66% (masonry percent gable) x 15% (percent tile) x 80% (percent without shutters) = 7.9%; this is the percentage of that home type that would be expected in this region, for that year built. Each model matrix is multiplied by its weight factor, and the results are summed. The final result is a weighted matrix that is a combination of all the model matrices and can be applied to an insurance policy if only the ZIP Code, year built, and ISO classification are known. As a result, for each county in each subregion (inland, wind-borne debris region, and high velocity hurricane zone) of each region (Keys, South, Central, and North), there will be sets of weighted matrices (masonry, wood, and others) for weak, medium, and strong structures.

Age-Weighted Matrices

The year built or year of last upgrade of a structure in a portfolio might not be available when performing a portfolio analysis to estimate hurricane losses in a certain region. In that case, it becomes necessary to assume a certain distribution of ages in the region to develop an average vulnerability by combining weak, medium, and strong.

The tax appraisers' databases include effective year of construction and thus provide guidance as to how to weigh the combined weak, medium, and strong model results when year built information is not available in other portfolio files. In each region, the data were analyzed to provide the age statistics. These statistics were used to weigh the average of weak, medium, and strong vulnerabilities in each region. The results are shown in Figure 12 for the wind-borne debris zone in the Central region. The different weighted vulnerability curves are shown for the weak, medium, and strong models, superimposed with the age-weighted vulnerability curve.

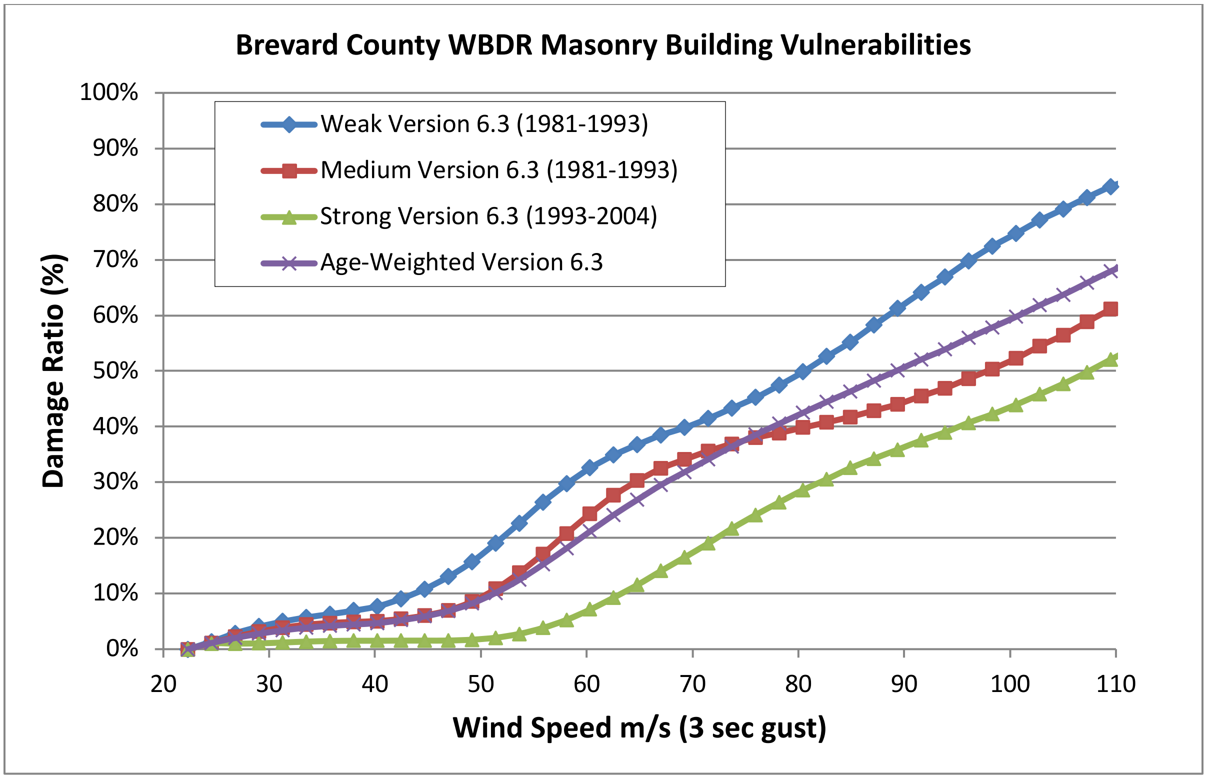


Figure 12. Weighted masonry structure vulnerabilities in a central wind-borne debris region.

Mapping of Insurance Policies to Vulnerability Matrices

The FPHLM processes insurance portfolios from many different insurance companies. Since there is no universal way to classify building characteristics, each company assigns different names or classifications to the building variables. In many cases most of the building structural information in a portfolio is unknown since, in general, detailed records of building characteristics are missing. In a minority of cases, parameters are known, but they do not match any value in the library of the FPHLM. In this case these parameters are classified as "other." For example, the FPHLM models only timber or masonry residential single-family homes. A steel structure would be classified as other.

This makes the mapping of existing portfolio policies to available vulnerability matrices challenging. The engineering team designed a mapping tool to read a policy and assign building characteristics, if unknown or other, on the basis of building population statistics and year built, where the year built serves as a proxy for the strength of the building. The process is summarized in Table 6. Once all the unknown parameters in the policy have been defined, an unweighted vulnerability matrix based on the corresponding combination of parameters can then be assigned. If the number of unknown parameters exceeds a certain threshold defined by the actuarial team, a weighted matrix or age-weighted matrix is used instead.

In the few cases in which a policy in a portfolio has a combination of parameters that would result in a vulnerability matrix different than any of the existing matrices in the library of the FPHLM, the program assigns to the policy a so-called "other" weighted matrix (see Table 6 below). The "other" matrices are an average of timber and masonry matrices.

Data in Insurance Portfolio	Year Built	Exterior Wall	No. of Story	Roof Shape	Roof Cover	Opening Protection	Vulnerability Matrix
Case 1	known	known	known	known	known	known	Use unweighted vulnerability matrix
Case 2	known	known or unknown	Any combination of the four parameters is either unknown or other				use weighted matrix or replace all unknown and others based on stats and use unweighted vulnerability matrix
Case 3	known	other	Any combination of the four parameters is either unknown or other				use the "other" weighted matrix
Case 4	unknown	known	Any combination of the four parameters is either unknown or other				use age weighted matrix or replace all unknown and others based on stats and use unweighted vulnerability matrix
Case 5	unknown	other	Any combination of the four parameters is either unknown or other				Use age weighted matrices for "other"

Table 6. Assignment of vulnerability matrix depending on data availability in insurance portfolios.

Models' Distribution in Time

Over time the codes used for construction in Florida have evolved to reduce wind damage vulnerability. The weak W00, modified weak W10, retrofitted weak W01, medium M00, modified medium M10, retrofitted medium M01, and strong models represent this evolution in time of relative quality of construction in Florida. Each model is representative of the prevalent building type for a certain historical period. However, the assignment of a building strength (its relative vulnerability to wind damage) based on its year of construction is not a straightforward task. The appropriate relationship between age and strength is a function of location within Florida, code in place in that location, and code enforcement policy (also regional). It is therefore important to define the cut-off date between the different periods since the overall aggregate losses in any region are determined as a mixture of homes of various strengths (ages). The cut-off dates are based on both the evolution of the building code and the prevailing local builder/community code enforcement standards in each era.

Given the importance of these issues in the estimation of wind damage vulnerability, a brief history of codes and enforcement is presented next.

Construction practice in South Florida recognized the importance of truss-to-wall connection as early as the 1950s, when it became common to use clips rather than toe nails. The clips were not as strong as modern straps, but they were an improvement over nails. North Florida has fewer historical occurrences of severe hurricane impact, resulting in weaker construction in general than in the south within the same given era. The use of clips became relatively standard statewide by the mid-1980s. The use of improved shingle products and resistant garage doors became more common after Hurricane Andrew. The issue of code enforcement has also evolved over time. The State of Florida took an active role in uniform enforcement only recently. Prior to Hurricane Andrew, a given county may have built to standards that were worse than or exceeded the code in place at the time. Following consultation with building code development experts, which included the director of the Miami-Dade building department, the president of an engineering consulting firm and consultant to the South Florida Building Code, the consensus was that the issue was not only the contents of the code, but also enforcement of the code.

In an attempt to standardize construction, some cities and counties in Florida adopted building codes, some of the earliest being Clearwater, which adopted a draft of the Standard Building Code (SBC) in 1945 (Cox, 1962); Daytona Beach in 1946 (The Morning Journal, 1946); Bradenton and Manatee counties by 1950; Sarasota County in 1956 (Sarasota Journal, 1956), and Riviera Beach in Palm Beach County in 1957 (The Palm Beach Post, 1957). Miami-Dade and Broward counties adopted the South Florida Building Code (SFBC, 1957) in 1957 and 1961, respectively. The SFBC, one of the most stringent codes in the United States, had some wind provisions since its inception. SBC made wind-load provisions mandatory in 1986. Modern wind design started in 1972 and improved considerably for low-rise construction in 1982 (Mehta, 2010). In addition, Florida's construction boom of the 1970s led the state authorities to promote a statewide uniformity of building standards. The first attempt was Chapter 553, "Building Construction Standards," of the Florida Statutes (F.S.), which was enacted in 1974 and required all counties to adopt a code by January 1st, 1975. The statute selected four allowable minimum codes as the pool from which jurisdictions needed to adopt their official building codes, namely: (1) SBC (Southern Building Code Congress International, 1975), (2) the SFBC (South Florida Building Code, 1957), (3) the One and Two Family Dwelling Code, (CABO) (ICC, 1992) and (4) the EPCOT code (enforced in Walt Disney World and based on the SBC, SFBC, and Uniform Building Code) (Reedy Creek Improvement District, 2002). However, the responsibility for the administration and enforcement was left to the discretion of 400 local jurisdictions as diverse as local governments, local school boards, and state agencies (Governor's Report, 1996). The State allowed the jurisdictions to choose any code from the four allowed codes and granted them the authority to amend the code according to their needs, as long as the amendments resulted in more stringent requirements and the power to enforce it.

Problems in the Building Code System

After 1975, there were two main codes in use in Florida before the 1990s: the SFBC in Miami-Dade and Broward counties and the SBC in most of the rest of the state. Although the SFBC was the most stringent code in Florida, this was uncorrelated with compliance and enforcement from many builders, design professionals, and inspectors. To a lesser extent, some of the code stringency was eroded for almost three decades (Getter, 1992; Fronstin & Holtmann, 1994). Some measures that watered down the code included the allowance of power-driven staples instead of nails for roof decking, thinner roofing-felt, 63 mph resisting shingles, and waferboards (pressed wood) as a replacement for plywood for roof decking. A study by Florida A&M University published in 1987 also highlighted deficiencies in code compliance and enforcement in the rest of Florida. Furthermore, the local amendments created a state of confusion, making it difficult for engineers, architects, and contractors to identify the locally administered codes and their jurisdictions (Shingle, 2007; Barnes et al., 1991).

The aftermath of Hurricane Andrew confirmed the concerns reported above. Post-storm damage surveys revealed innumerable violations to the SFBC (the absence of corner columns, vertical reinforcement, and gypsum board used as wall sheathing to name a few) that produced catastrophic failures of buildings (Khan & Suaris, 1993; Siddiq Khan & Associates, 1993). Clearly there were serious shortcomings in the compliance and enforcement process.

For later hurricanes like Opal and Erin in 1995, the rebuild process was also delayed because of the intricacies of the jurisdictional, enforcement, and compliance issues of the codes, exacerbating losses. An expeditious and unambiguous system would have eased proper compliance and enforcement and therefore would have drastically reduced losses (Governor's Report, 1996).

Post-Andrew Building Code Development Enforcement

The South Florida Building Code

Three to four months after Hurricane Andrew, South Florida began to reform the code and the code enforcement system. Engineers became directly involved in the design of residential structures. OSB decking and staples were banned. Wind-rated shingles were required. In 1994 the whole SFBC was reformed and adopted the ASCE 7 wind provisions.

The Florida Building Code

After Hurricane Andrew, local and state agencies were unsure about how to guarantee building safety. Concerns arose that a diminution of insurance availability would occur, which threatened the continuity of economic growth. In response, Governor Lawton Chiles established a Building Codes Study Commission in 1996 to review the current system of codes. The Governor's Commission found that the existing system had led to a "patchwork of technical and administrative processes." Its recommendations led to the formation of the Florida Building Commission in 1998, which was responsible for creating a unified Florida Building Code (Governor's Report, 1996).

For the new unified Florida Building Code (FBC), the Commission selected the SBC, developed in Alabama from 1940 to 1945 (Ratay, 2009), as the base code because 64 out of 67 counties were already using the 1973 and the 1997 versions of the code with amendments (Shingle, 2007). The SFBC was later included as an additional base code in 1999 to meet South Florida's special requirements. The Building Commission worked to reach a consensus among all stakeholders, and the first version of a unified FBC was made effective on March 1, 2002 (Blair, 2009). Studies indicate that the losses due to hurricanes have decreased since the enactment of the FBC (Gurley et al., 2006, Gurley & Masters, 2011).

Application of the Building Code History

The history above clearly indicates that a completely accurate accounting of all building practices in every region of Florida going back many decades is not possible, given the limited policy information of age and location. To accommodate the history of residential building construction practice in Florida, buildings were classified into different eras. The classifications shown in Table 7 were adopted for characterizing the regions by age and model. The strength descriptions within Table 7 are provided at the bottom of Table 7 in terms of the nomenclature used in Table 1 and

Table 2. The specific building eras and classifications per region are based on the evolution of the building codes in Florida and the opinions of the experts consulted.

	Pre-1960	1960-1970	1971-1980	1981-1993	1994-2001	2002-pres.
HVHZ	⅔ modified Weak, ⅓ Medium	⅔ Weak, ⅓ Medium	½ Weak, ½ modified Medium	⅔ Weak, ⅓ modified Medium	Modified Strong	Modified Strong
Keys	½ modified Weak, ½ Medium	Medium	Medium	Medium	⅓ Medium ⅔ Strong_OP	Strong_OP
WBDR	modified Weak	⅔ Weak, ⅓ Medium	⅓ Weak, ⅔ Medium	⅓ Weak, ⅔ Medium	½ Medium, ½ Strong_OP	Strong_OP
Inland	modified Weak	⅔ Weak, ⅓ Medium	½ Weak, ½ Medium	½ Weak, ½ Medium	½ Medium, ½ Strong	Strong

Table 7. Age classification of the models per region.

Table 7 Nomenclature with respect to Table 1 and Table 2.

Strong:	S00 or S02
Strong_OP:	S00-OP or S02-OP
Modified Strong:	S01
Medium:	M00
Modified Medium:	M10
Weak:	W00
Modified Weak:	W10

Note: HVHZ means high velocity hurricane zone; WBDR means wind borne debris region. The boundaries of the WBDR vary depending on the year built, and the edition of the FBC which applies, as explained in Standard G-1, in the description of the site-built models.

Appurtenant Structures

Appurtenant structures are not attached to the dwelling or main residence of the home but are located on the insured property. These types of structures could include detached garages, guesthouses, pool houses, sheds, gazebos, patio covers, patio decks, swimming pools, spas, etc. Insurance claims data reveal no obvious relationship between building damage and appurtenant structure claims. The variability of the structures covered by an appurtenant structure policy may be responsible for this result.

Since the appurtenant structures damage is not derived from the building damage, only one vulnerability matrix is developed for appurtenant structures. To model appurtenant structure damage, three equations were developed. Each determines the appurtenant structure insured damage ratio as a function of wind speed. One equation predicts damage for structures highly susceptible to wind damage, the second predicts damage for structures moderately susceptible to wind damage, and the third predicts damage for structures that are affected only slightly by wind.

Because a typical insurance portfolio file gives no indication of the type of appurtenant structure covered under a particular policy, a distribution of the three types (slightly vulnerable, moderately vulnerable, and highly vulnerable) must be assumed and is validated against the claim data.

Vulnerability Component: Commercial Residential Model

Given the hurricane hazard defined by the atmospheric component, the engineering component performs several tasks: (1) it estimates the physical damage to exterior components of typical buildings or apartment units; (2) it assesses the interior and utilities damage and contents damage due to water penetration through exterior damage and defects to interior walls, ceiling, doors, etc.; (3) it combines the exterior and interior damage to estimate the building and content vulnerabilities; (4) it estimates the time related expenses; and (5) it estimates appurtenant structure vulnerability (Pita et al., 2008, 2009a, 2009b, 2009c, 2010, 2011a, 2011b, 2011c, 2012a, 2012b, 2013, 2014; Pinelli et al., 2009b, 2010b, 2012, 2013a, 2013b; Weekes et al., 2009, 2014).

Exposure Study

Most low-rise commercial residential buildings (LB) (Figure 13) can be categorized into a few generic groups having similar structural characteristics, layout, and materials, although they may differ somewhat in dimensions. These buildings can suffer substantial external structural damage, in addition to envelope and interior damage, from hurricane winds. The modeling approach to assessing damage for these building types is the same as that for assessing damage for personal residential buildings, modeling the building as a whole.

However, commercial residential mid- and high-rise buildings (MHB) (Figure 14) are very different from low-rise buildings and single-family homes. The mid-/high-rise buildings are engineered structures, which suffer few structural failures during a windstorm but are subject to water ingress from cladding and opening failures. These buildings, which come in many different types, shapes, height, and geometries, consist of steel, reinforced concrete, timber, masonry, or a combination of different structural materials.

It is not realistic to perform damage simulations on a reduced collection of 'base' buildings, as is done for single-family residential and low-rise commercial residential buildings, because that will necessarily leave out a majority of existing mid- and high-rise typologies. For instance, for steel frame structures alone there are a wide variety of possible building shapes and configurations. These different shapes lead to very different wind-loading scenarios and therefore different vulnerabilities. Equally important, the number of MHB is at least an order of magnitude smaller than the number of PRB or LB. It is therefore not feasible to average the losses over a very large number of buildings and compensate small differences between buildings, as in the case of PRB. On the contrary, the analyst is faced with a relatively small number of buildings, each of which is different from the other.

As a result, the FPHLM has adopted a modular approach to model mid- and high-rise buildings. Rather than considering a structure as a whole, the model treats the building as a collection of apartment units. The base modules are typical apartment units, divided as corner and middle units. Thus, buildings with any number of stories and any number of units per floor can be modeled by aggregating the corresponding apartment units vulnerabilities and accounting for correlation of damage among units (e.g., water ingress through an envelope breach in a fifth-floor unit creates problems for lower units with no failures).

To summarize, in the case of LB (low rise buildings), typical models of the whole structure that are representative of the vast majority of this building population in Florida were defined. In the case of MHB (mid-high rise buildings), typical models of individual units that are representative of the vast majority of units in Florida were defined.

An extensive survey of the commercial residential Florida building stock was carried out to generate a manageable number of these building and apartment models to represent the majority of the Florida residential building stock. The modelers analyzed Florida counties' property tax appraisers' (CPTA) databases for building stock information. Although the database contents and format vary from county to county, many of the databases contain the structural information needed to define the most common structural types. Information from 40 counties was collected for commercial residential buildings (Michalski, 2016). The modelers extracted information on several building characteristics for classification, including roof cover, roof shape, exterior wall material, number of stories, year built, building area, foundation type, floor plan, shape, and opening protection.

Figure 13. Typical low-rise buildings (LB).

Figure 14. Examples of mid- and high-rise buildings (MHB).

Commercial Residential Building Survey

In the case of the commercial residential buildings, the CPTAs classify the buildings either as condominiums or as multifamily residential (MFR) based only on the type of ownership. Condo buildings are such that each unit or apartment has a different owner. The condo unit can then be occupied by the owner or by a renter. The CPTAs do not record if the condo unit is rented or owned. Condo owners' expenses include the maintenance and use of the common areas and common facilities because the condo owner actually owns a percentage of the entire facility. The condo buildings relevant to this survey are all classified by the CPTAs as residential. Commercial office condo buildings are out of the scope of the survey.

A MFR building has a single owner who rents the units to tenants. The CPTAs classify MFR buildings with fewer than 10 units (duplex, triplex, and quadruplex) as residential buildings; MFR buildings with 10 units or more are classified as commercial buildings. Both residential and commercial MFR buildings were considered in this survey. MFR buildings are interchangeably referred to as apartment buildings by CPTAs. Residential MFR buildings (fewer than 10 units) account for approximately 70% of the MFR building stock, and the remaining 30% are commercial MFR buildings (10 units or more).

The commercial-residential buildings, regardless of whether they are condos or MFR buildings, were divided in two categories: low-rise (one–three stories) and mid-high rise (four stories and more). Low-rise buildings have three stories or fewer. The survey shows these buildings, which represent the majority of the building stock, have different characteristics than taller buildings. Unanwa (1997) uses a similar definition in his study. The mid- and high-rise buildings tend to be more heterogeneous and necessitate a different treatment in the vulnerability model. Owned as well as rented apartment units are included in this survey; the CPTAs do not distinguish between the two.

Appraisers have confirmed that MFR buildings tend to have fewer stories than condo buildings and the majority of MFR buildings are duplexes, triplexes, and quadruplexes. Also, the proportion of MFR buildings that can be classified as mid-/high-rise is negligible according to available information and consultation with CPTAs.

Building Models

Distinctly different construction characteristics and modes of damage in high winds led to the development of separate models for low-rise commercial residential construction (LB) and mid-/high-rise commercial residential construction (MHR).

Low-Rise Commercial Residential Models

The LB model was developed to represent typical apartment and town-house style structures of three stories or fewer (Figure 13). The model framework is based on the single-family, site-built residential model, which uses a probabilistic description of wind loads and exterior and structural component capacities to project physical damage as a function of wind speed. The components in the LB damage model include roof cover, roof sheathing, roof-to-wall connections, wall type, wall sheathing, windows, entry doors, sliding-glass doors, soffits, and gable end truss integrity.

Given the large array of sizes and geometries for low-rise commercial residential structures, the program is developed to provide flexibility in choosing a building layout and dimensioning details (footprint, overhang length, roof slope, roof shape, etc.). The changes in construction practice over decades in Florida also necessitate flexibility when choosing construction quality with regard to hurricane wind resistance. The model allows the selection of building components with a variety of strength options to represent a range from low to high wind resistance (braced or unbraced gable ends, old or new roof cover, sheathing nailing schedules, etc.).

A standard (default) model was developed based on the building exposure study that quantified average square footage per story, units per story, and other descriptors. Default settings were also developed to represent weak, medium, and strong construction practice. Any given strong, medium, or weak model may be altered by additional mitigation or retrofit measures individually or in combination. For example, reroofing an older apartment can be represented by increasing the probabilistic descriptor of capacity for the roof cover.

Outputs (damage matrices) have been produced for each combination of the following: building height (one, two, or three stories), wall type (timber or masonry), roof shape (hip or gable), strength (weak, medium, or strong), and window protection (no protection or with metal shutters).

Mid-/High-Rise Commercial Residential Models

The mid-/high-rise model uses the Monte Carlo simulation concept, but it differs from the low-rise model in significant ways. There is a high level of variability among mid-/high-rise buildings because of the combination of the number of stories, the number of units per floor, intentionally unique geometries, and the materials used for the exterior. This makes the application of a "standard" or default model unfeasible. Because of the construction methods and materials used in these structures, damage to the superstructure and exterior surfaces of the buildings tends to be relatively minor. The majority of damage accumulation in mid-/high-rise structures is due to water penetration and failure of openings. The model reflects this by focusing on the failure of windows and doors, the ingress of rain water, and the proliferation of water from the source of the ingress to adjacent living units. The structure in whole is not modeled. Rather, individual units are modeled in isolation. That is, the vulnerability of a single unit is explicitly modeled, and damage is assessed to openings as a function of wind speed.

Two different mid-/high-rise classifications are modeled for this study: "closed building" and "open building." Closed buildings are characterized by the location of the unit entry doors at the interior of the building. The sliding-glass doors and windows are all facing the exterior of the building. For the open building model there is exterior corridor access to each unit entry door on one side of the building, and the patio areas are situated on the opposite side of the building (Figure 15). The type of building chosen can increase or decrease the vulnerability of a selected unit because of the exposure of the exterior openings. Middle units in a closed or open building have one or two exterior walls, respectively.

There are three main differences between the low-rise and mid-/high-rise models: (1) the use of a modular (i.e., per unit rather than per building) approach, (2) the exterior components being analyzed for failure, and (3) the use of two basic floor plans. Location of unit within the plan view of the building, unit square footage, and number of available openings are some of the important factors that separate one unit from another.

Corner units are subjected to higher wind pressures that are present along the edges of the building, compared to the middle units, which are located within lower pressure zones at the center of the wall area (Figure 15). Increased square footage typically results in an increase in exterior wall frontage and the number of openings vulnerable to damage.

The MHB model uses the same analysis and output technique as the LB model. The difference is the number of failure types modeled. The MHB model analyzes only the damage to the openings, which include the windows, sliding doors, and entry doors. Each of the components can fail due to pressure or debris impact.

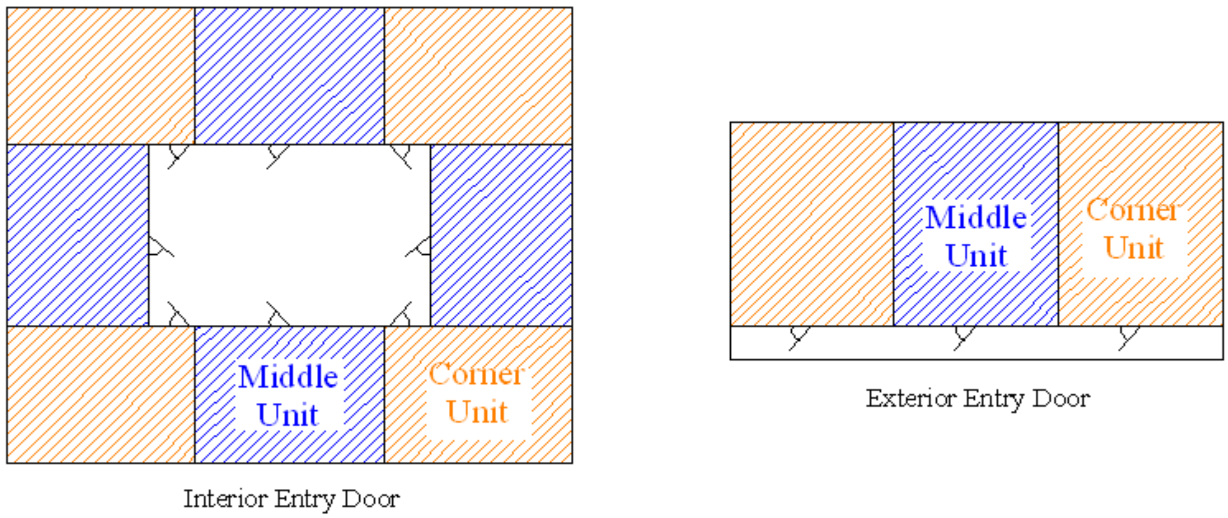


Figure 15. Apartment types according to layout (left: closed building with interior entry door; right: open building with exterior entry door).

Damage Matrices

Exterior Damage

The vulnerability model uses a Monte Carlo simulation based on a component approach to determine the external vulnerability (as shown in) at various wind speeds of buildings in the case of LB, or apartment units in the case of MHB. For the case of LB, the procedure is identical to the one described for single-family residential (PRB). In the case of MHB, the simulations address only wind pressure and debris impact on the openings.

The damage assessment is conducted over a range of wind speeds and wind directions, and results are stored in a damage matrix. Probabilistic damage assessment is conducted by first creating an individual building realization by mapping each component according to typical construction practice. Random capacity values are assigned to the various components on the basis of a probability distribution for each component type. This realization is subjected to a peak three-second gust wind speed from a particular direction. Directional loads are calculated using randomized pressure coefficients based on directional modifications to ASCE 7 as well as wind tunnel data (NIST Aerodynamic Database - http://fris2.nist.gov/winddata), and a comparison of resulting surface and internal loads to component capacities is conducted. Damage occurs when the assigned capacity of a component is exceeded by its loading. Once the openings have been checked for failure due to pressure, the damage due to the impact of windborne debris is also evaluated. Damaged components are removed, and a series of checks are performed to determine if lost components will redistribute loading to adjacent components or change the overall loading. For example, loss of a roof-to-wall connection places additional load on adjacent connections, whereas an envelope breach will potentially alter internal loading—changing the overall loading on most components. Iterative convergence is used to produce the final damage state for that building realization. The results of this single simulation are documented on the basis of the final iteration, another realization of that building is constructed by assigning new random capacities to each component, and the process repeats for the same three-second gust, same wind direction, and newly randomized pressure coefficients based on the number of desired simulations the user would like to run. The process is repeated for eight wind directions and a series of three-second wind speeds between 50 and 250 mph in 5 mph increments.

The output of the Monte Carlo simulation model is an estimate of physical damage to structural and exterior components. The results are in the form of a four-dimensional damage matrix. Each row of the matrix lists the results of one simulation. The amount of damage to each of the modeled components for a simulation is listed in 75 columns. The third dimension represents the peak three-second gust wind speed between 50 and 250 mph in 5 mph increments, and the fourth dimension represents the eight angles between 0 and 315 degrees in 45-degree increments. Table 8 delineates the damage matrix contents for the case of the LB. A description of each of the nine columns of the MHB damage matrix is given in Table 9.

Column #	Timber Models	Masonry Models
Col 1	Percent roof cover (shingles or tiles) failed	
Col 2	Percent field roof sheathing lost (field roof sheathing is all but overhang)	
Col 3	Percent edge (overhang) roof sheathing failed	
Col 4	Percent roof-to-wall connections failed	
Col 5	Collapse of gable end trusses (0 = no, 1 to 20) starting from side 1	
Col 6	Collapse of gable end trusses (0 = no, 1 to 20) starting from side 2	
Col 7-8	Percent gable end wall covering failed (side 1 and 2, positive for windward, negative for leeward)	
Col 9-10	Percent gable end sheathing failed (side 1 and 2, positive for windward, negative for leeward)	
Col 11- 14	Percent wall covering failed – 1st floor (walls 1-4, positive for windward, negative for Leeward)	Shear Damage Ratio for Masonry Walls- 1st Floor (walls 1-4, positive for windward, negative for leeward)
Col 15-18	Percent wall sheathing failed – 1st floor (walls 1-4, positive for windward, negative for leeward)	Bending Damage Ratio for Masonry Walls- 1st Floor (walls 1-4, positive for windward, negative for leeward)
Col 19-22	Number of windows failed from wind pressure – 1st floor - (walls 1-4, positive for windward, negative for leeward)	
Col 23-26	Number of windows failed from wind Debris– 1st floor - (walls 1-4)	
Col 27	Number of sliding glass doors failed from wind pressure – 1st floor (+ for windward - for leeward)	
Col 28	Number of sliding glass doors failed from debris impact – 1st floor	
Col 29	Number of entry doors failed from wind pressure – 1st floor (+ for windward - for leeward)	
Col 30	Number of entry doors failed from debris impact – 1st floor	
Col 31-50	Repeat Col 11 - Col 30 for 2nd Floor	
Col 51-70	Repeat Col 11 - Col 30 for 3nd Floor	
Col 71	Garage Door Damage (positive for windward, negative for leeward)	
Col 72-75	Percent Soffit Damage (walls 1-4)	

Table 8. Description of damage matrices for LB.

Commercial and Single Family Residential	
Column #	**Inner and Outer Stair Models**
Col 1	Number of Windows failed from wind pressure
Col 2	Number of Entry Doors failed from wind pressure
Col 3	Number of Sliding failed from wind pressure
Col 4	Number of Windows failed from debris impact
Col 5	Number of Entry Doors failed from debris impact
Col 6	Number of Sliding failed from debris impact
Col 7	Number of Windows breached from debris impact
Col 8	Number of Entry Doors breach from debris impact
Col 9	Number of Sliding breach from debris impact

Table 9. Description of the damage matrices for MHB apartments.

Interior and Utilities Damage

The FPHLM introduced a novel approach to assessing the interior damage by considering the physics of the problem. The approach starts from the damage to the building envelope (Weekes et al., 2009), described in the previous section. The model then estimates the amount of wind-driven rain that enters through the breaches and defects in the building envelope and converts it to interior damage. The approach is summarized below. More details are provided in standard V-1 and in (Pita, 2012; Pita et al., 2012a).

The method () combines existing building defects and estimated building envelope damage with the impinging rain to predict the amount of water that will enter a building. This physically based approach models the main contributor to interior damage, addresses the uncertainty in the interior damage source, and documents the individual water ingress contribution of each component to the total water intrusion.

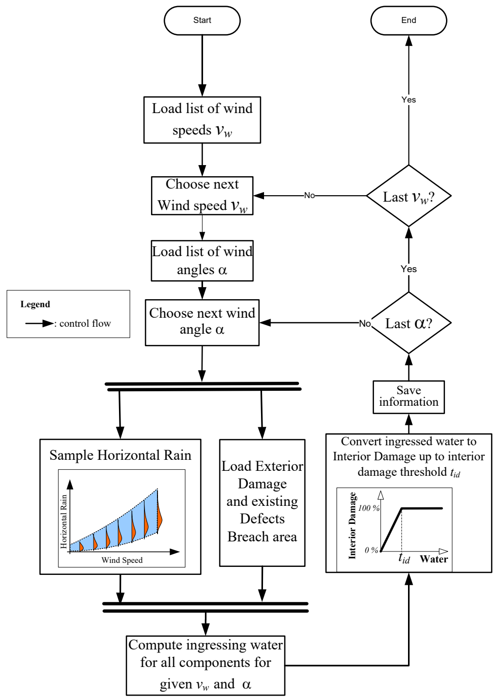


Figure 16. Flowchart of the interior damage model.

The exterior building components that the model considers include roof cover, roof sheathing, wall cover, wall sheathing, gable cover, gable sheathing, windows, doors, and sliding doors. In the case of MHB units, only windows, doors, and sliding doors are considered. For a given wind speed, the model first estimates breach areas of each component from the exterior damage array. The area of existing defects in envelope components is estimated based on surveys (Mullens et al., 2006) and engineering experience.

This approach for both low-rise and mid/high-rise buildings estimates the amount of water that enters through the breaches and defects of each component of the envelope. The total amount of water is calculated by adding the contribution of all components for a given wind speed, and by estimating the water which percolates from story to story. The final step maps water inside the building to interior damage with a bilinear relationship, where total interior damage is achieved for a certain threshold of height of accumulated water.

Contents Damage

Contents include anything in the building that is not attached to the structure itself. As in the case of interior and utilities damage, the contents damage is assumed to be a function of the amount of water that penetrates the building, and it is therefore proportional to interior damage. The function is based on engineering judgment and is validated using claims data. In the case of a condo building, only the contents of the common areas are covered by the policy. In the case of an apartment building, the personal contents of the renters are not covered by the building policy.

Time Related Expenses

Time Related Expenses refer to loss of rent for owners of apartment buildings, which are mainly low-rise commercial residential buildings. As in the case of interior and utilities damage, the Time Related Expenses are assumed to be a function of the amount of water that penetrates into the building, and they are therefore proportional to interior damage. The function is based on engineering judgment and should be validated using claims data, which is almost non-existent.

Vulnerability Matrices for Low-Rise Buildings

Unweighted Vulnerability Matrices of LB

A description of the process to estimate the total vulnerability of low-rise buildings is displayed in . Given a particular building type, the Monte Carlo simulation-generated damage array that expresses the exterior damage in the envelope is loaded. For a particular wind speed and wind direction, each component physical damage is normalized to a percentage value. For instance, the number of damaged doors, windows, and sliding doors is divided by the total number of the corresponding openings; collapsed trusses are divided over the total number of trusses, etc. The cost of the damage is then assessed.

Interior damage is estimated by (1) simulating the amount of wind-driven rain that enters through the breaches and defects in the building envelope, (2) propagating water from floor to floor, and (3) converting to damage to interior and utilities.

Replacement cost ratios provide the link between modeled physical damage and the corresponding monetary losses. They can be defined as the cost of replacing a damaged component or assembly of a building divided by the cost of constructing a completely new building of the same type. An explicit procedure is used to convert physical damage of the modeled components to monetary damage. The procedure is almost identical to the one already described for single-family residential buildings. The damage ratio (DR) as a function of wind speed for the exterior, interior, and utilities is calculated by adding the corresponding costs of damaged exterior plus damaged interior plus damaged utilities divided over the overall building cost that is contingent upon the type and size of the building.

Derivation of the probability distribution functions of damage at each wind speed interval is the final step of the process. For each wind speed interval, the probability of damage given that wind speed interval (i.e., the cells of the vulnerability matrices) is computed as the summation of specific damage ratios for all wind directions divided by the total number of simulations at that particular wind speed interval.

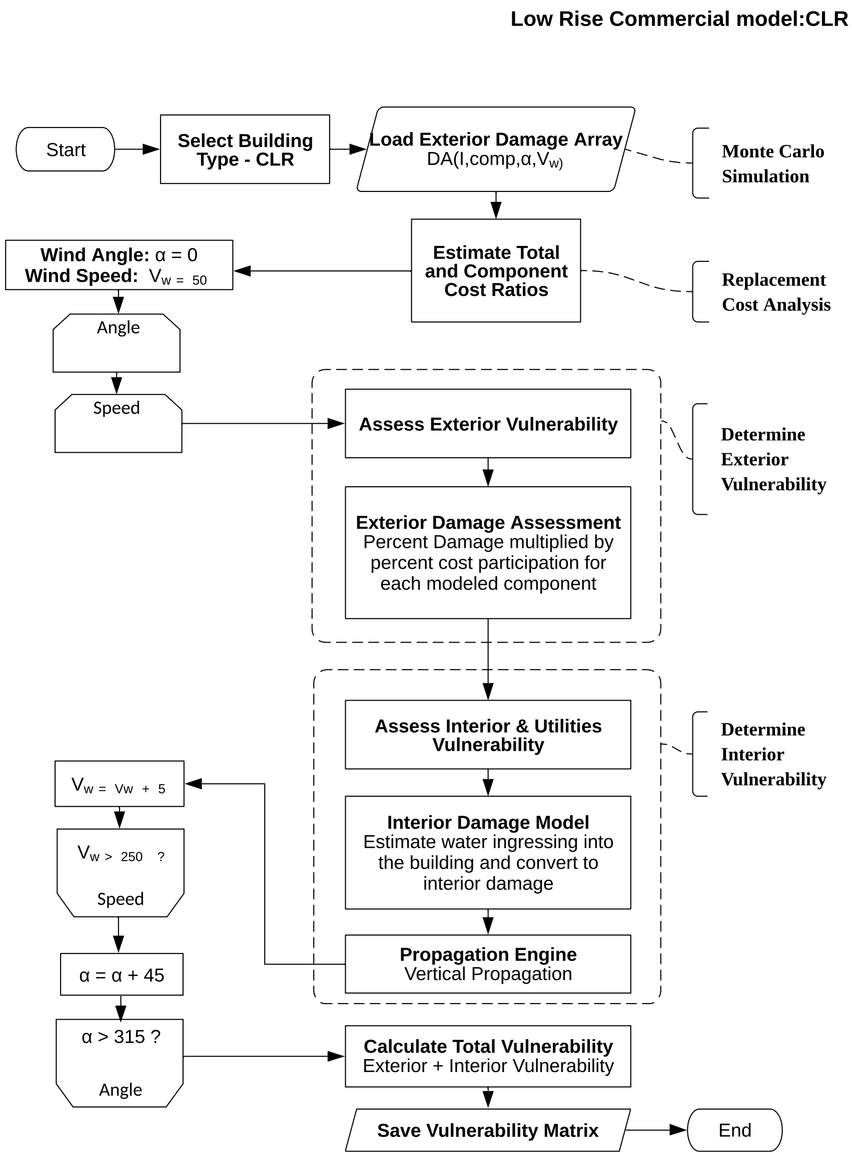


Figure 17. Procedure to create a CR vulnerability matrix.

Weighted Vulnerability Matrices of LB

In the case of LB, vulnerability matrices were created for every combination of construction type (masonry, timber, or other), roof shape (gable or hip), roof cover (tile or shingle or metal), shutters (with or without), number of stories (one, two, or three), and subregion (inland, wind-borne debris region, and high velocity zone). However, in general, there is little information available in an insurance portfolio file regarding the structural characteristics and the wind resistance of the insured property. Instead, insurance companies rely on the ISO fire resistance classification. Portfolio files have information on ZIP Code and year built. The ISO classification is used to determine if the home is constructed of masonry, timber, or other. The ZIP Code is used to define the subregion. The year built is used to assist in defining whether a building should be considered weak, medium, or strong.

From the insurance files, sub-region, construction type, and year built are determined. This leaves the roof shape, roof cover, number of stories, and shutter options undefined. From the exposure study of 21 Florida counties, the distribution of these parameters can be extrapolated. For each age group, we define a weighted matrix for each construction type in each sub-region. The procedure is identical to the one already described for single-family buildings.

Age-Weighted Matrices of LB

The year built or year of last upgrade of a structure in a portfolio may not be available when performing a portfolio analysis to estimate hurricane losses in a certain region. In that case, it becomes necessary to assume a certain distribution of ages in the region to develop an average vulnerability by combining weak, medium, and strong. Here again, the procedure is identical to the one described for single-family residential buildings.

Mapping of Insurance Policies to Vulnerability Matrices for LB

The mapping of the low-rise vulnerability matrices to the insurance policies in any given portfolio is also very similar to the process already reported for single-family buildings.

LB Models' Distribution in Time

The low-rise building models' distribution in time is similar to that of the single-family buildings.

Vulnerability of Mid-/High-Rise Buildings

MHB opening vulnerabilities

In the case of MHB, a process similar to the one described above is followed to derive exterior vulnerability and breach curves for different openings of typical apartment units. These curves are derived for the cases of open and closed buildings, for corner and middle units, with different opening protections (with or without impact-resistant glass; with or without metal shutters). Each vulnerability curve for openings of corner or middle apartment units (window, door, or slider) gives the number or fraction of opening damaged as a function of wind speed. Each breach curve for openings of corner or middle apartment units (window, door, or slider) gives the breach area in ft2 of opening damaged as a function of wind speed.

MHB building vulnerability

Unlike the single-family home loss model in which interior and exterior damage was aggregated inside the vulnerability module, the aggregation for mid-/high-rise buildings is performed outside that module because of the interior damage propagation. The modular approach produces independent assessments of exterior damage for each unit while also considering the interior water damage that can spread from unit to unit and trigger damage far from its source. Therefore, interior damage is treated in two stages: the first stage occurs as a direct result of the exterior damage, and the second occurs as a consequence of propagation between units. The separate modeling of exterior and interior damage is also well suited to dealing with the insurance issue of different insurance coverage for apartment and condo buildings.

The process for damage estimation for MHB is presented in . For each policy in the portfolio, the program reads the information on the building (location and number of stories and units) and assigns a wind speed profile based on its location (i.e., surrounding terrain). The algorithm calculates the number of corner and middle units per floor (a_c and a_M) and loads the corresponding opening vulnerability and breach curves ($V_{C,M}$ and $B_{C,M}$). The vulnerability curves, combined with the wind speed value at every story, W_i, yield the number of openings of each kind damaged at each story, which are then assigned a replacement cost, $C_{W,D,S}$. The result is the cost of damage to the openings at each story (CDO_s), which is then accumulated over all the stories as the total expected cost of damage to the openings (TECDO).

For the interior damage estimation the process is similar. From the wind profile, the corresponding wind speed, W_i, is calculated at each story. For a given story and its corresponding wind speed, the value of the expected breach size for windows, entry door, and sliding door, $B_C^{W,D,S}$ and $B_M^{W,D,S}$, are retrieved from the corresponding breach curves. The breach size of each component is added to get the total breach size per story. The next step is to estimate the amount of water that will enter a particular story with a given breach size, as described in the section describing the interior damage model. Note that for the sake of simplification, defects are not represented in the flow chart.

Increased water penetration through possible roof cover damage as well as roof defects or ventilation ducts could happen in the upper floors, which would then trickle down to the lower stories. Therefore an additional volume of water penetration is modeled at the upper story.

A scheme for vertical propagation of water between floors was implemented. The water content is then transformed at each story into an interior damage ratio (ID) based on the bilinear relationship described in Standard V-1. The final product of the interior damage assessment is the Expected Interior Damage Ratio (EIDR).

At this point in the process, the algorithm has computed expected damages, both exterior (TECDO) and interior (EIDR), for the particular building of the policy under study. The EIDR is then multiplied by the interior insured value expressed as a percentage of the total insured value BV, thanks to a coefficient k_I which varies for condos and apartment buildings. The final value is the total expected damage value (EDV).

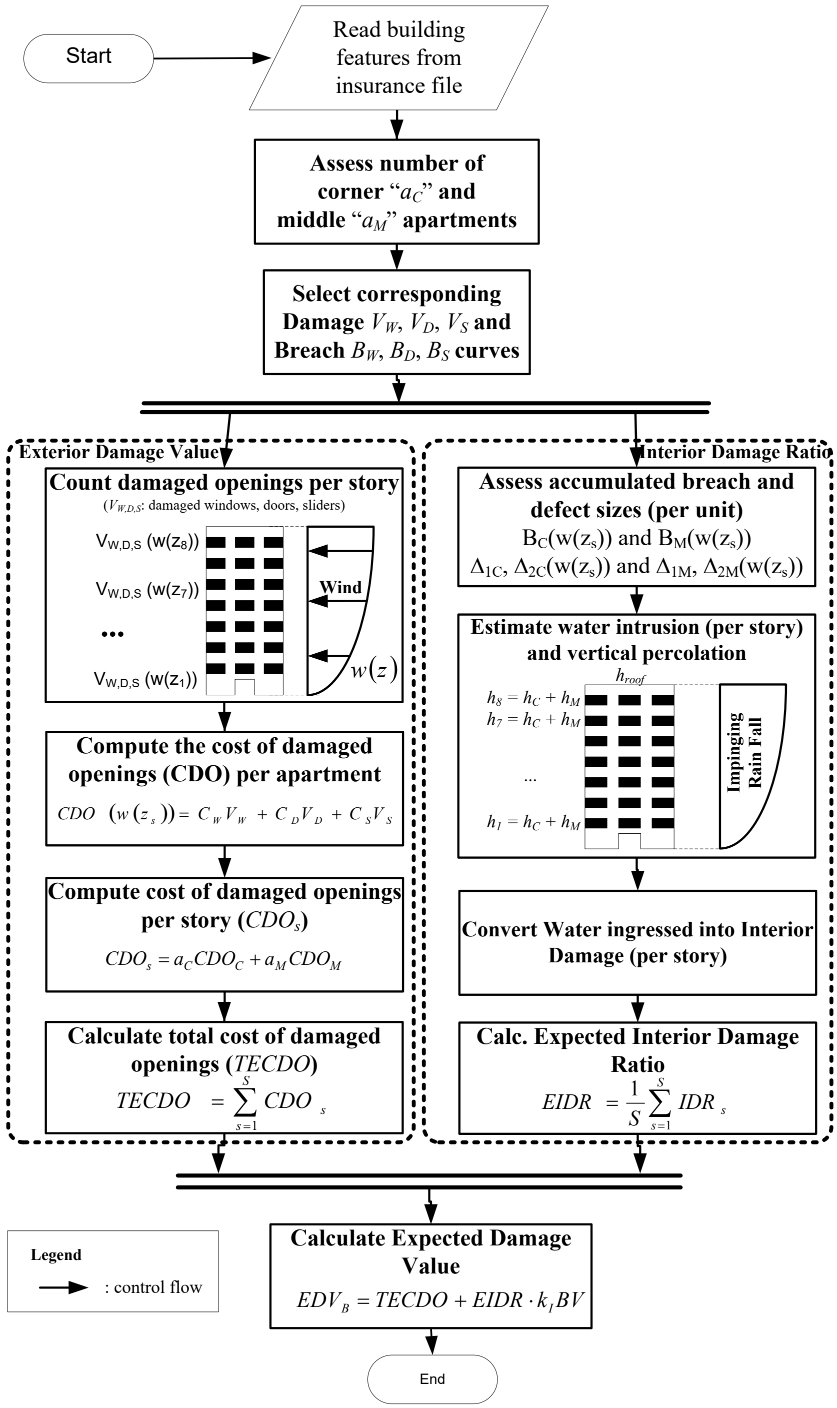


Figure 18. Exterior and interior damage assessment for MHB.

Contents Vulnerability

Contents include anything in the building that is not attached to the structure. In the case of a condo building only the contents of the common areas are covered by the policy. In the case of an apartment building, the personal contents of the renters are not covered by the building policy. In both cases, the contents vulnerability is proportional to the interior vulnerability. The constant of proportionality is based on engineering judgment and is validated using claims data.

Time-Related Expenses

Time-related expenses are coverage for loss of income due to the building damage. The value of a claim is obviously dependent on the time it takes to repair a damaged building as well as the surrounding utilities and infrastructure. This coverage applies only to apartment buildings, where the loss of income is the loss of rent. The time-related expenses are modeled as directly proportional to the interior vulnerability.

Appurtenant Structures

For commercial residential structures, appurtenant structures might include a clubhouse or administration building, which are treated like additional buildings. For other structures such as pools, etc., the appurtenant structures model developed for residential buildings is applicable.

Actuarial Component

The actuarial component consists of a set of algorithms. The process involves a series of steps: rigorous check of the input data; selection and use of the relevant output produced by the meteorology component; selection and use of the appropriate vulnerability matrices for building structure, contents, appurtenant structure, and additional living expenses; running the actuarial algorithm to produce expected losses; aggregating the losses in a variety of manners to produce a set of expected annual hurricane wind losses; and producing probable maximum losses for various return periods. The expected losses can be reported by construction type (e.g., masonry, frame, manufactured homes), by county or ZIP Code, by policy form (e.g., HO-3, HO-4, etc.), by rating territory, and combinations thereof.

Expected annual losses are estimated for individual policies in the portfolio. They are estimated for building structure, appurtenant structure, contents, and ALE on the basis of their exposures and by using the respective vulnerability matrices or vulnerability curves for the construction types. For each policy, losses are estimated for all the hurricanes in the stochastic set by using appropriate damage matrices and policy exposure data. The losses are then summed over all hurricanes and divided by the number of years in the simulation to get the annual expected loss. These are aggregated at the ZIP Code, county, territory, or portfolio level and then divided by the respective level of aggregated exposure to get the loss costs. This is a computationally demanding method. Each portfolio must be run through the entire stochastic set of hurricanes.

The distribution of losses is driven by both the distribution of damage ratios generated by the engineering component and by the distribution of wind speeds generated by the meteorology

component. The meteorology component provides, for each lat-long grid, the associated probabilities for a common set of wind speeds. Thus, locations are essentially differentiated by their probability distribution of wind speeds. The meteorology component uses up to 56,000 year simulations to generate a stochastic set of storms. The storms are hurricane events at landfall or when bypassing closely. Each simulated storm has a track and a set of modeled windfields at successive time intervals. The windfields generate the one-minute maximum sustained wind speeds for the storm at various locations (lat-long grid) along its track. These one-minute maximum sustained winds are then converted to three-second peak gust winds and corrected for terrain roughness by using the gust wind model and the terrain roughness model.
For each lat-long grid, an accounting is then made of all the simulated storms that pass through it. On the basis of the number of pass-through storms and their peak wind speeds, a distribution of the wind speed is then generated for the grid. On the basis of this distribution, probabilities are generated for each 5-mph interval of wind speeds, starting at 20 mph. These 5-mph bins constitute the column headings of the damage matrices generated by the engineering component.

The engineering group has produced vulnerability matrices for personal residential buildings and vulnerability curves for commercial residential buildings.

Vulnerability matrices are provided for personal residential building structure, contents, appurtenant structures and additional living expenses for a variety of residential construction types and for different policy types. The construction types are masonry, frame, mobile home, and other. The vulnerability matrices are also developed for weak, medium, and strong construction as proxy by year built.

Within each broad construction category, the vulnerability matrices are specific to the roof types and number of stories, etc. Since the policy data do not provide this level of specificity, weighted matrices are used instead, where the weights are the proportion of different roof types in given region as determined by a survey of the building blocks and exposure data. The vulnerability matrices are used as input in the actuarial model.

The starting point for the computations of personal residential losses is the vulnerability matrix with its set of damage intervals and associated probabilities. Appropriate vulnerability matrices are applied separately for building structure, content, appurtenant structure, and ALE. Once the matrix is selected, for a given wind speed, for each of the midpoint of the damage intervals, the ground up loss is computed, the appropriate deductibles and limits are applied, and the loss net of deductible is calculated. More specifically, for each damage outcome the damage ratio is multiplied by insured value to get dollar damages, the deductible is deducted, and net of deductible loss is estimated. Percentage deductibles are converted into dollar amounts. Both the replacement cost and actual cash value are generally assumed to equal the coverage limit. Furthermore, if there are multiple hurricanes in a year in the stochastic set, the wind deductibles are applied to the first hurricane, and any remaining amount is then applied to the second hurricane. If none remains then the general peril deductible can be applied.

The net of deductible loss is multiplied by the probability in the corresponding cell to get the expected loss for the given damage ratio. The results are then averaged across the possible damages for the given wind speed. The expected losses are then adjusted by the appropriate expected demand surge factor.

In the case of low-rise commercial residential structures, the expected damage ratios (EDR) are derived from the vulnerability curves for the maximum wind in the given storms. The EDRs are multiplied by the respective coverage limits to produce the expected ground up building damage value (EDV^B), and expected ground up content damage value (EDV^C) for the storm. The deductible is then applied to these damage values on a pro-rata basis to generate the net of deductible expected losses. The process is repeated across all the storms in the stochastic set to produce the average loss for the policy. The expected losses are then adjusted by the appropriate expected demand surge factor.

In the case of mid-high rise commercial residential buildings, the vulnerability component produces, for a given storm (or given vertical maximum wind profile) and across all the floors in the building, the total expected cost of damage to the openings (TECDO) and the expected interior damage ratio (EIDR). The EIDR is then multiplied by the fraction of the coverage limit corresponding to the value of the interior and added to the TECDO to produce the expected building damage value (EDV^B). The expected content damage value (EDV^C) is produced by multiplying a fraction of the EIDR by the content coverage limit. The deductible is then applied on a pro-rata basis to generate the expected loss for the storms. The process is repeated across all storms to produce the average loss for the policy. The expected losses are then adjusted by the appropriate expected demand surge factor.

For commercial residential policies, if there are multiple risks (multiple structures) within the policy, the default is to apply the deductible at the risk level. The percentage deductible is applied to each risk based on their individual limit. If information is so available, then deductible is applied at the policy level.

The demand surge factors are estimated by a separate model and applied appropriately to each hurricane in the stochastic set. The surge factors for structures are a function of the size of statewide storm losses and are produced separately for the different regions in Florida. The surge factors for content and ALE are functionally related to the surge factor for structure. To estimate the impact of demand surge on the settlement cost of structural claims following a hurricane, data from 1992 to 2007 on a quarterly construction cost index produced by Marshall & Swift/Boeckh are used. The approach to estimating structural demand surge was to examine the index for specific regions impacted by one or more hurricanes since 1992. From the history of the index we projected what the index would have been in the period following the storm had no storm occurred. Any gap between the predicted and actual index was assumed to be due to demand surge. In total ten storm–region combinations are examined. From these ten observations of structural demand surge the functional relationship is generalized.

After the losses are adjusted for demand surge, they are summed across all structures of the type in the grid and also across the grids to get expected aggregate portfolio loss. The model can process any combination of policy type, construction type, deductibles, coverage limits, etc. The model output reports include separate loss estimates for structure, content, appurtenant structure, and ALE. These losses are also reported by construction type (e.g., masonry, frame, manufactured homes), by county or ZIP Code, by policy form (e.g., HO-3, HO-4, etc.), by rating territory, and combinations thereof.

Another function of the actuarial algorithms is to produce estimates of the probable maximum loss for various return periods. The PML is produced non-parametrically using order statistics of simulated annual losses. Suppose the model produces N years of simulated annual losses. The annual losses L are ordered in increasing order so that $L(1) \leq L(2) \leq \ldots \leq L(N)$. For a return period of Y years, let $p = 1-1/Y$. The corresponding PML for the return period Y is the p^{th} quantile of the ordered losses. Let $k = (N)*p$. If k is an integer, then the estimate of the PML is the kth order statistic, L(k), of the simulated losses. If k is not an integer, then let k^* = the smallest integer greater than k, and the estimate of the p^{th} quantile is given by $L(k^*)$.

Computer System Architecture

The FPHLM is a large-scale system that is designed to store, retrieve, and process a large amount of historical and simulated hurricane data. In addition, intensive computation is supported for hurricane damage assessment and insured loss projection. To achieve system robustness and flexibility, a three-tier architecture is adopted and deployed in our system. It aims to solve a number of recurring design and development problems and make the application development work easier and more efficient. The computer system architecture consists of three layers: the user interface layer, the application logic layer, and the database layer.
The interface layer offers the user a friendly and convenient user interface to communicate with the system. To offer greater convenience to the users, the system is prototyped on the web so that the users can access the system with existing web-browser software.

The application logic layer activates model logic based on the functionality presented to the user, processes data, and controls the information flow. This is the middle tier in the computer system architecture. It aims to bridge the gap between the user interface and the underlying database and to hide technical details from the users.

The database layer is responsible for data modeling to store, index, manage, and model information for the application. Data needed by the application logic layer are retrieved from the database, and the computational results produced by the application logic layer are stored back to the database.

Software, Hardware, and Program Structure

The user-facing part of the system consists of a web-based application that is hosted on a Tomcat web application server. The backend server environment is Linux and the server-side scripts that support the model's functionality are written in Bash, Java Server Pages (JSP) and JavaBeans. Backend probabilistic calculations are coded in C++ using the IMSL library and called through Java Native Interface (JNI). The system uses a PostgreSQL database that runs on a Linux server. Server-side software requirements are the IMSL library CNL 5.0, JDBC 3, JNI 1.3.1, and JDK 1.6. The end-user workstation requirements are minimal. Any current version of Internet Explorer, Firefox, Chrome, or Safari running on a currently supported version of Windows, Mac or Linux should deliver optimal user experience. Typically, the manufacturer's minimal set of hardware features for the current version of the web browser and operating system combination is sufficient for an optimal operation of the application.

Translation from Model Structure to Program Structure

The FPHLM uses a component-based approach in converting from model to program structure. The model is divided into the following components or modules: Storm Forecast Module, Wind Field Module, Damage Estimation Module, and Loss Estimation Module. Each of these modules fulfills its individual functionality and communicates with other modules via well-defined interfaces. The architecture and program flow of each module are defined in its corresponding use case document following software engineering specifications. Each model element is translated into subroutines, functions, or class methods on a one-to-one basis. Changes to the models are strictly reflected in the software code.

3. Provide a flowchart that illustrates interactions among major hurricane model components.

See below.

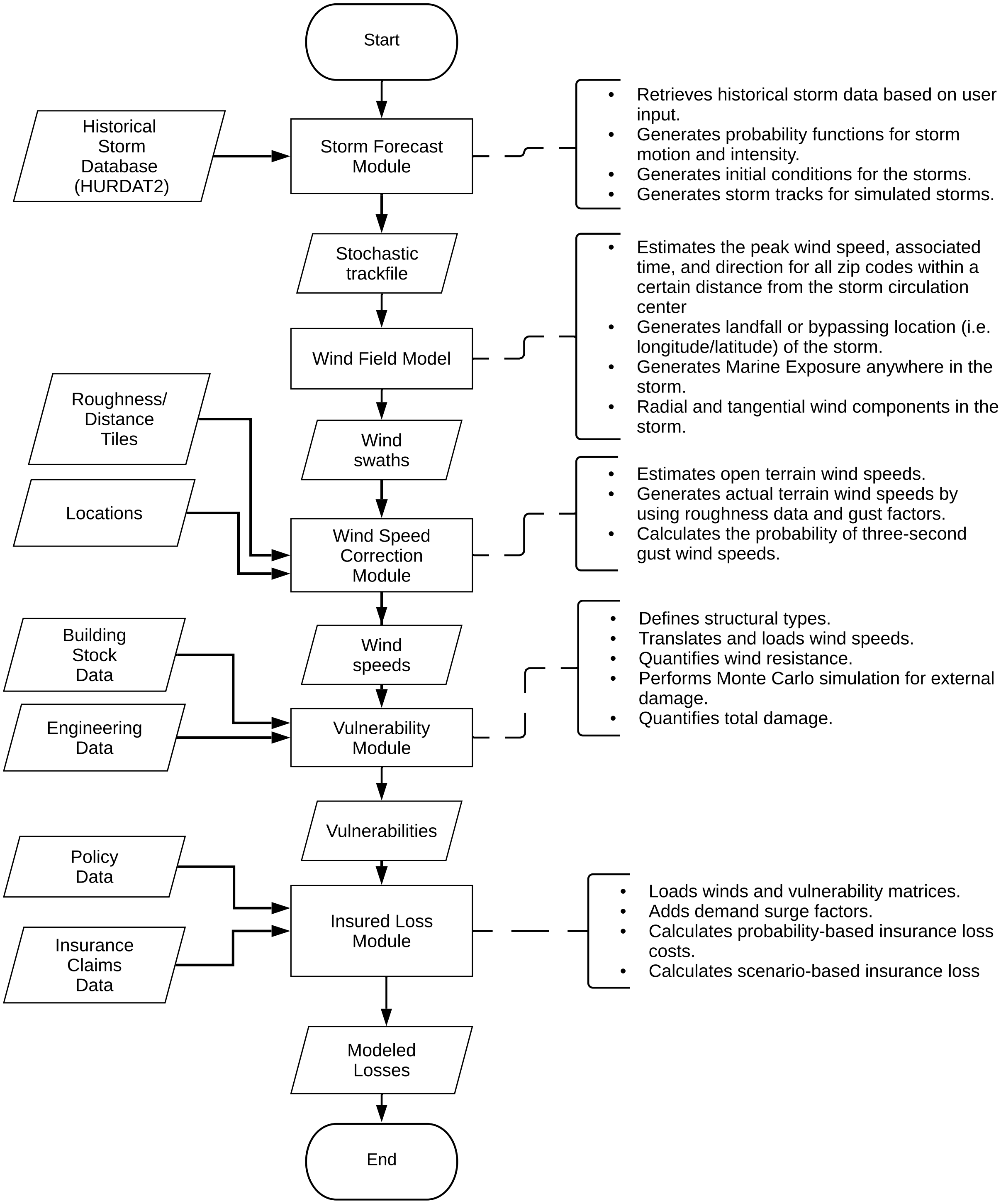


Figure 19. Flow diagram of the computer model.

4. Provide a comprehensive list of complete references pertinent to the hurricane model by standard grouping using professional citation standards.

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NOAA Coastal Services Center. http:www.csc.noaa.gov

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NOAA LA Nina Page. http://www.elnino.noaa.gov/lanina.html

PHRLM Manual. http://www.cis.fiu.edu/hurricaneloss

RAMS: Regional Atmospheric Modeling System. http://rams.atmos.colostate.edu/

R.L. Walko, C.J. Tremback, "RAMS: regional atmospheric modeling system, version 4.3/4.4 - Introduction to RAMS 4.3/4.4."
http://www.atmet.com/html/docs/rams/ug44-rams-intro.pdf

RMS home page. http://www.rms.com

The JDBC API Universal Data Access for the Enterprise.
http://java.sun.com/products/jdbc/overview.html

The Interactive Data Language. https://www.harrisgeospatial.com/Software-Technology/IDL

Track of hurricane Andrew (1992) (Source from NOVA).
http://www.pbs.org/newshour/science/hurricane/facts.html

Tropical cyclone heat potential: http://www.aoml.noaa.gov/phod/cyclone/data/

5. Provide the following information related to changes in the hurricane model from the previously-accepted hurricane model to the initial submission this year.

A. Hurricane Model changes:

1. A summary description of changes that affect the personal or commercial residential hurricane loss costs or hurricane probable maximum loss levels,

Meteorological Component

- We updated to a recent version of HURDAT2 (5/1/2018) which includes storms up through the 2017 season.
- We updated the ZIP Code database to the April 2017 ZIP Code boundaries as per Standard G-3. The update of the ZIP Code database resulted in the update of the following ZIP Code-based databases: (1) population-weighted centroids of each ZIP Code, (2) population-weighted roughness for each ZIP Code, (3) distance to coast of each ZIP Code, (4) list of 2007 FBC WBDR ZIP Codes and list of 2010 FBC WBDR ZIP Codes, and (5) classification of coastal/inland for each ZIP Code.

Vulnerability Component

- There are no changes to report.

2. A list of all other changes, and

Created the capability to model losses with or without Law and Ordinance coverage.

3. The rationale for each change.

Meteorological Component

- Change made to update to a recent version of HURDAT2 (5/1/2018) as per Standard M-1.
- Updated centroid locations as per Standard G-3.

The capability to model losses with and without Law and Ordinance coverage was required in order to complete the Actuarial forms in compliance with the ROA instructions.

B. Percentage difference in average annual zero deductible statewide hurricane loss costs based on the 2012 Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data found in the file named "hlpm2012c.exe" for:

1. All changes combined, and

The impact of all model changes combined is +2.43%.

2. Each individual hurricane model component change.

Meteorological Component

The statewide impact of the meteorological components:

- HURDAT2 update +2.34%
- ZIP Code centroid and five aforementioned databases update +0.002%

The changes shown above are for Personal Residential, Low-rise Commercial Residential, and Mid/High-rise Commercial Residential models combined.

C. Color-coded maps by county reflecting the percentage difference in average annual zero deductible statewide hurricane loss costs based on the 2012 Florida Hurricane Catastrophe Fund's aggregate personal and commercial residential zero deductible exposure data found in the file named "hlpm2012c.exe" for each hurricane model component change.

See Figure 20 and Figure 21.

D. Color-coded map by county reflecting the percentage difference in average annual zero deductible statewide hurricane loss costs based on the 2012 Florida Hurricane Catastrophe Fund's aggregate personal and commercial residential zero deductible exposure data found in the file named "hlpm2012c.exe" for all hurricane model components changed.

See Figure 22.

6. Provide a list and description of any potential interim updates to underlying data relied upon by the hurricane model. State whether the time interval for the update has a possibility of occurring during the period of time the hurricane model could be found acceptable by the Commission under the review cycle in this Hurricane Standards Report of Activities.

The FPHLM currently does not anticipate any interim updates.

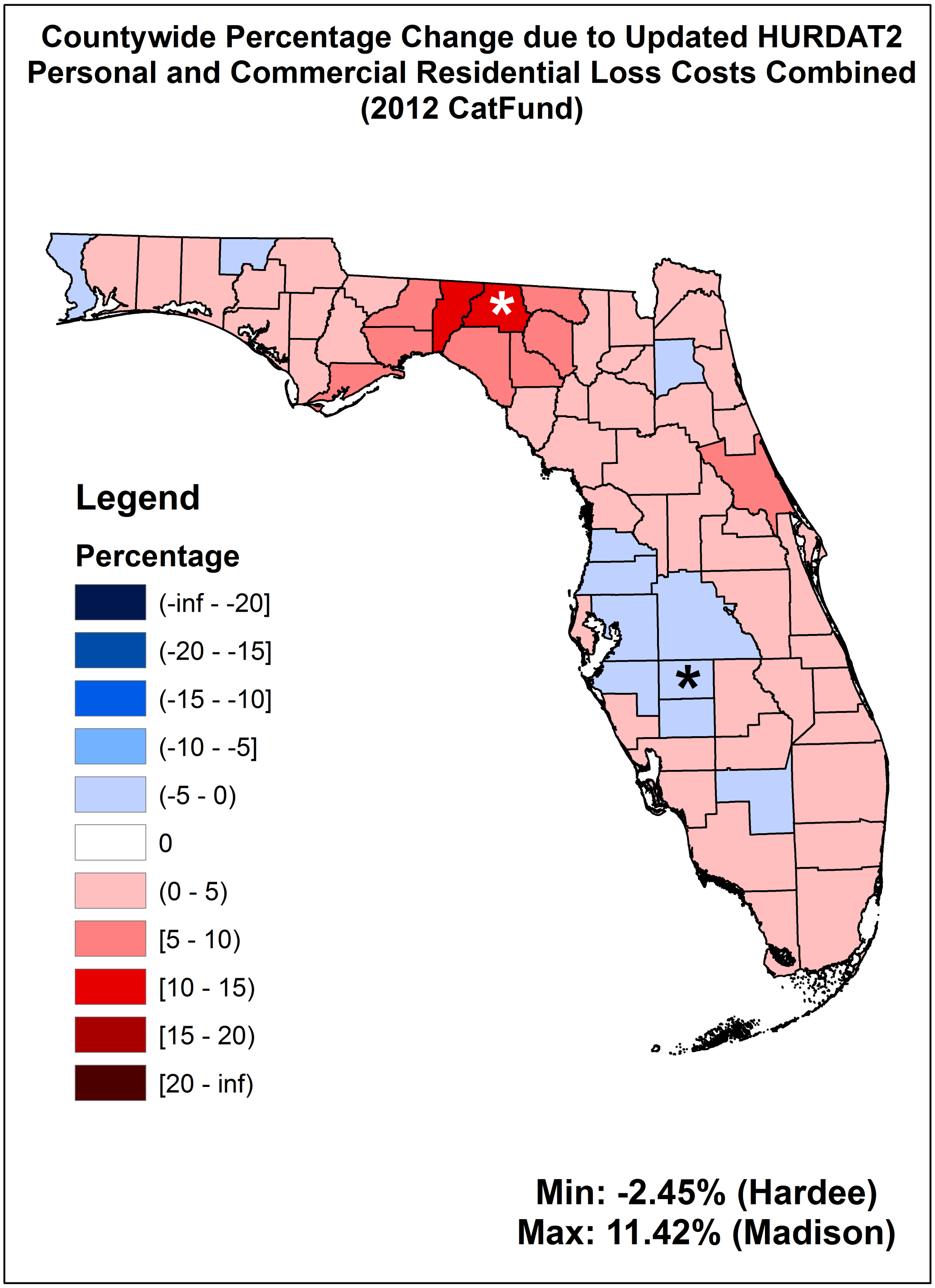


Figure 20. Countywide Percentage Change due to Updated HURDAT2 – Personal and Commercial Residential Loss Costs Combined (2012 FHCF Exposure Data)

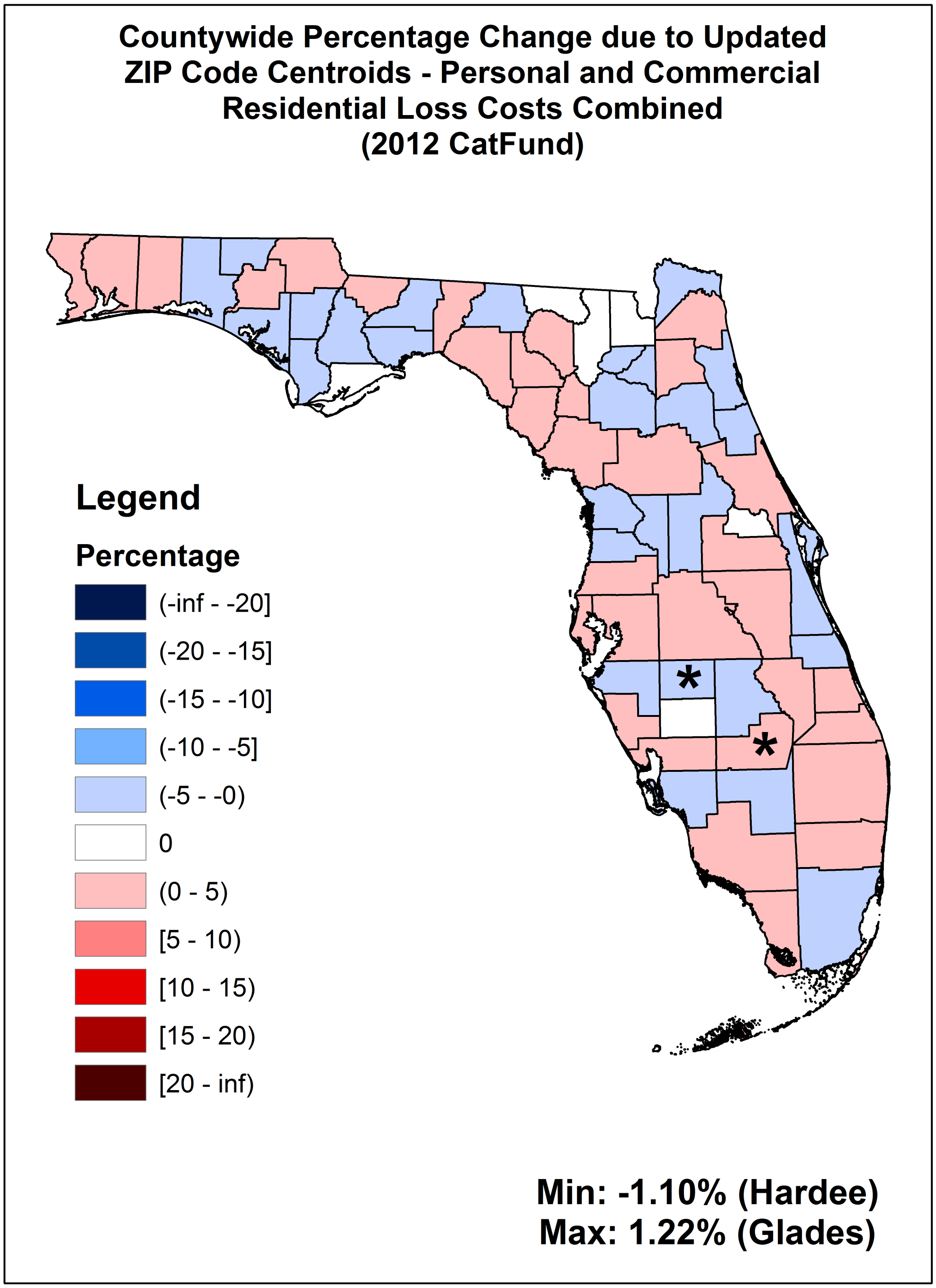


Figure 21. Countywide Percentage Change due to Updated ZIP Code Centroids – Personal and Commercial Residential Loss Costs Combined (2012 FHCF Exposure Data)

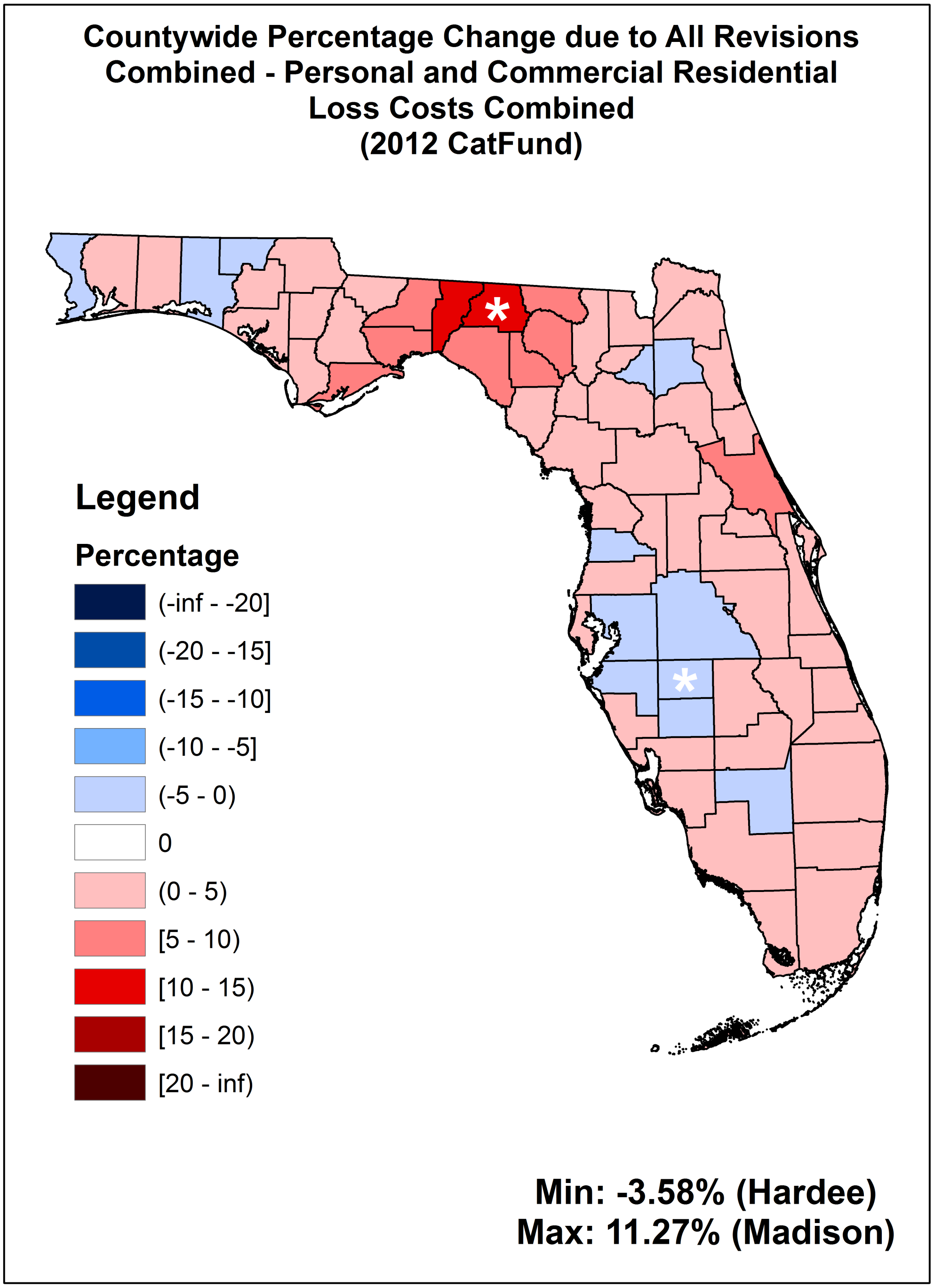


Figure 22. Countywide Percentage Change due to All Revisions Combined - Personal and Commercial Residential Loss Costs Combined (2012 FHCF Exposure Data)

G-2 Qualifications of Modeling Organization Personnel and Consultants Engaged in Development of the Hurricane Model

A. Hurricane model construction, testing, and evaluation shall be performed by modeling organization personnel or consultants who possess the necessary skills, formal education, and experience to develop the relevant components for hurricane loss projection methodologies.

The model was developed, tested, and evaluated by a multi-disciplinary team of professors and experts in the fields of meteorology, wind and structural engineering, computer science, statistics, finance, economics, and actuarial science. The experts work primarily at Florida International University, Florida Institute of Technology, Florida State University, University of Florida, Hurricane Research Division of NOAA, and University of Miami.

B. The hurricane model and hurricane model submission documentation shall be reviewed by modeling organization personnel or consultants in the following professional disciplines with requisite experience: structural/wind engineering (licensed Professional Engineer), statistics (advanced degree), actuarial science (Associate or Fellow of Casualty Actuarial Society or Society of Actuaries), meteorology (advanced degree), and computer/information science (advanced degree or equivalent experience and certifications). These individuals shall certify Expert Certification Forms G-1 through G-6, as applicable.

The model has been reviewed by modeler personnel and consultants in the required professional disciplines. These individuals abide by the standards of professional conduct as adopted by their profession.

Disclosures

1. Organization Background

A. Describe the ownership structure of the modeling organization engaged in the development of the hurricane model. Describe affiliations with other companies and the nature of the relationship, if any. Indicate if the organization has changed its name and explain the circumstances.

The model was developed independently by a multi-disciplinary team of professors and experts. The lead university is the Florida International University. The model was commissioned by the Florida Office of Insurance Regulation.

B. If the hurricane model is developed by an entity other than the modeling organization, describe its organizational structure and indicate how proprietary rights and control over the hurricane model and its components is are exercised. If more than one entity is involved in the development of the hurricane model, describe all involved.

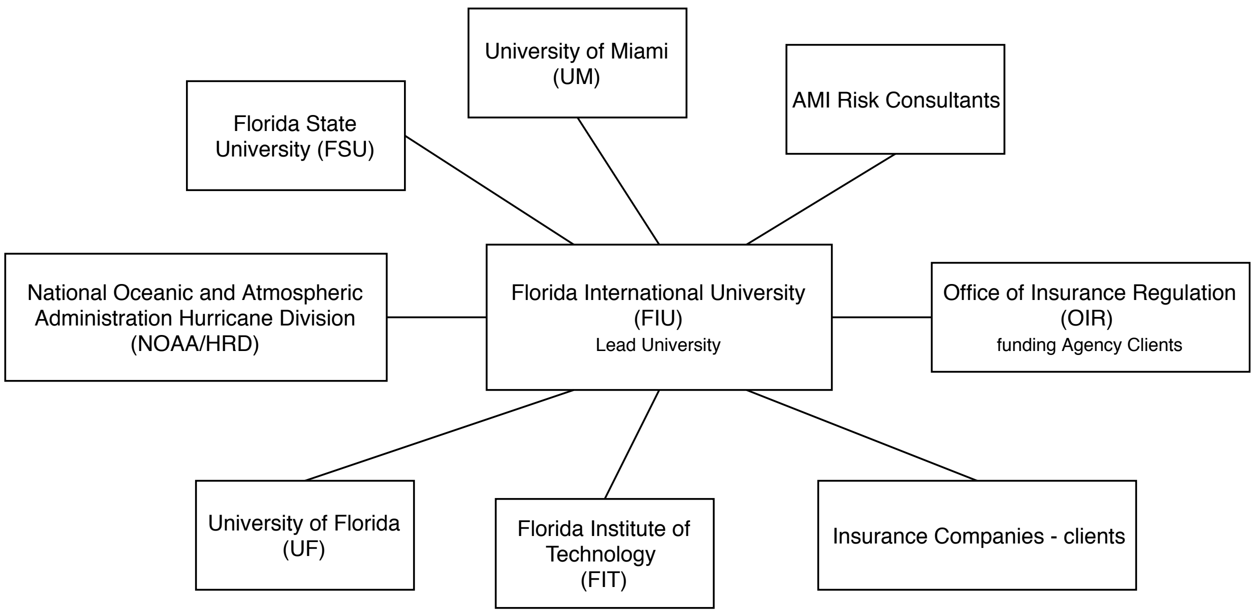


Figure 23. Organizational structure

The Florida Office of Insurance Regulation (OIR) contracted and funded Florida International University to develop the Florida Public Hurricane Loss Model. The model is based at the Laboratory for Insurance, Financial and Economic Research, which is part of the International Hurricane Research Center at Florida International University. The OIR did not influence the development of the model. The model was developed independently by a team of professors, experts, and graduate students working primarily at Florida International University, Florida Institute of Technology, Florida State University, University of Florida, Hurricane Research Division of NOAA, University of Miami, and AMI Risk Consultants. The copyright for the model belongs to OIR.

C. If the hurricane model is developed by an entity other than the modeling organization, describe the funding source for the development of the hurricane model.

The model was funded by the state legislature at the request of the Florida Office of Insurance Regulation.

D. Describe any services other than hurricane modeling provided by the modeling organization.

No other services beside hurricane modeling is provided by modeling organization.

Until 2008 the modeler provided services to only one major client, the FL-OIR. Effective January 2009 the modeler is providing services to the firms and organizations in the insurance and reinsurance industries. It has expanded the infrastructure and computational capacity to handle the added load.

The first version of the model was completed in May 2005 and was based on the knowledge and the limited data available prior to the 2004–2005 hurricane seasons. It was not used for purposes of estimating loss costs for insurance company exposures. Essentially, it was an internal model that was never implemented.

The next version of the model was developed upon the acquisition of a limited amount of meteorological, engineering, and insurance claim data from the 2004–2005 hurricane events and was implemented in March 2006. This version was used to process the insurance company data on behalf of the Florida Office of Insurance Regulation.

In summer 2007 a revised and updated version of the model, 2.6, was accepted by the Florida Commission on Hurricane Loss Projection Methodology and put to immediate use. Another revised and updated version, 3.0, was accepted by the Commission in June 2008. The next updated version of the model was 3.1, which was accepted by the Commission in June 2009. This was followed by version of the model was 4.1, which was accepted by the Commission in August 2011, the version 5.0 accepted in July 2013, and the version 6.1 accepted in July 2015. The latest updated version of the model is 6.2, which was accepted by the Commission in May 2017.

E. Indicate if the modeling organization has ever been involved directly in litigation or challenged by a governmental authority where the credibility of one of its U.S. hurricane model versions for projection of hurricane loss costs or hurricane probable maximum loss levels was disputed. Describe the nature of each case and its conclusion.

None.

2. Professional Credentials

A. Provide in a tabular format (a) the highest degree obtained (discipline and university), (b) employment or consultant status and tenure in years, and (c) relevant experience and responsibilities of individuals currently involved in the acceptability process or in any of the following aspects of the hurricane model:

1. Meteorology

2. Statistics

3. Vulnerability

4. Actuarial Science

5. Computer/Information Science

See below.

Key Personnel	Degree/ Discipline	University	Employment Status	Tenure	Experience
Meteorology					
Dr. Steve Cocke	Ph.D. Physics	Univ. Texas Austin	Scholar/Scientist FSU, Dept of Meteorology	22	Meteorology track, intensity, roughness models
Dr. Dongwook Shin	Ph.D. Meteorology	Florida State University	FSU/COAPS, Associate Research Scientist	17	Meteorology
Bachir Annane	M.S. Meteorology, M.S. Mathematics	Florida State University	Meteorologist, Univ. of Miami	24	Meteorology
Neal Dorst	B.S. Meteorology	Florida State University	Meteorologist, HRD/NOAA	34	Meteorology
Statistics					
Dr. B. M. Golam Kibria	Ph.D. Statistics	University of Western Ontario	Professor of Statistics, FIU	18	Distribution Theory, Ridge regression, Statistical Inference, Sensitivity Analysis
Dr. Wensong Wu	Ph.D. Statistics	University of South Carolina	Associate Professor, Statistics, FIU	7	Bayesian decision theory and computation, model selection and model averaging in risk analysis
Engineering					

Key Personnel	Degree/ Discipline	University	Employment Status	Tenure	Experience
Dr. Jean-Paul Pinelli	Ph.D. Civil Engineering	Georgia Tech	Professor, CE Florida Institute of Technology	22	Wind engineering, vulnerability functions
Dr. Kurt Gurley	Ph.D. Civil Engineering	University of Notre Dame	Associate Professor, CE University of Florida	19	Wind engineering, simulations
Roberto Vicente Silva de Abreu	B.S. Civil Engineering	Florida Institute of Technology	M. S.. Candidate in Civil Engineering, Florida Institute of Technology	1	Wind and structural engineering
Josemar Faustino Da Cruz	M.S. Computer Engineering	Florida Institute of Technology	Ph.D. Candidate in Computer Science, Florida Institute of Technology	1	Software and database development
Karthik Yarasuri	B.S. Civil Engineering	Jawaharlal Nehru Technological University	Ph.D. Candidate in Civil Engineering, University of Florida	4	Wind engineering, simulations
Actuarial/Finance					
Dr. Shahid Hamid Project Manager, PI	Ph.D. Economics (Financial), CFA	University of Maryland	Professor of Finance Florida International University	30	Insurance and finance
Gail Flannery	FCAS, Actuary	CAS	VP, AMI Risk Consultants	33	Reviewer, demand surge, actuarial analysis
Aguedo Ingco	FCAS, Actuary	CAS	President, AMI Risk Consultants	43	Reviewer, demand surge
Computer Science					
Dr. Shu-Ching Chen	Ph.D. Electrical and Computer Engineering	Purdue University	Professor of Computer Science, FIU	18	Software and database development
Dr. Mei-ling Shyu	Ph.D. Electrical and Computer Engineering	Purdue University	Professor of Electrical and Computer Engineering, University of Miami	18	Software quality assurance
Raul Garcia	M.S. Computer Science	Georgia Institute of Technology	Research Specialist II, FIU	8	Software and database development
Diana Machado	M.S. Computer Science	Georgia Institute of Technology	Research Specialist II, FIU	7	Software and database development
Haiman Tian	M.S. Computer Engineering	Florida International University	Ph.D. Candidate in Computer Science, FIU	5	Software and database development
Samira Pouyanfar	M.S. Computer Engineering	Sharif University of Technology	Ph.D. Candidate in Computer Science, FIU	5	Software and database development
Yudong Tao	B.S. Microelectronics	Fudan University	Ph.D. Candidate in Electrical and Computer Engineering, UM	3	Software and database development

Key Personnel	Degree/ Discipline	University	Employment Status	Tenure	Experience
Maria Presa Reyes	M.S. Computer Science	Florida International University	Ph.D. student in Computer Science, FIU	3	Software and database development
Tianyi Wang	M.S. Computer Science	Florida International University	Ph.D. student in Computer Science, FIU	1	Software and database development
Hector Cen	M.S. Information Technology	Florida International University	Research assistant in the DMIS lab, FIU	1	Software and database development
Daniel Martinez	High School	Florida International University	Student assistant in the DMIS lab, FIU	1	Information management systems

Table 10. Professional credentials

B. Identify any new employees or consultants (since the previous submission) engaged in the development of the hurricane model or the acceptability process.

Roberto Vicente Silva de Abreu, Josemar Faustino Da Cruz, Tianyi Wang, Hector Cen, Daniel Martinez, Dr. Wensong Wu.

C. Provide visual business workflow documentation connecting all personnel related to hurricane model design, testing, execution, maintenance, and decision-making.

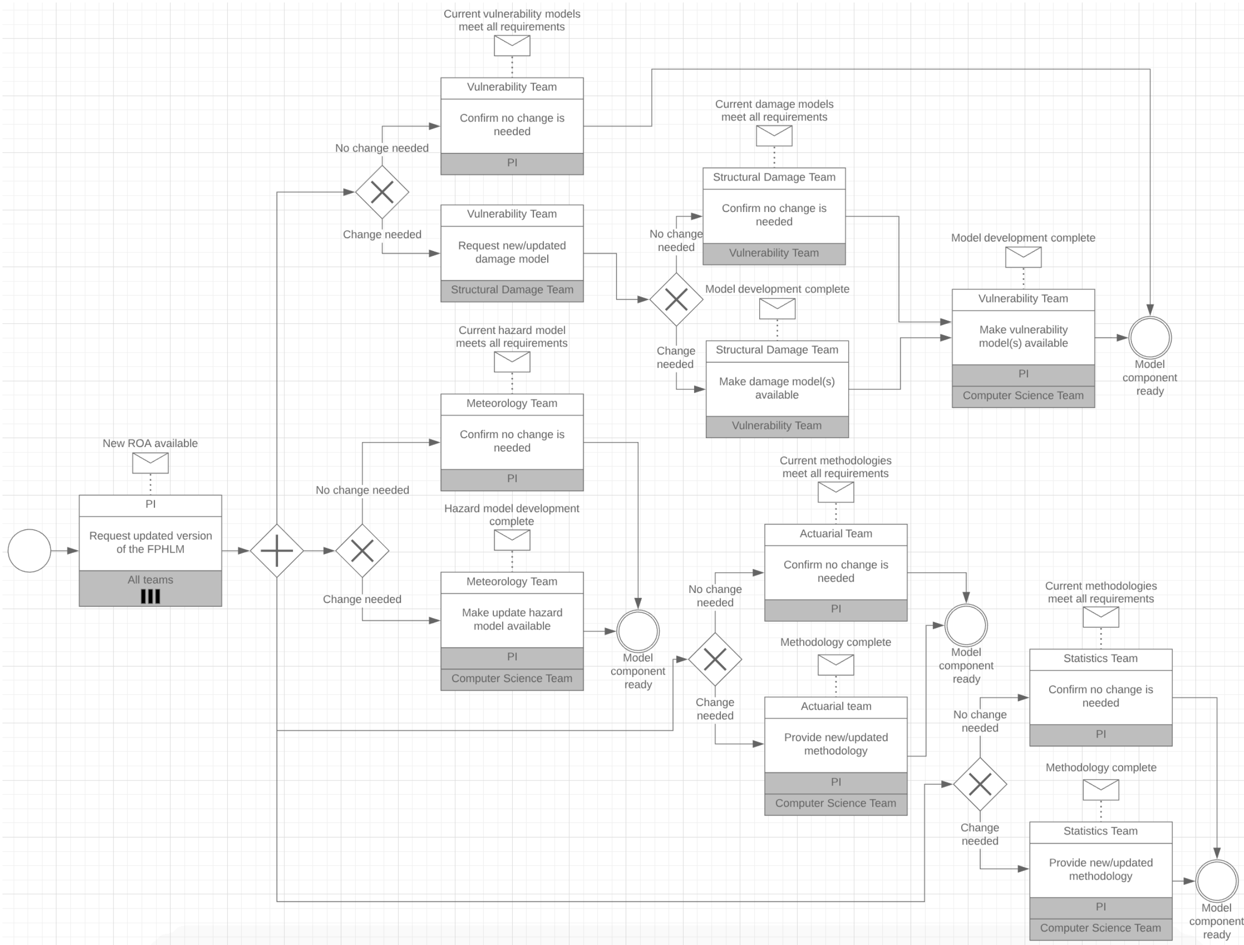


Figure 24. Florida Public Hurricane Loss Model workflow – Part 1

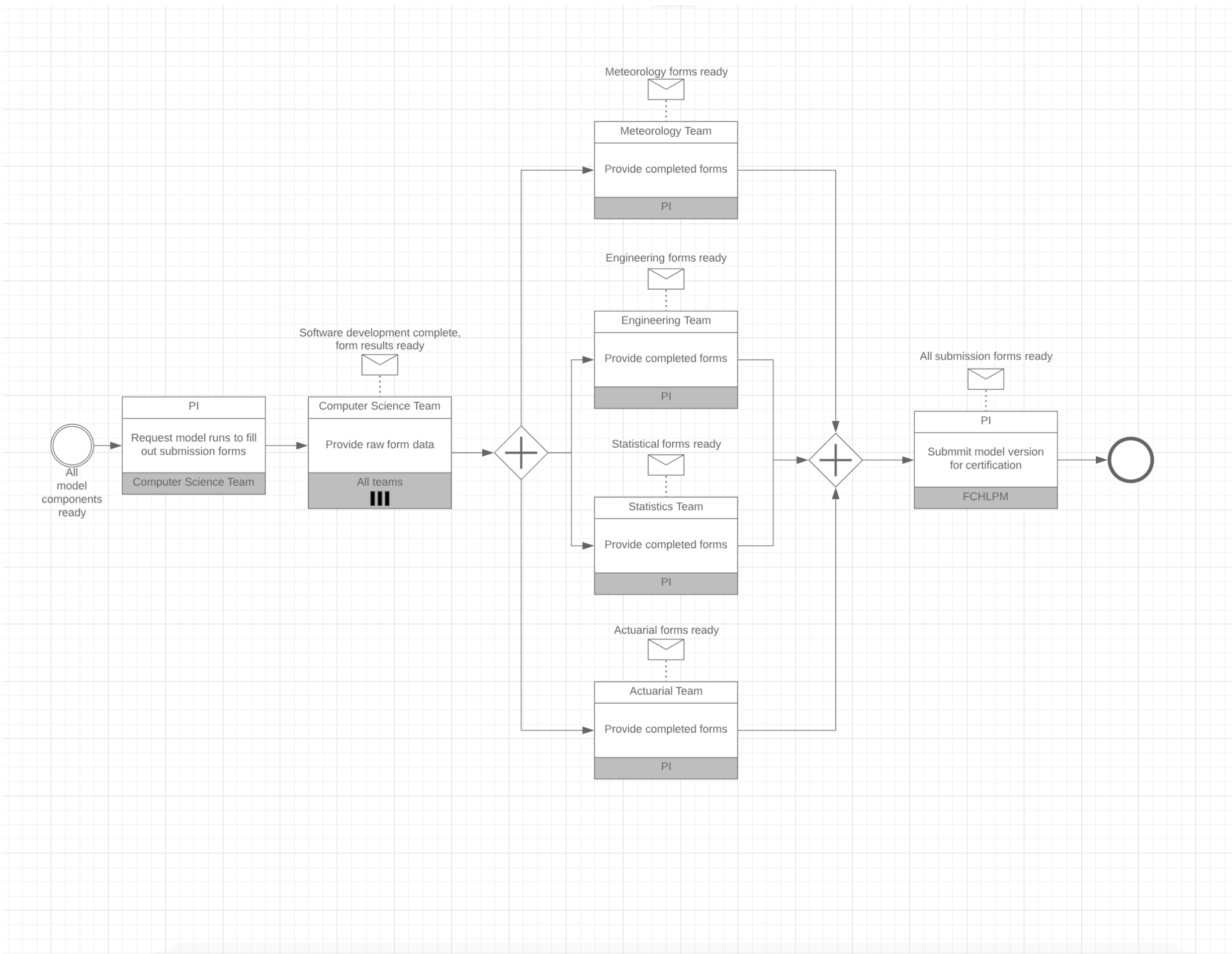


Figure 24. Florida Public Hurricane Loss Model workflow – Part 2

3. Independent Peer Review

A. Provide reviewer names and dates of external independent peer reviews that have been performed on the following components as currently functioning in the hurricane model:

1. Meteorology

2. Statistics

3. Vulnerability

4. Actuarial Science

5. Computer/Information Science

Dr. Gary Barnes, Professor of Meteorology at University of Hawaii, performed the external review of the meteorology component in February 2007. The current version was reviewed by modeler personnel.

Gail Flannery, FCAS, and Aguedo Ingco, FCAS, actuaries and vice president and president, respectively, of AMI Risk Consultants in Miami, performed the external review of the actuarial component and submission in October 2018. Gail Flannery was also involved in the development of the demand surge model and the commercial residential model.

The vulnerability, statistical, and computer science components were reviewed by modeler personnel.

B. Provide documentation of independent peer reviews directly relevant to the modeling organization's responses to the current hurricane standards, disclosures, or forms. Identify any unresolved or outstanding issues as a result of these reviews.

The written independent review of the wind component by Dr. Gary Barnes is presented in Appendix A. No unresolved outstanding issues remain after the review.

Gail Flannery, FCAS, performed the independent review of the actuarial component. She attended many meetings with the model team and helped in the understanding of the requirements of the actuarial standards, disclosures, and forms. She was provided with all relevant forms and supporting documents. She conducted independent analysis of the A forms and asked questions and provided feedback and suggestions; her questions were addressed, and the feedback and suggestions were acted upon so that no unresolved outstanding issues remain. She prepared the submission document for the actuarial standards. A letter from Gail Flannery can be found in Appendix A. See also Form G-5.

C. Describe the nature of any on-going or functional relationship the organization has with any of the persons performing the independent peer reviews.

Dr. Gary Barnes, Professor of Meteorology at University of Hawaii, performed the external review of the version 2.6 meteorology component of the model, particularly the wind field model. He has no on-going or functional relationship to FIU or the modeling organization, other than as an independent reviewer. He did not take part in the development or testing of the model. His role in the model has been confined to being an independent external reviewer.

4. Provide a completed Form G-1, General Standards Expert Certification. Provide a link to the location of the form here.

See Form G-1.

5. Provide a completed Form G-2, Meteorological Standards Expert Certification. Provide a link to the location of the form here.

See Form G-2.

6. Provide a completed Form G-3, Statistical Standards Expert Certification. Provide a link to the location of the form here.

See Form G-3.

7. Provide a completed Form G-4, Vulnerability Standards Expert Certification. Provide a link to the location of the form here.

See Form G-4.

8. Provide a completed Form G-5, Actuarial Standards Expert Certification. Provide a link to the location of the form here.

See Form G-5.

9. Provide a completed Form G-6, Computer/Information Standards Expert Certification. Provide a link to the location of the here.

See Form G-6.

G-3 Insured Exposure Location

A. ZIP Codes used in the hurricane model shall not differ from the United States Postal Service publication date by more than 24 months at the date of submission of the hurricane model. ZIP Code information shall originate from the United States Postal Service.

Our model uses ZIP Code data exclusively from a third-party developer, which bases its information on the ZIP Code definitions issued by the United States Postal Service. The version we used has a USPS vintage of April 2017. The ZIP Code data have been changed in the current release of the model from the last submission.

B. ZIP Code centroids, when used in the hurricane model, shall be based on population data.

ZIP Code centroids used in the model are population centroids.

C. ZIP Code information purchased by the modeling organization shall be verified by the modeling organization for accuracy and appropriateness.

The ZIP Code information is checked for consistency by experts developing our model. Maps showing the ZIP Code boundaries and the associated centroids will be provided to the professional team during the on-site visit.

D. If any hazard or any hurricane model vulnerability components are dependent on ZIP Code databases, the modeling organization shall maintain a logical process for ensuring these components are consistent with the recent ZIP Code database updates.

All ZIP Code-dependent components are recreated using the latest update of the ZIP code data in the model.

E. Geocoding methodology shall be justified.

The FPHLM uses an enterprise class geocoding engine for converting street addresses to latitude-longitude values.

Disclosures

1. List the current ZIP Code databases used by the hurricane model and the hurricane model components to which they relate. Provide the effective (official United States Postal Service) dates corresponding to the ZIP Code databases.

The FPHLM uses 5-digit ZIP Codes distributed by zip-codes.com. The 5-digit ZIP Codes product constitutes a geographic data set that contains the boundaries for each 5-digit ZIP Code in the United States assigned by the U.S. Postal Service.
The ZIP Code data are updated monthly. The release we used in this submission has a vintage of 2017.04 (April 2017).

The ZIP Code data are used in the Wind Speed Correction and Insured Loss modules of the model. The Wind Speed Correction Module converts the output from the wind model from marine exposure to actual or open terrain exposure and includes calculation of gust factors.

2. Describe in detail how invalid ZIP Codes are handled.

For historical loss costs where street addresses are not available, we use contemporaneous ZIP Codes and associated population-based centroids to locate the exposure. The Wind Speed Correction module subsequently determines the current (2017) ZIP Code that contains the historical centroid, and the exposure is then modeled on the basis of the 2017 ZIP code centroid location. If a policy has a ZIP Code that cannot be found in the contemporaneous database of ZIP Codes, it is not modeled.

3. Describe the data, methods, and process used in the hurricane model to convert among street addresses, geocode locations (latitude-longitude), and ZIP Codes.

The FPHLM uses the REST API of the ArcGIS Server with the StreetMap Premium for ArcGIS locators to geocode street addresses. A request is sent to the server containing the given street address, city, state, and ZIP Code. The server processes the request and sends a response containing the status, the location, and the standardized address. The location and address fields of the response are empty when the status is unmatched.

When the status is matched, the coordinates (longitude, latitude) are assigned to the policy and the ZIP Code is updated if necessary. When the status is unmatched, but the ZIP Code is given, the policy is assigned the coordinates of the population-weighted centroid of the ZIP Code. Finally, if the status is unmatched and a correct ZIP Code is not given, the policy is dropped.

4. List and provide a brief description of each hurricane model ZIP Code-based database (e.g., ZIP Code centroids).

Population-based ZIP Code centroids and roughness. This database provides the ZIP Code centroid location and corresponding population-weighted roughness and distance to coast for each incoming wind direction octant.

Wind-borne Debris Region (WBDR) ZIP Codes. This database provides two lists of Florida ZIP Codes: one containing the ZIP Codes that fall within the WBDR specified by the 2007 Florida Building Code (FBC), and another containing the ZIP Codes falling within the 2010 FBC WBDR definition .

Classification of coastal/inland for each ZIP Code. This database provides the list of ZIP Codes that are classified as coastal.

5. Describe the process for updating hurricane model ZIP Code-based databases.

The updated ZIP Code data, compliant with Standard G-3.A., is received from the vendor and checked and verified for accuracy and appropriateness. The ZIP Code data include a plain text list of all Florida ZIP Codes and GIS layers for the ZIP Code boundaries. These vendor data are used to calculate various datasets for use in the model:

1. Population-weighted centroids of each ZIP Code.
2. Population-weighted roughness for each ZIP code.
3. Distance to coast of each ZIP Code.
4. Lists of ZIP Codes within the Wind-Borne Debris Region (WBDR). One list based on the 2007 FBC's definition and another based on the 2010 FBC's definition.
5. Classification of coastal/inland for each ZIP Code.

The GIS ZIP Code layers obtained from the vendor, in combination with U.S. Census block data and the effective roughness model gridded data (See Standard G-1, Disclosure 2), are used to compute the population-based centroids and population-weighted effective roughness for each ZIP Code. Once the centroids are calculated, the distance to coast for each centroid, in each of eight possible upstream wind directions, is then computed.

Each of the two lists of WBDR ZIP Codes is created by overlaying the map defining the WBDR over the ZIP Code boundaries map from the vendor and selecting the intersection. The list of coastal ZIP Codes is similarly derived from the boundaries map by selecting the ZIP Codes that have some portion of their boundary along the coastline.

These new data sets are formatted to be read directly by model code. Items (1) through (4) are formatted as files and transferred to dedicated directories for each version on the model's server platform where software links are used to ensure that the appropriate model components always read the correct version of the files. A copy of item (1) is also formatted as a database table as it is item (5), and both are used during the pre-processing applied to data to be used as input to the model. These tables are part of a dedicated database that is used as a template for the creation of new processing databases in order to ensure that the data pre-processing code uses the correct version of the ZIP Code datasets.

G-4 Independence of Hurricane Model Components

The meteorological, vulnerability, and actuarial components of the hurricane model shall each be theoretically sound without compensation for potential bias from the other two components.

The meteorology, vulnerability, and actuarial components of the model are theoretically sound and were developed and validated independently before being integrated. The model components were tested individually.

G-5 Editorial Compliance

The submission and any revisions provided to the Commission throughout the review process shall be reviewed and edited by a person or persons with experience in reviewing technical documents who shall certify on Form G-7, Editorial Review Expert Certification, that the submission has been personally reviewed and is editorially correct.

The current submission document has been reviewed and edited by persons who are qualified to perform such tasks. Future revisions and related documentation will likewise be reviewed and edited by the qualified individual listed in Form G-7.

Disclosures

1. Describe the process used for document control of the submission. Describe the process used to ensure that the paper and electronic versions of specific files are identical in content.

All submission document revisions are passed to the Editor prior to inclusion in the document. The editor is responsible for the electronic version of the document and the technical software issues. Several Microsoft Word tools are utilized to automate the process of formatting and editing the document. For example, we used Source Manager for APA-style bibliographies, consistent formatting via styles for standards, forms and disclosures, cross-references to cite figures and tables, and multi-level lists to ensure consistent numbering. In addition, Microsoft Word's track changes tool is used to keep track of modifications to the document since the initial submission. An export filter to PDF format is used to export the document directly to PDF format, which subsequently is printed directly to paper via a printer. The PDF and printed document should be identical barring unforeseen bugs in the PDF export plug-in or PDF printing software.

2. Describe the process used by the signatories on Expert Certification Forms G-1 through G-6 to ensure that the information contained under each set of hurricane standards is accurate and complete.

Each signatory was responsible for doing a final review of the standards related to their expertise prior to submission to verify the accuracy and completeness of the information in the submission document. A technical editor performs a thorough edit of the document. All signatories were required to proof-read a PDF version of the document to ensure accuracy and completeness. On-site meetings were held to perform a thorough review of the final version of the document.

3. Provide a completed Form G-7, Editorial Review Expert Certification. Provide a link to the location of the form here.

See Form G-7.

METEOROLOGICAL STANDARDS

M-1 Base Hurricane Storm Set

A. The Base Hurricane Storm Set is the National Hurricane Center HURDAT2 as of April 11, 2017 (or later), incorporating the period 1900-2016. Annual frequencies used in both hurricane model calibration and hurricane model validation shall be based upon the Base Hurricane Storm Set. Complete additional season increments based on updates to HURDAT2 approved by the Tropical Prediction Center/National Hurricane Center are acceptable modifications to these data. Peer reviewed atmospheric science literature may be used to justify modifications to the Base Hurricane Storm Set.

Validation of the FPHLM is based on the 1900–2017 period of historical record as provided in the May 1, 2018 version of HURDAT released by the National Hurricane Center.

B. Any trends, weighting, or partitioning shall be justified and consistent with current scientific and technical literature. Calibration and validation shall encompass the complete Base Hurricane Storm Set as well as any partitions.

Validation and comparison of the FPHLM encompasses the complete Base Hurricane Storm Set provided in HURDAT. We conduct no trending, weighting, or partitioning of the Base Hurricane Set.

Disclosures

1. Specify the Base Hurricane Storm Set release date and the time period used to develop and implement landfall and by-passing hurricane frequencies into the hurricane model.

The National Hurricane Center HURDAT file from May 1, 2018 for the period 1900–2017 is used to establish the official hurricane base set used by our model. All HURDAT storm tracks that have made landfall in Florida or bypassed Florida but passed close enough to produce damaging winds are documented in our archives.

2. If the modeling organization has made any modifications to the Base Hurricane Storm Set related to hurricane landfall frequency and characteristics, provide justification for such modifications.

For stochastic hurricane loss modeling, the HURDAT database indicated in Disclosure 1 is used, unmodified, to develop the probability distribution functions for track and intensity changes and to determine storm frequency.

To model historical losses, we developed a Historical Base Set. This base set is based on the latest HURDAT but includes additional data, such as central pressure and *Rmax*, that may not be available in HURDAT but is needed by the wind model.

3. If the hurricane model incorporates short-term, long-term, or other systematic modification of the historical data leading to differences between modeled climatology and that in the Base Hurricane Storm Set, describe how this is incorporated.

The FPHLM incorporates no short-term, long-term, or other systematic modifications of the climate record. Storm frequencies are based on historical occurrences derived from HURDAT and thus implicitly contain any long- or short-term variations that are contained in the historical record. No attempt is made to explicitly model long- or short-term variations.

4. Provide a completed Form M-1, Annual Occurrence Rates. Provide a link to the location of the form here.

See Form M-1.

M-2 Hurricane Parameters and Characteristics

Methods for depicting all modeled hurricane parameters and characteristics, including but not limited to windspeed, radial distributions of wind and pressure, minimum central pressure, radius of maximum winds, landfall frequency, tracks, spatial and time variant windfields, and conversion factors, shall be based on information documented in current scientific and technical literature.

All methods used to depict storm characteristics are based on methods described in the peer-reviewed scientific literature. Our scientists developed datasets using data from published reports, the HURDAT database, archives, observations, and analyses from NOAA's Hurricane Research Division, The Florida State University, Florida International University, and the Florida Coastal Monitoring Program.

Disclosures

1. Identify the hurricane parameters (e.g., central pressure, radius of maximum winds) that are used in the hurricane model.

Hurricane parameters used in the model include storm track (translation speed and direction of the storm), radius of maximum wind (*Rmax*), Holland surface pressure profile parameter (*B*), the minimum central sea level pressure (*Pmin*), the damage threshold distance, and the pressure decay as a function of time after landfall.

The storm initial position and motion are modeled using the HURDAT database. For pressure decay we use the Vickery (2005) decay model. Vickery developed the model on the basis of pressure observations in HURDAT and NWS-38, together with *Rmax* and storm motion data as described in the publication. The radius of maximum winds at landfall is modeled by fitting a gamma distribution to a comprehensive set of historical data published in NWS-38 by Ho et al. (1987) and supplemented by the extended best track data of DeMaria, NOAA HRD research flight data, and NOAA-AOML-HRD H*Wind analyses (Powell & Houston, 1996; Powell et al., 1996; Powell & Houston, 1998; Powell et al., 1998).

Additional research was used to construct a historical landfall *Rmax-Pmin* database using existing literature (Ho et al., 1987), extended best track data, HRD Hurricane field program data, and the H*Wind wind analysis archive (Demuth et al., 2006). We developed an *Rmax* model using the revised landfall *Rmax* database, which includes more than 100 measurements for hurricanes up to 2012. We have opted to model the *Rmax* at landfall rather than the entire basin for a variety of reasons. One is that the distribution of landfall *Rmax* may be different than that over open water. An analysis of the landfall *Rmax* database and the 1988–2007 extended best track data shows that there appears to be a difference in the dependence of *Rmax* on central pressure (*Pmin*) between the two datasets (Demuth et al., 2006). The landfall dataset provides a larger set of independent measurements (more than 100 storms compared to about 31 storms affecting the Florida threat area region in the best track data). Since landfall *Rmax* is most relevant for loss cost estimation and has a larger independent sample size, we have chosen to model the landfall dataset.

Recent research results by Willoughby and Rahn (2004) based on the NOAA-AOML-HRD annual hurricane field program and Air Force reconnaissance flight-level observations are used to create a model for the "*Holland B*" parameter. Ongoing research on the relationship between horizontal surface wind distributions (based on Stepped Frequency Microwave Radiometer observations) to flight level distributions (Powell et al., 2009) is used to correct the flight-level *Rmax* to a surface *Rmax* when developing a relationship for the *Holland B* term. We multiply the flight-level *Rmax* from the Willoughby and Rahn (2004) dataset by 0.815 to estimate the surface *Rmax* (based on SFMR, flight-level maxima pair data). This adjustment keeps the Holland pressure profile parameter consistent with a surface *Rmax* and because of the negative term in the equation produces a larger value of *B* than if a flight-level value of *Rmax* were used. This is consistent with the concept of a stronger radial pressure gradient for the mean boundary layer slab than at flight level (due to the warm core of the storm), which agrees with GPS dropsonde wind profile observations showing boundary layer winds that are stronger than those at the 10,000 ft flight level, which is the level for most of the *B* data in Willoughby and Rahn (2004). The *B* adjustment for a surface *Rmax* produces an overall stronger surface wind field than if *B* were not adjusted. In addition, surface pressures from the "best track" information on HURDAT are used to associate a particular flight-level pressure profile *B* with a surface pressure.

The NOAA-AOML-HRD H*Wind analysis archive was used to develop a relationship between *Rmax* and the extent of damaging winds to make sure that the model would only consider land locations that have potential for damaging winds. HRD wind modeling research initiated by Ooyama (1969) and extended by Shapiro (1983) has been used to develop the HRD wind field model. This model is based on the concept of a slab boundary layer model, a concept pioneered at NOAA-AOML-HRD and now in use by other modelers for risk applications (Thompson & Cardone, 1996; Vickery & Twisdale, 1995; Vickery et al., 2000b). The HURDAT historical database is used to develop the track and intensity model. Historical data used for computing the potential intensity is based on the National Centers for Environmental Prediction (NCEP) sea surface temperature archives and the NCEP reanalysis for determining the upper tropospheric outflow temperatures. Use cases describing the various model functions and their research bases are available with the model documentation.

2. Describe the dependencies among variables in the windfield component and how they are represented in the hurricane model, including the mathematical dependence of modeled windfield as a function of distance and direction from the center position.

B depends linearly on latitude and *Rmax*, and quadratically on *DelP*. The gradient wind for the slab boundary layer depends on *Pmin* (through *DelP*) and *B*; the mean slab planetary boundary layer (PBL) wind depends on the gradient wind, the drag coefficient (which depends on wind speed), the air density, the gradients of the tangential and radial components of the wind, and the Coriolis parameter (which also depends on latitude). The wind field model solves the equations of motion on a polar grid with a 0.1 *R/Rmax* radial grid resolution. The input *Rmax* is reduced by 10% to correct a small bias in *Rmax* caused by a tendency of the wind field solution to place *Rmax* radially outward by one grid point. The wind field model terms and dependencies are further described in Powell et al. (2005).

3. Identify whether hurricane parameters are modeled as random variables, functions, or fixed values for the stochastic storm set. Provide rationale for the choice of parameter representations.

Initial storm positions and motion changes derived from HURDAT are modified by the addition of small uniform random error terms. Subsequent storm motion change and intensity are obtained by sampling from empirically derived PDFs as described in Section G-1.2. The random error term for the B parameter is a normal distribution with zero mean and a standard deviation derived from observed reconnaissance aircraft pressure profile fits for B (Willoughby & Rahn, 2004). The radius of maximum winds is sampled from a gamma distribution based on landfall *Rmax* data and is described in more detail below and in Standard G-1.2.

Since *Rmax* is nonnegative and skewed, we model the distribution using a gamma distribution. Using the maximum likelihood estimators, we found the parameters for the gamma distribution to be k=4.76, θ=5.41. A discussion of the goodness of fit for *Rmax* is found in Standard S-1.

An examination of the *Rmax* database shows that intense storms, essentially Category 5 storms, have rather small radii. Thermodynamic considerations (Willoughby, 1998) also suggest that smaller radii are more likely for these storms. Thus, we model Category 5 (*DelP*>90 mb, where *DelP*=1013-*Pmin* and *Pmin* is the central pressure of the storm) storms using a gamma distribution, but with a smaller value of the θ parameter, which yields a smaller mean *Rmax* as well as smaller variance. We have found that for Category 1–4 (*DelP*<80 mb) storms there is essentially no discernable dependence of *Rmax* on central pressure. This is further verified by looking at the mean and variance of *Rmax* in each 10 mb interval. Thus, we model Category 1–4 storms with a single set of parameters. For a gamma distribution, the mean is given by $k\theta$, and variance is $k\theta^2$. For Category 5 storms, we adjust θ such that the mean is equal to the mean of the three Category 5 storms in the database: 1935 No Name, 1969 Camille, and 1992 Andrew. An intermediate zone between *DelP*=80 mb and *DelP*=90 mb is established where the mean of the distribution is linearly interpolated between the Category 1–4 value and the Category 5 value. As the θ value is reduced, the variance is likewise reduced. Since there are insufficient observations to determine what the variance should be for Category 5 storms, we rely on the assumption that variance is appropriately described by the rescaled θ, via $k\theta^2$.

A simple method is used to generate the gamma-distributed values. A uniformly distributed variable is mapped onto the range of *Rmax* values via the inverse cumulative gamma distribution function. For computational efficiency, a lookup table is used for the inverse cumulative gamma distribution function.

For Category 5 and intermediate Category 4–5 storms, we use the property that the gamma cumulative distribution function is a function of $(k,x/\theta)$. Thus, by rescaling θ, we can use the same function (lookup table), but just rescale x (*Rmax*). The rescaled *Rmax* will then still have a gamma distribution but with different mean and variance.

The storms in the stochastic model will undergo central pressure changes during the storm life cycle. When a storm is generated, an appropriate *Rmax* is sampled for the storm. To ensure the appropriate mean values of *Rmax* as pressure changes, the *Rmax* is rescaled every time step as necessary. As long as the storm has *DelP* < 80 mb, there is in effect no rescaling. In the stochastic storm generator, we limit the range of *Rmax* from 4 sm to 120 sm. The wind field solution, after including the translation speed, results in values of *Rmax* that are outside this range less than 2% of the time.

4. Describe if and how any hurricane parameters are treated differently in the historical and stochastic storm sets and provide rationale.

All historical storm sets consist of input files containing information derived from HURDAT or other observation sources as described in Standard M-1. All stochastic input storm tracks are modeled.

5. State whether the hurricane model simulates surface winds directly or requires conversion between some other reference level or layer and the surface. Describe the source(s) of conversion factors and the rationale for their use. Describe the process for converting the modeled vortex winds to surface winds including the treatment of the inherent uncertainties in the conversion factor with respect to location of the site compared to the radius of maximum winds over time. Justify the variation in the surface winds conversion factor as a function of hurricane intensity and distance from the hurricane center.

The mean boundary layer winds computed by the model are adjusted to the surface using results from Powell et al. (2003), which estimated a mean surface wind factor of 77.5% on the basis of over 300 GPS sonde wind profile observations in hurricanes. The surface wind factor is based on the ratio of the surface wind speed at 10 m to the mean wind speed for the 0–500 m layer (mean boundary layer wind speed or MBL) published in Powell et al. (2003). This ratio is far more relevant to a slab boundary layer model than using data based on higher, reconnaissance aircraft flight levels. The depth of the slab boundary layer model is assigned a value of 450 m, which is the level of the maximum mean wind speed from GPS sonde wind profiles published in Powell et al. (2003). The uncertainty of the surface wind factor is ~8%, based on the standard deviation of the measurements, but no attempt is made to model this uncertainty. No radial distance from center or intensity dependent variation of reduction factor is used at this time because of a lack of dependency on these quantities based on examination of GPS dropsonde data (Figure 25).

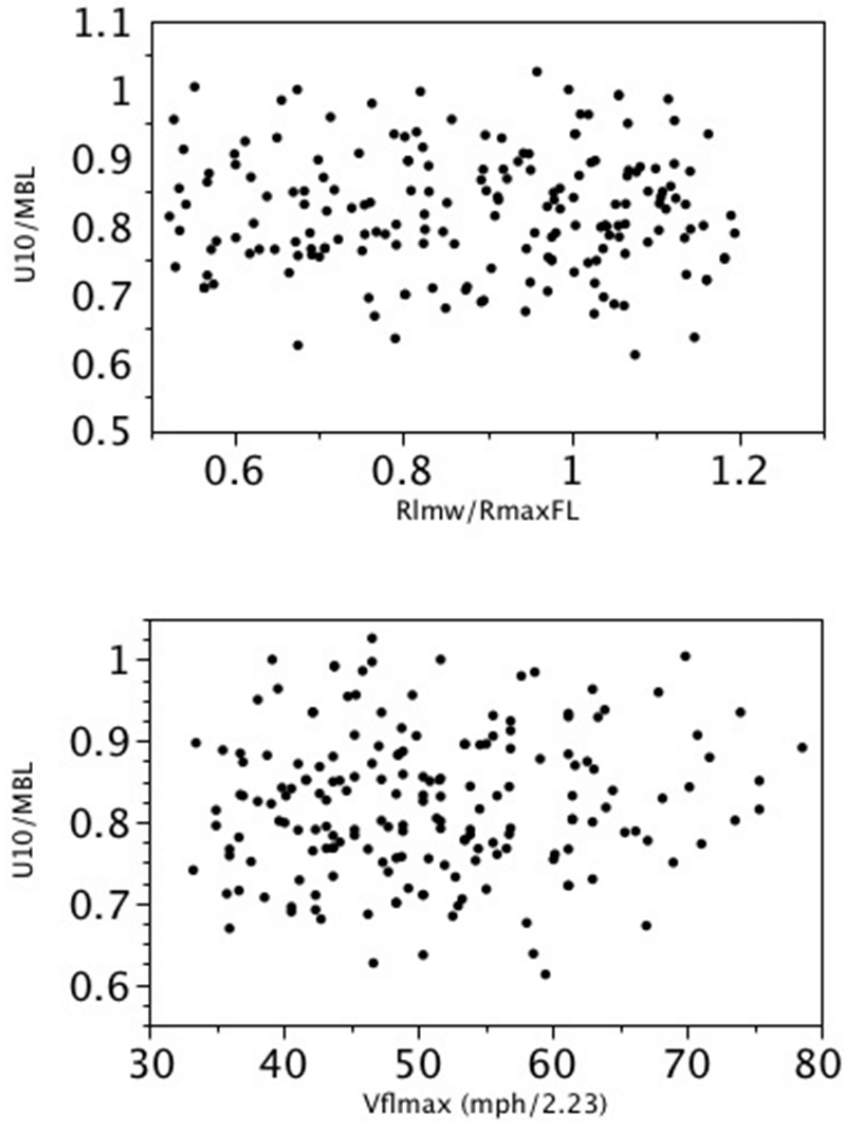


Figure 25. Analysis of 742 GPS dropsonde profiles launched from 2-4 km with flight-level winds at launch greater than hurricane force and with measured surface winds. Upper figure: Dependence of the ratio of 10 m wind speed (U10) to the mean boundary layer wind speed (MBL) on the scaled radius (ratio of radius of last measured wind (Rlmw) to the radius of maximum wind at flight level (RmaxFL). Lower figure: Surface wind factor (U10/MBL) dependence on maximum flight level wind speed (Vflmax, in units of miles per hour / 2.23).

6. Describe how the windspeeds generated in the windfield model are converted from sustained to gust and identify the averaging time.

Wind speeds from the HRD slab boundary layer wind field model are assumed to represent ten-minute averages. A sustained wind is computed by applying a gust factor to account for the highest one-minute wind speed over the ten-minute period. A peak three-second gust is also computed. Gust factors depend on wind speed and the upstream fetch roughness, which in turn depends on wind direction at a particular location. Gust factor calculations were developed using research in the Engineering Sciences Data Unit (ESDU) series papers as summarized and applied to tropical cyclones by Vickery and Skerlj (2005).

7. Describe the historical data used as the basis for the hurricane model's hurricane tracks. Discuss the appropriateness of the hurricane model stochastic hurricane tracks with reference to the historical hurricane data.

The hurricane tracks are modeled as a Markov process. Initial storm conditions are derived from HURDAT. Small uniform random perturbations are added to the historical initial conditions, including initial storm location, change in motion, and intensity.

Storm motion is determined by sampling empirical distributions, based on HURDAT, of change in speed and change in direction, as well as change in relative intensity. These functions are also spatially dependent, binned in variable box sizes (typically 2.5 degrees), and enlarged as necessary to ensure sufficient density of storms for the distribution.

The model has been validated by examining key hurricane statistics relative to HURDAT at roughly 30 sm milepost locations along the Gulf and Atlantic coasts. The parameters examined include average central pressure deficit, average heading angle and speed, and total occurrence by Saffir-Simpson category.

8. If the historical data are partitioned or modified, describe how the hurricane parameters are affected.

The FPHLM does not partition or modify the historical data.

9. Describe how the coastline is segmented (or partitioned) in determining the parameters for hurricane frequency used in the hurricane model. Provide the hurricane frequency distribution by intensity for each segment.

The model does not use coastline segmentation to determine hurricane frequency.

10. Describe any evolution of the functional representation of hurricane parameters during an individual storm life cycle.

Upon landfall, the evolution of the central pressure changes from sampling a PDF to a decay model described in Vickery (2005). When the storm exits back over water, the pressure is again modeled via the PDF. After landfall, the slab boundary layer, surface drag coefficient changes from a functional marine form to a constant based on a mean aerodynamic roughness length of 0.2 m. The slab boundary layer height increases from 450 m to 1 km after the center makes landfall and decreases back to 450 m if the center exits land to go back to sea.

M-3 Hurricane Probability Distributions

A. Modeled probability distributions of hurricane parameters and characteristics shall be consistent with historical hurricanes in the Atlantic basin.

Hurricane motion (track) is modeled based on historical geographic probability distributions of hurricane translation velocity and velocity change, initial intensity, intensity change, and potential intensity. Modeled probability distributions for hurricane intensity, forward speed, *Rmax*, and storm heading are consistent with historical hurricanes in the Atlantic basin.

B. Modeled hurricane landfall frequency distributions shall reflect the Base Hurricane Storm Set used for category 1 to 5 hurricanes and shall be consistent with those observed for each coastal segment of Florida and neighboring states (Alabama, Georgia, and Mississippi).

As shown in Form M-1 and the accompanying plots, our model reflects reasonably the 1900–2017 Base Hurricane Set for hurricanes of Saffir-Simpson Categories 1–5 in each coastal region of Florida, as well as in the neighboring states. In addition, a finer scale coastal milepost study of model parameters (occurrence rate, storm translation speed, storm heading, and *Pmin*) was conducted during the development of the model.

C. Hurricane models shall use maximum one-minute sustained 10-meter windspeed when defining hurricane landfall intensity. This applies both to the Base Hurricane Storm Set used to develop landfall frequency distributions as a function of coastal location and to the modeled winds in each hurricane which causes damage. The associated maximum one- minute sustained 10-meter windspeed shall be within the range of windspeeds (in statute miles per hour) categorized by the Saffir- Simpson Hurricane Wind Scale.

Saffir-Simpson Hurricane Wind Scale:

Category	Winds (mph)	Damage
1	74 – 95	Minimal
2	96 – 110	Moderate
3	111 – 129	Extensive
4	130 – 156	Extreme
5	157 or higher	Catastrophic

The HRD wind field model simulates landfall intensity according to the maximum one-minute sustained wind for the 10 m level for both stochastic simulations and the Base Hurricane Set. The

Saffir-Simpson damage potential scale is used to further categorize the intensity at landfall, and the range of simulated wind speeds (in miles per hour) is within the range defined in the scale.

Disclosures

1. Provide a complete list of the assumptions used in creating the hurricane characteristics databases.

The *Holland B* database is based on flight-level pressure profiles corresponding to constant pressure surfaces at 700 mb and below. Because of a lack of surface pressure field data, an assumption is made that the *Holland B* at the surface is equivalent to a *B* determined from information collected at flight level. The surface pressure profile uses *Pmin*, *DelP*, and *Rmax* at the surface. It would be ideal to have a *B* dataset also corresponding to the surface, but such data are not available. The best available data on *B* are flight-level data from Willoughby and Rahn (2004). Willoughby and Rahn (2004) reveal that during major hurricanes most flights flew at 3 km (700 mb). Few lower-level data are available for mature hurricanes, so their plot (Figure 3) of *B* vs. flight level does not provide data about average vertical structure. In lieu of lower-level data, we model *B* using flight data supplied by Willoughby, but with *Rmax* adjusted to a surface *Rmax*, and with surface *DelP* added from NHC best track data for each flight. Since we are modeling hurricane winds during landfall, our *Rmax* model applies only to landfall and is not designed to model the life cycle of *Rmax* as a function of intensity.

2. Provide a brief rationale for the probability distributions used for all hurricane parameters and characteristics.

Form S-3 provides a list of probability distributions used to model hurricane parameters. Further discussion and rationale for these functions are provided in Standard M-2, Disclosure 1 and Standard S-1, Disclosure 1. Some of the details pertaining to data sources used are described below.

Monthly geographic distributions of climatological sea surface temperatures (Reynolds et al., 2002) and upper tropospheric outflow temperatures (Kanamitsu et al., 2002) are used to determine physically realistic potential intensities that help to bound the modeled intensity. Terrain elevation and bathymetry data were obtained from the United States Geological Survey. The radius of maximum wind at landfall is modeled from a comprehensive set of historical data published in NWS-38 by Ho et al. (1987) but supplemented by the extended best track data of DeMaria (Pennington et al., 2000), the HURDAT Reanalysis Project (Landsea et al, 2004), NOAA HRD research flight data, and NOAA-HRD H*Wind analyses (Powell et al., 1996, 1998). The development of the *Rmax* frequency distribution fit and its comparison to historical hurricane data are discussed in M-2.1, M-2.3 and in Standard S-1. Comparisons of the modeled radius of maximum wind to the observed data are shown in Form M-3.

M-4 Hurricane Windfield Structure

A. Windfields generated by the hurricane model shall be consistent with observed historical storms affecting Florida.

As described in Statistical Standards S-1, Disclosure 2, comparisons of FPHLM to gridded H*Wind fields indicate that the FPHLM wind fields are consistent with observed historical wind fields from Florida landfalling hurricanes.

B. The land use and land cover (LULC) database shall be consistent with National Land Cover Database (NLCD) 2011 or later. Use of alternate datasets shall be justified.

We use the MRLC NLCD 2011 land use dataset as well as the Statewide 2004-2011 Land Use/Land Cover dataset developed and maintained by the Florida Water Management Districts (WMD) and compiled and distributed by the Florida Department of Environmental Protection. The NLCD dataset became available in Spring 2014 and provides detailed (30 m) land use characteristics circa 2011. The datasets of the individual water management districts were combined in the statewide WMD dataset to form a unified dataset. The WMD data are based on 2004-2011 imagery.

C. The translation of land use and land cover or other source information into a surface roughness distribution shall be consistent with current state-of-the-science and shall be implemented with appropriate geographic-information-system data.

Land friction is modeled according to the currently accepted, state-of-the-science principles of surface layer similarity theory as described in the disciplines of micrometeorology, atmospheric turbulence, and wind engineering. The geographic distribution of surface roughness is determined by careful studies of aerial photography and satellite remote sensing measurements used to create land use-land cover classification systems. We have developed a roughness dataset at 90 meter resolution covering the state of Florida to enable modeling losses at the "street level." For modeling losses at the ZIP Code level, we use population-weighted roughness.

All street level locations (at 90 m resolution) and population-weighted ZIP Code centroids are assigned roughness values as a function of upstream fetch for each wind direction octant. After landfall, the surface drag coefficient used in the hurricane PBL slab model changes from a marine value to a fixed value associated with a roughness of 0.2 m.

D. With respect to multi-story buildings, the hurricane model windfield shall account for the effects of the vertical variation of winds if not accounted for in the vulnerability functions.

The modeled wind fields take into account vertical variation through the terrain conversion methodology based on Vickery et al. (2009). The coastal transition function also takes into account variation of wind with height.

Disclosures

1. Provide a rotational windspeed (y-axis) versus radius (x-axis) plot of the average or default symmetric wind profile used in the hurricane model and justify the choice of this wind profile. If the windfield represents a modification from the previous submission, plot the old and new profiles on the same figure using consistent inputs. Describe variations between the old and new profiles with references to historical storms.

See Figure 26. The *Holland B* profile has been compared extensively to historical data (Holland, 1980; Willoughby & Rahn, 2004) and found to be a reasonable fit.

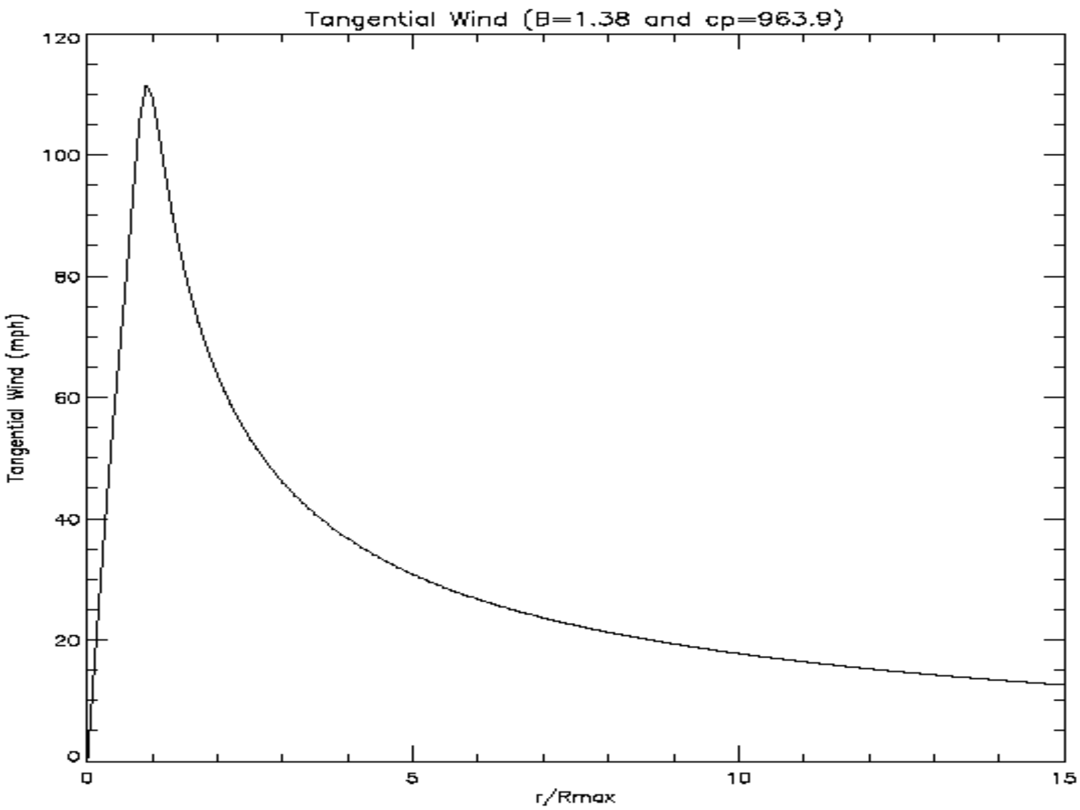


Figure 26. Axisymmetric rotational wind speed (mph) vs. scaled radius for B = 1.38, DelP = 49.1 mb.

The wind field model has not been modified since the previous submission.

2. Describe how the vertical variation of winds is accounted for in the hurricane model where applicable. Document and justify any difference in the methodology for treating historical and stochastic storm sets.

Vertical variation of wind is accounted for in the terrain conversion methodology described in Vickery et al. (2009). This methodology is a modification of the log wind profile and has been validated against dropsonde data. The coastal transition function, which is based on the above methodology, also incorporates variation with height so that the impact of a larger marine fetch on taller structures in coastal regions can be modeled. The treatment of vertical variation of winds is the same for both historical and stochastic storm sets.

3. Describe the relevance of the formulation of gust factor(s) used in the hurricane model.

The gust factors used in the model were developed from hurricane wind speed data and the Engineering Sciences Data Unit methods as described in Vickery and Skerlj (2005).

4. Identify all non-meteorological variables (e.g., surface roughness, topography) that affect windspeed estimation.

Upstream aerodynamic surface roughness within a fixed 45-degree sector extending upstream has an effect on the determination of wind speed for a given street location (latitude and longitude) or ZIP Code centroid and is a significant variable that affects estimation of surface wind speeds. The upstream sectors are defined according to the Tropical Cyclone Winds at Landfall Project (Powell et al., 2004), which characterized upstream wind exposure for each of eight wind direction sectors at over 200 coastal automated weather stations (Figure 27). In additional, a coastal transition function is employed to account for the smooth marine fetch near coastal regions.

Figure 27. Upstream fetch wind exposure photograph for Chatham, MA (left, looking north), and Panama City, FL (right, looking northeast). After Powell et al. (2004).

5. Provide the collection and publication dates of the land use and land cover data used in the hurricane model and justify their timeliness for Florida.

We use the 2011 Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database released on March 31, 2014. This is a high-resolution (30 m) land cover dataset that covers not only Florida, but the entire United States, and roughly depicts land characteristics circa 2011 [see Jin et al. (2013) for more details]. We also use the Statewide 2004-2011 Florida Water Management District Land Use/Land Cover dataset based on 2004-2011 imagery. This dataset was published by the Florida Department of Environmental Protection on March 8, 2013.

6. Describe the methodology used to convert land use and land cover information into a spatial distribution of roughness coefficients in Florida and neighboring states.

The land cover classifications provided by the MRLC Land Cover Database and the WMD land use/land cover data are first mapped to roughness values using a lookup table based on HAZUS (FEMA, 2003) that associates a representative roughness for the land use category on the basis of peer-reviewed literature. An algorithm was developed to merge the datasets based on how well each dataset classified the land surface with respect to surface roughness. An effective roughness model (Axe, 2004) is then used to incorporate upstream roughness elements to provide a more realistic roughness on a 90 m (295 ft) grid covering Florida.

7. Demonstrate the consistency of the spatial distribution of model-generated winds with observed windfields for hurricanes affecting Florida. Describe and justify the appropriateness of the databases used in the windfield validations.

As shown below in Disclosure 10 and in Statistical Standard 1, Disclosure 2, the spatial distribution of model-generated winds is consistent with observed wind fields for hurricanes affecting Florida. The observations are from the H*Wind surface analyses produced by NOAA's Hurricane Research Division. These analyses are described in detail in Standard S-1, Disclosure 2. The H*wind analyses are highly regarded in the scientific community and have been cited in over 400 peer-reviewed publications.

8. Describe how the hurricane model's windfield is consistent with the inherent differences in windfields for such diverse hurricanes as Hurricane King (1950), Hurricane Charley (2004), Hurricane Jeanne (2004), and Hurricane Wilma (2005).

The model can represent a wide variety of storms through variation of parameters for radius of maximum winds, central pressure deficit, and *Holland B*. Snapshots of model wind fields at landfall are compared to NOAA-AOML-HRD H*Wind analyses below (for further details see Disclosure 2 for Standard S-1). In these cases, rather than tuning the model to best fit the observations by varying the *Holland B* parameter, we derived the input B from the H*Wind analyses. Hurricane Charley, a small, fast moving 2004 hurricane (Figure 28, top), was modeled quite well; the motion asymmetry and extent of strong winds in the core of the storm were captured, but the peak wind (near 150 mph) was underestimated by the model. Hurricane Jeanne (Figure 28, bottom) struck the central Florida Atlantic coast in 2004. Similar to the observed (H*Wind) field, the modeled wind field maximum is on the right (north) side of the storm, but the model underestimates the peak wind of 105 mph and the area of winds above 70 mph. Wilma made landfall in Florida in 2005 as a very large hurricane (Figure 29). The FPHLM captures the location of maximum winds in the core of the storm and represents the left-right motion asymmetry, but tends to produce too broad of a wind field. In Figure 30, we show a plot Hurricane King (1950). We do not have H*Wind analyses for this storm. However, the modeled maximum wind, 130-135 mph, is close to the observed 132 mph (115 kt) and the modeled radius of maximum winds is 5.6 sm, compared to the observed 5.75 sm (5 nm).

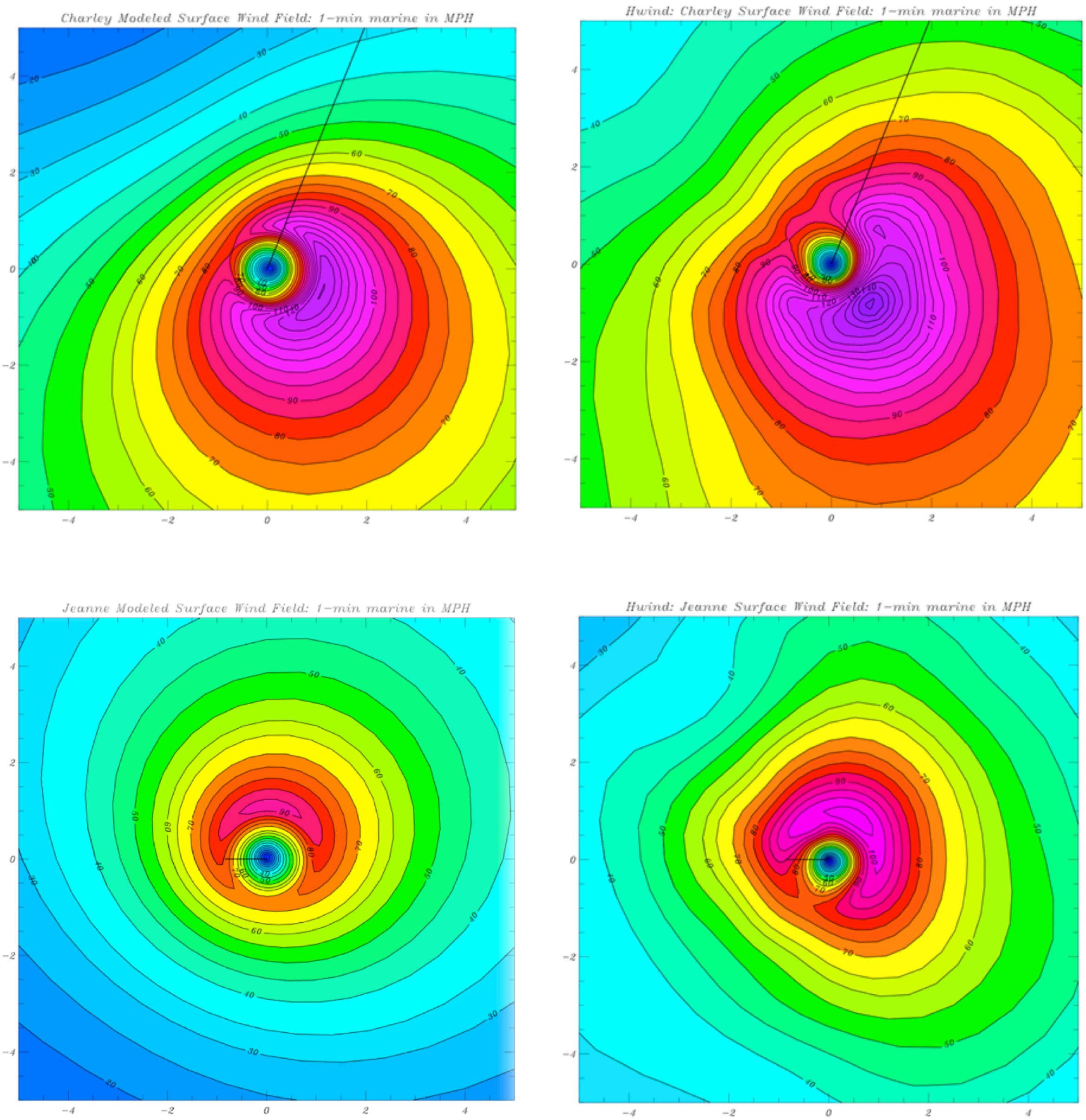


Figure 28. Comparison of modeled (left) and observed (H*Wind, right) landfall wind fields of Hurricane Charley (2004, top) and Hurricane Jeanne (2004, bottom). Line segment indicates storm heading. Horizontal coordinates are in units of *R/Rmax* and winds units of miles per hour. All wind fields are for marine exposure.

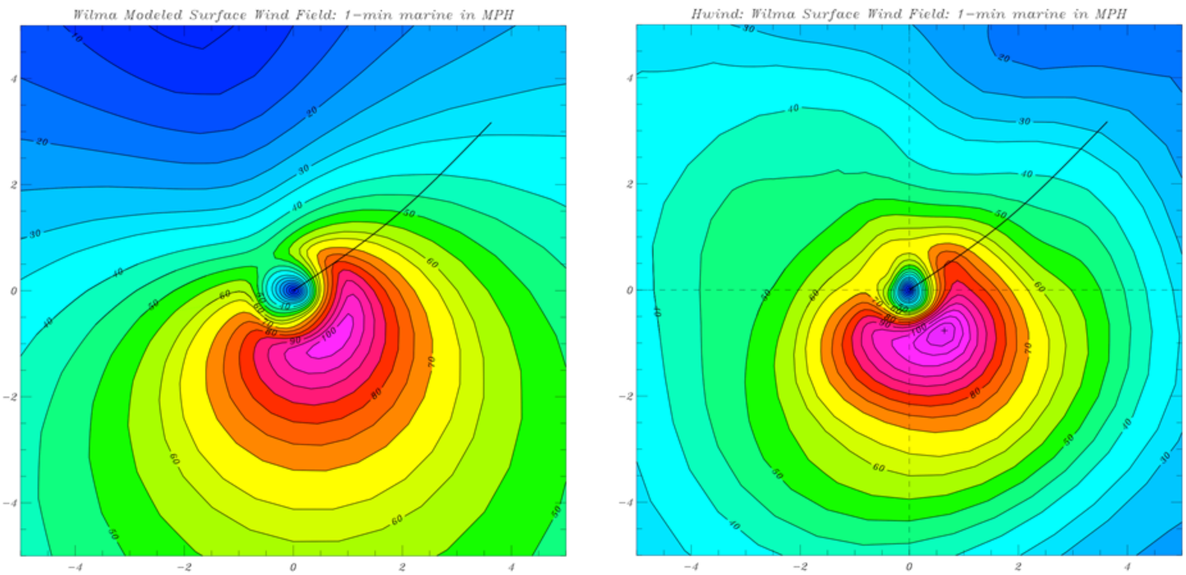


Figure 29. As in Figure 28, but for Hurricane Wilma of 2005.

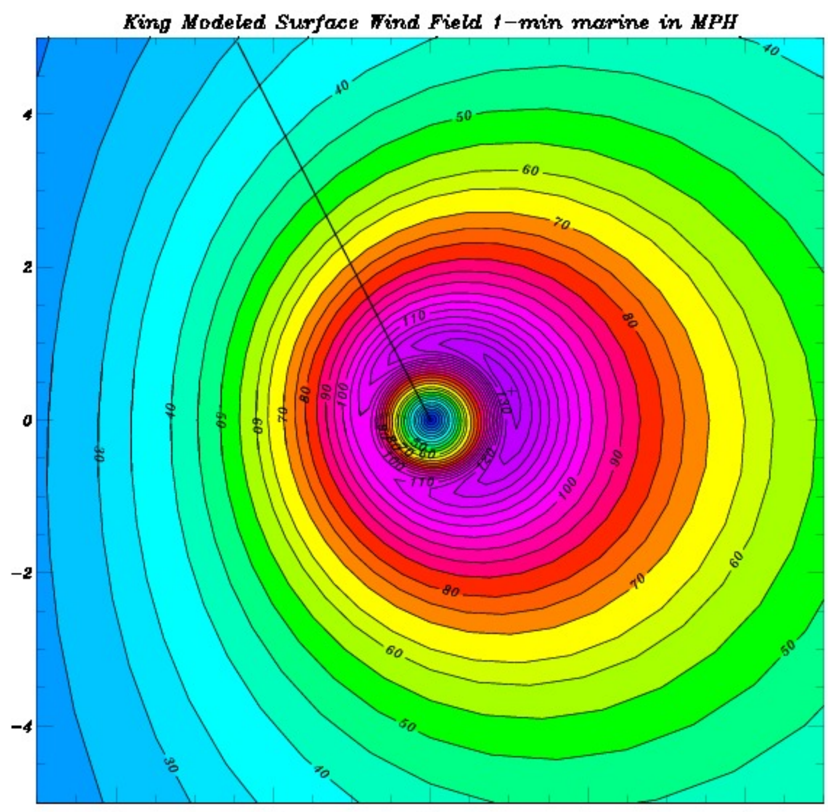


Figure 30. Plot of Hurricane King (1950). Line segment indicates storm heading. Horizontal coordinates are in units of *R/Rmax* and winds units of miles per hour. All wind fields are for marine exposure.

9. Describe any variations in the treatment of the hurricane model windfield for stochastic versus historical storms and justify this variation.

All historical storm sets consist of input files containing information derived from HURDAT or other observation sources as described in Standard M-1. All stochastic input storm tracks are modeled. The wind field is modeled from the stochastic or historical input files in the same manner.

10. Provide a completed Form M-2, Maps of Maximum Winds. Explain the differences between the spatial distributions of maximum winds for open terrain and actual terrain for historical storms. Provide a link to the location of the form here.

See Form M-2.

The open terrain winds are based on the assumption that the wind is in equilibrium with open terrain roughness (0.03 m). The actual terrain winds are assumed to be in equilibrium with the local (effective) roughness near the surface, but near coastal regions the winds aloft may be more in equilibrium with marine roughness. The spatial distributions of open and actual terrain wind can be quite different because of the coastal transition and the fact that surface roughness in general has a large impact on the wind field. Spatial variations of roughness on the order of a few miles can cause large differences in the wind on that spatial scale.

M-5 Hurricane Landfall and Over-Land Weakening Methodologies

A. The hurricane over-land weakening rate methodology used by the hurricane model shall be consistent with historical records and with current state-of-the-science.

Overland weakening rates are based on a pressure decay model developed from historical data as described by a paper published in peer-reviewed atmospheric science literature (Vickery, 2005).

B. The transition of winds from over-water to over-land within the hurricane model shall be consistent with current state-of-the-science.

The transition of winds from over-water to over-land is consistent with the current state of the science through the use of a pressure decay model (Vickery, 2005), a terrain conversion model from marine to actual roughness, and a coastal transition function (Vickery et al., 2009).

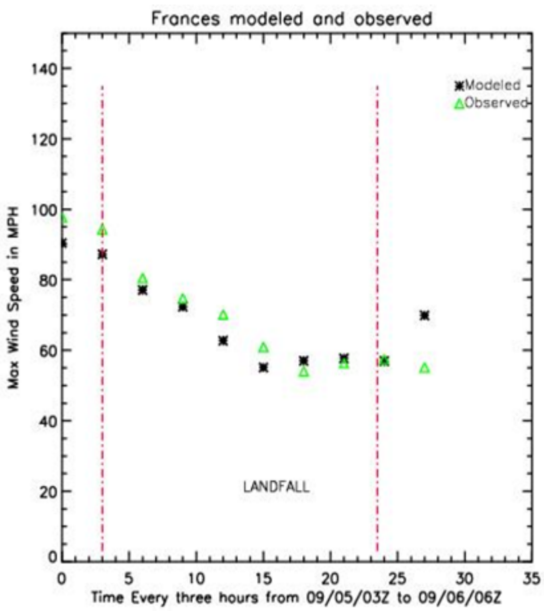
Disclosures

1. Describe and justify the functional form of hurricane decay rates used by the hurricane model.

The hurricane decay rate function acts to decrease the *DelP* with time after landfall. The functional form is an exponential in time since landfall and is based on historical data (Vickery, 2005).

2. Provide a graphical representation of the modeled decay rates for Florida hurricanes over time compared to wind observations.

The degradation of the wind field of a landfalling hurricane is associated with the filling of the central sea level pressure and the associated weakening of the surface pressure gradient; also the hurricane is over land, where the flow is subject to friction while flowing across obstacles in the form of roughness elements. Maximum wind degradation is shown according to how the maximum sustained surface wind (at the location containing the maximum winds in the storm) changes with time after landfall. At landfall the marine exposure wind is assumed to be representative of the maximum winds occurring onshore. After landfall the open terrain wind is chosen to represent the maximum envelope of sustained winds over land. The NOAA-HRD H*Wind system is used to analyze the maximum winds at a sequence of times following landfalls of Hurricanes Katrina, Charley, Frances, Jeanne, and Wilma. H*Wind uses all available wind observations. The landfall wind field is used as a background field for times after landfall and compared to the available observations at a sequence of times after landfall. An empirical decay is applied to the background field based on the comparisons to the observations. These data are then objectively analyzed to determine the wind field at each time. The model maximum sustained winds are compared to the maximum winds from the H*Wind analyses for the same times and roughness exposures. In general, points after landfall are given for open terrain exposure. At times, even though the storm center is over land, the maximum wind speed may remain over water. For example, in the Hurricane Frances plot (Figure 31), the first three pairs of points represent marine exposure, the next three open terrain, and the final three marine exposure again, while all Hurricane Wilma point pairs (Figure 32) represent marine exposure. The plots indicate that the public wind field model realistically simulates decay of the maximum wind speed during the landfall process, as well as subsequent strengthening after exit.



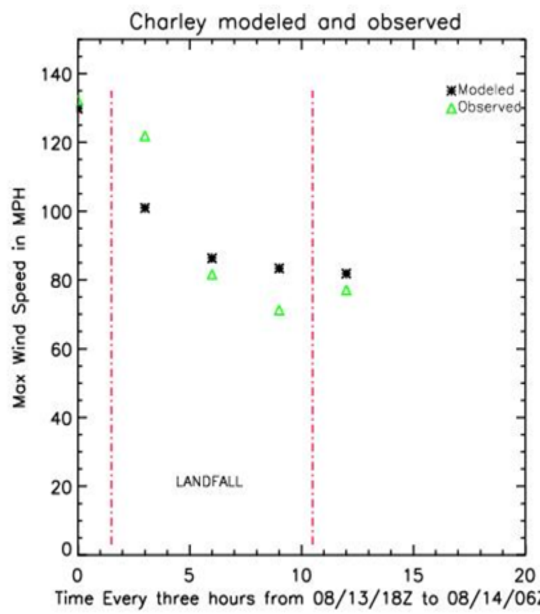


Figure 31. Observed (green) and modeled (black) maximum sustained surface winds as a function of time for 2004 Hurricanes Frances (left) and Charley (right). Landfall is represented by the vertical dash-dot red line at the left and time of exit as the red line on the right. For Hurricane Frances (left) the first three pairs of points represent marine exposure, the next three open terrain, and the final three pairs represent marine exposure. For Hurricane Charley (right) all pairs represent open terrain.

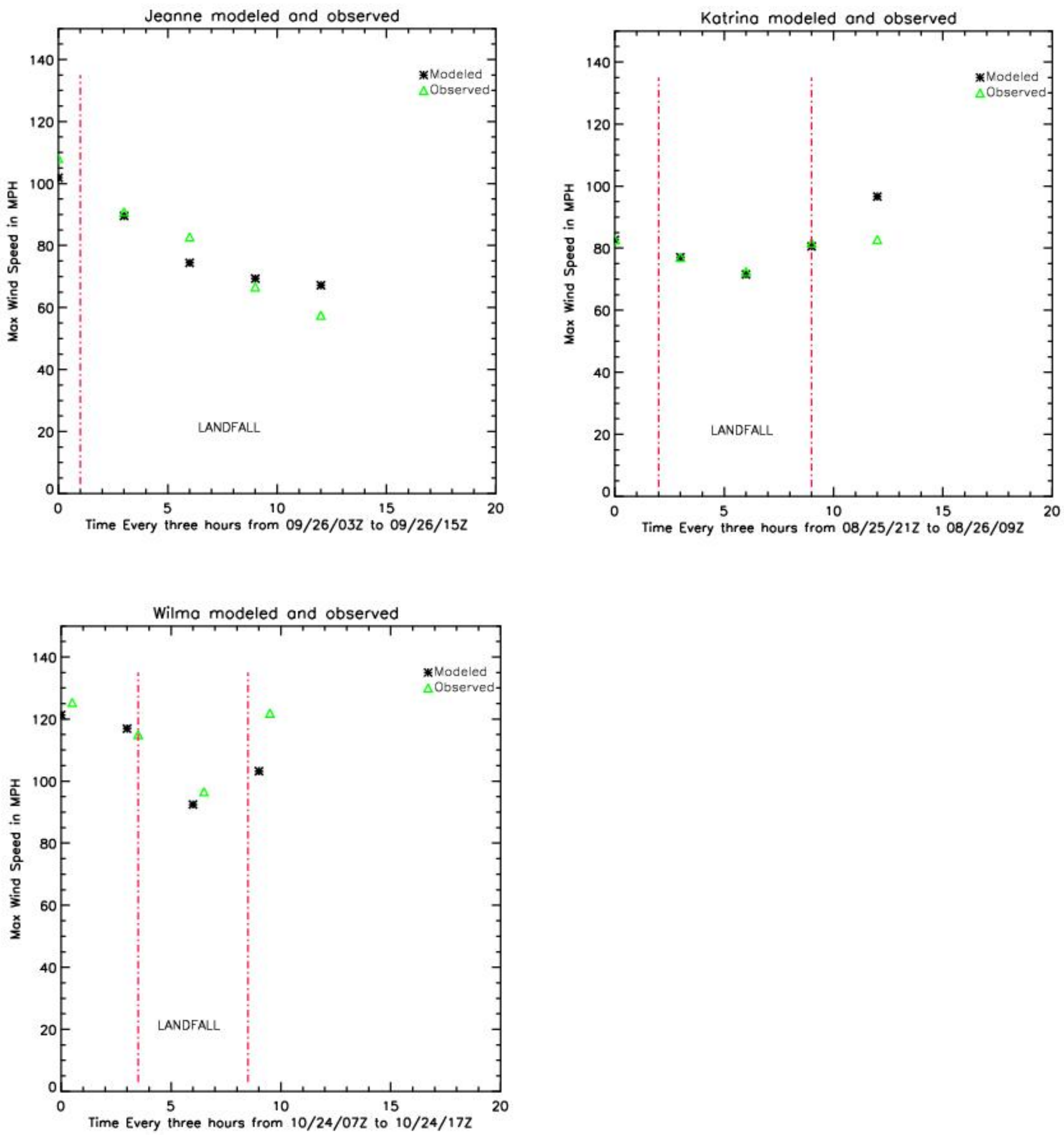


Figure 32. Observed (green) and modeled (black) maximum sustained surface winds as a function of time for Hurricanes Jeanne (2004, top left, open terrain), Katrina (2005 in South Florida, top right, open terrain), and Wilma (2005, lower left, marine exposure). Landfall is represented by the vertical dash-dot red line at the left and time of exit as the red line on the right.

3. Describe the transition from over-water to over-land boundary layer simulated in the hurricane model.

After landfall, the slab boundary layer, surface drag coefficient changes from a functional marine form to a constant based on a mean aerodynamic roughness length of 0.2 m. The slab boundary layer height increases from 450 m to 1 km after the center makes landfall and decreases back to 450 m if the center exits land to go back to sea. To determine surface winds, an effective roughness model is used along with a coastal transition function. The coastal transition function is based on the concept of a growing internal boundary layer (Arya, 1988) for the sea-to-land transition. Within the equilibrium layer, assumed to be one tenth of the internal boundary layer (IBL) height in depth, the wind is assumed to be in equilibrium with the local effective roughness. Above the IBL the wind is assumed to be in equilibrium with marine roughness. Between the equilibrium layer and the IBL we assume that the wind is in equilibrium with vertically varying, stepwise increments of roughness that decay linearly from the local roughness to marine roughness. This is similar in concept to the methodology described in ESDU, and the modeled transition is very close to the ESDU values reported in Vickery et al. (2009).

4. Describe any changes in hurricane parameters, other than intensity, resulting from the transition from over-water to over-land.

See Standard M-2, Disclosure 10. The *Holland B* parameter has a weak dependence on pressure and will undergo slight change. The radius of maximum winds has an implicit dependence on pressure through the scale and shape parameters of the gamma distribution (see M-2, Disclosure 3), and thus strong storms making landfall could undergo some expansion.

5. Describe the representation in the hurricane model of passage over non-continental U.S. land masses on hurricanes affecting Florida.

Noncontinental U. S. land masses are identified by a land-ocean mask that keeps track of whether the storm center is over the land or ocean. Storms that pass over noncontinental U.S. land masses (e.g., Cuba) undergo decay, just as storms do crossing continental land masses (e.g., mainland U. S.) using a pressure-filling model (Vickery, 2005).

6. Describe any differences in the treatment of decay rates in the hurricane model for stochastic hurricanes compared to historical hurricanes affecting Florida.

In the FPHLM model, decay is defined as the change in minimum sea level pressure (*Pmin*) with time after landfall. The input file for the wind field model consists of a hurricane track file that contains storm position, *Pmin*, *Rmax*, and *Holland B* at 1 h frequency. The wind field model is exactly the same for scenario (historical) or stochastic events. When running the model in scenario mode for historical hurricanes affecting Florida, we use a set of historical hurricane tracks as input to the model. When the model is run in stochastic mode, the input hurricane tracks are provided by the track and intensity model. The track and intensity model uses the Vickery (2005) pressure decay after landfall. When a hurricane exits land, the *Pmin* over water is determined on the basis of the Markov process as described in Disclosure G-1.2.

For historical hurricane tracks the landfall pressure is determined from HURDAT or from the Ho et al. (1987) report. If post-landfall pressure data are available in HURDAT, we interpolate pressure values over land. If post-landfall pressure data are not available, we apply the Vickery (2005) pressure decay model to the landfall pressure. After the storm exits land, the pressure is based on HURDAT data. Therefore, decay rates for historical hurricanes are based on HURDAT data if available, or the Vickery decay rate model applied to the HURDAT or Ho et al. (1987) landfall *Pmin*, and decay rates for stochastic hurricanes are based on Vickery (2005).

M-6 Logical Relationships of Hurricane Characteristics

A. The magnitude of asymmetry shall increase as the translation speed increases, all other factors held constant.

With all other factors held constant, the wind field asymmetry increases with translation speed. The storm translation speed causes a major right-left (looking in the direction the storm is moving) asymmetry in the wind field, which in turn causes an asymmetry in surface friction since the surface stress is wind-speed dependent. The magnitude of the asymmetry increases as the translation speed increases; there is no asymmetry for a stationary storm except for possible land friction effects if a storm becomes stationary while a large percentage of its circulation is over both land and water.

B. The mean windspeed shall decrease with increasing surface roughness (friction), all other factors held constant.

With all other factors held constant, the mean wind speed decreases with increasing surface roughness. However, the gust factor, which is used to estimate the peak one-minute wind and the peak three-second gust over the time period corresponding to the model mean wind increases as a function of turbulence intensity, which increases with surface roughness (Paulsen et al., 2003; Masters, 2004; Powell et al., 2004). For roughness values representative of ZIP Codes in Florida, with residential roughness values on the order of 0.2–0.3 m, the roughness effect on decreasing the mean wind speed overwhelms the enhanced turbulence intensity effect that increases the gust factor.

Disclosures

1. Describe how the asymmetric structure of hurricanes is represented in the hurricane model.

The asymmetry of the wind field is determined by the storm translation motion (right-left asymmetry) and the associated asymmetric surface friction. A set of form factors for the wind field also contributes to the asymmetry, and the proximity of the storm to land introduces an additional asymmetry because of the effect of land roughness elements on the flow. Azimuthal variation is introduced through the use of two form factors [see Appendix of Powell et al. (2005) for more detail]. The form factors multiply the radial and tangential profiles and provide a “factorized” ansatz for both the radial and tangential storm–relative wind components. Each form factor contains three constant coefficients that are variationally determined in such a way that the ansatz constructed satisfies (as far as its numerical degrees of freedom permit) the scaled momentum equations for the storm-relative polar wind components.

2. Provide a completed Form M-3, Radius of Maximum Winds and Radii of Standard Wind Thresholds. Provide a link to the location of the form here.

See Form M-3.

3. Discuss the radii values for each wind threshold in Form M-3, Radius of Maximum Winds and Radii of Standard Wind Thresholds, with reference to available hurricane observations such as those in HURDAT2. Justify the appropriateness of the databases used in the radii validations.

We have validated the modeled wind field against H*Wind observations as described and justified in Standard S-1, Disclosure 2. In addition, we have compared the modeled radii with those in the HURDAT2 database, released February 17, 2016. We discuss this comparison in more detail below.

The HURDAT2 database has limited observations for some storms at three standard radii: 64 kt (73 mph), 50 kt (58 mph) and 34 kt (40 mph). There are no observations of 110 mph winds in HURDAT2. For the FPHLM wind model, the winds are often not computed or stored for winds below the damage threshold (50 mph 3-sec gust). Thus our comparison was limited to 64 kt ("R64" - 73 mph) and 50 kt ("R50" - 58 mph) radii. As described in Form M-3, the reported radii in Form M-3 for the model are limited to landfall values in Florida and neighboring states, and are within +/- 0.5 mb of the pressure threshold. In HURDAT2, there are too few storms that meet these criteria, so we relaxed the criteria to include all storms in the database, and within +/- 5 mb of the pressure threshold. For many storms there are multiple observations, and therefore the whole set of observations cannot be considered independent measurements. For pressures below 930 mb, there were only 6 storms that had reported radii, and thus too few to determine appropriate quantile values. In Form M-3 Supplemental (Table 33), we show the reported HURDAT2 outer radii thresholds for R64 (73 mph) and R50 (58 mph) in comparison with the modeled values which were obtained as described in Form M-3.

The comparison between the HURDAT2 and FPHLM wind model radii quantiles shows reasonable agreement, especially given the limitations of the comparison due to sparse data and relaxed criteria for the observations. In addition, NHC considers outer radii quality (as reported in HURDAT2) to be poor because of data sparseness, and therefore does not validate wind radii forecasts. Observed radii quantiles are sensitive to small sample size as well.

Form M-1: Annual Occurrence Rates

See Appendix O.

Form M-2: Maps of Maximum Winds

A. Provide color-coded contour plots on maps with ZIP Code boundaries of the maximum winds for the modeled version of the Base Hurricane Storm Set for land use set for open terrain and for land use set for actual terrain. Plot the position and values of the maximum windspeeds on each contour map.

B. Provide color-coded contour plots on maps with ZIP Code boundaries of the maximum winds for a 100-year and a 250-year return period from the stochastic storm set for land use set for open terrain and for land use set for actual terrain. Plot the position and values of the maximum windspeeds on each contour map.

Actual terrain is the roughness distribution used in the standard version of the hurricane model as defined by the modeling organization. Open terrain uses the same roughness length of 0.03 meters at all land points.

Maximum winds in these maps are defined as the maximum one-minute sustained winds over the terrain as modeled and recorded at each location.

The same color scheme and increments shall be used for all maps.

Use the following eight isotach values and interval color coding:

(1)	***Minimum damaging***	***Blue***
(2)	***50 mph***	***Medium Blue***
(3)	***65 mph***	***Light Blue***
(4)	***80 mph***	***White***
(5)	***95 mph***	***Light Red***
(6)	***110 mph***	***Medium Red***
(7)	***125 mph***	***Red***
(8)	***140 mph***	***Magenta***

Contouring in addition to these isotach values may be included.

C. Include Form M-2, Maps of Maximum Winds, in a submission appendix.

See Appendix P.

Form M-3: Radius of Maximum Winds and Radii of Standard Wind Thresholds

See Appendix Q.

STATISTICAL STANDARDS

S-1 Modeled Results and Goodness-of-Fit

A. The use of historical data in developing the hurricane model shall be supported by rigorous methods published in current scientific and technical literature.

The historical data for the period 1900-2017 were modeled using scientifically accepted methods that have been published in accepted scientific literature.

B. Modeled and historical results shall reflect statistical agreement using current scientific and statistical methods for the academic disciplines appropriate for the various hurricane model components or characteristics.

Modeled and historical results are in agreement as indicated by appropriate statistical and scientific tests. Some of these tests will be discussed below.

Disclosures

1. Provide a completed Form S-3, Distributions of Stochastic Hurricane Parameters. Identify the form of the probability distributions used for each function or variable, if applicable. Identify statistical techniques used for estimation and the specific goodness-of-fit tests applied along with the corresponding p-values. Describe whether the fitted distributions provide a reasonable agreement with the historical data. Provide a link to the location of the form here.

Form S-3 at the end of this section identifies the form of the probability distribution used for each variable with a brief justification for the fit. Some of the methods and distributions are described in greater details below.

Historical initial conditions are used to provide the seed for storm genesis in the model. Small uniform random error terms are added to the historical starting positions, intensities and changes in storm motion. Subsequent storm motion and intensity are determined by randomly sampling empirical probability distribution functions derived from the HURDAT historical record.

Figure 33 shows the occurrence rate of both modeled and historical land-falling hurricanes in Florida. The figure shows a high level of agreement between historical and modeled occurrences. We also conducted a chi-square test to test whether the historical and modeled landfall occurrence rates were equal. The historical number of years with 0, 1, 2, and 3 or more hurricanes per year (4 bins each with 5 or more occurrences giving 3 degrees of freedom) were compared to the corresponding modeled number of years resulting in a chi-squared test statistic of 2.303 and a p-value of approximately 0.512 indicating that there was no significant difference between the two. A comparison of landfalls by region and intensity is given in Form M-1. The modeled results are consistent with the historical record, especially given the large uncertainty in the historical observations.

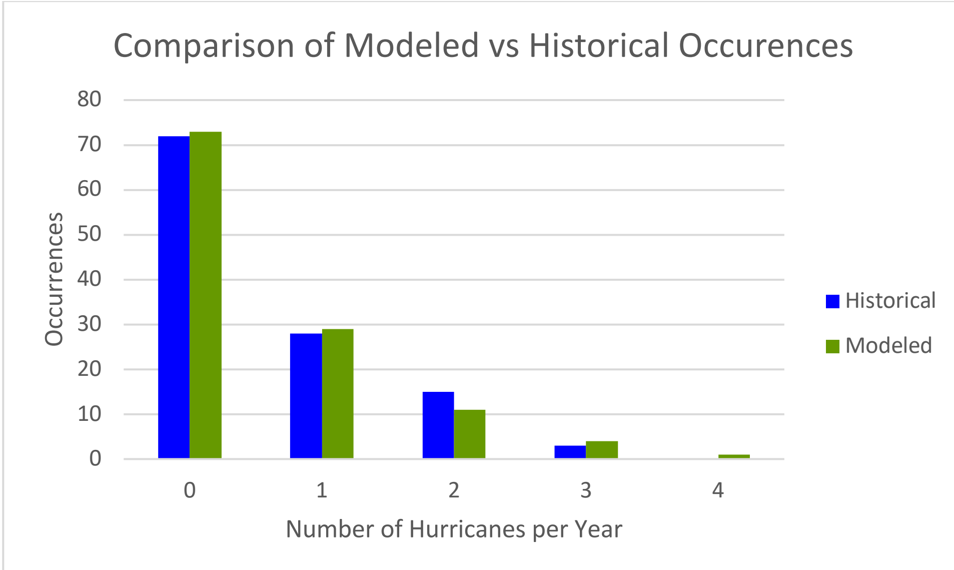


Figure 33. Comparison of modeled vs. historical occurrences.

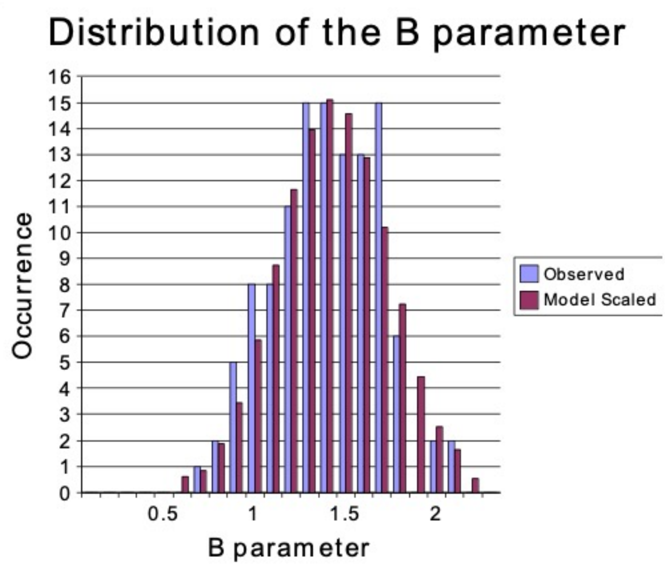


Figure 34. Comparison between the modeled and observed Willoughby and Rahn (2004) B data set.

The random error term for the Holland B is modeled using a Gaussian distribution with a standard deviation of 0.286. Figure 34 shows a comparison between the Willoughby and Rahn (2004) B data set (see Standard M-2.1) and the modeled results (scaled to equal the 116 measured occurrences in the observed data set). The modeled results with the error term have a mean of about 1.38 and are consistent with the observed results. The figure indicates a high level of agreement, and the chi-square goodness-of-fit test gives a p-value about 0.57, using 8 degrees of freedom (re-binning to 11 bins and two estimated parameters).

We developed an *Rmax* model using 106 measurements from the revised landfall *Rmax* database which includes observations for storms up to 2012. We have opted to model the *Rmax* at landfall rather than the entire basin for a variety of reasons. One is that the distribution of landfall *Rmax* may be different from the *Rmax* distribution over open water. An analysis of the landfall *Rmax* database and the 1988-2007 DeMaria Extended Best Track data show that there appears to be a difference in the dependence of *Rmax* on central pressure (*Pmin*) between the two data sets. The landfall data set provides a larger set of independent measurements, which is more than 100 storms compared to about 31 storms affecting the Florida threat area region in the Best Track Data. Since landfall *Rmax* is most relevant for loss cost estimation, and has a larger independent sample size, we have chosen to model the landfall data set. Future studies will examine how the Extended Best Track Data can be used to supplement the landfall data set.

Based on the skewness of *Rmax* and the fact that it is nonnegative, we sought to model the distribution using a gamma distribution. Using the maximum likelihood estimation method, we found the estimated shape and scale parameters for the gamma distribution are 4.76 and 5.41 respectively. Using these estimated values, we plotted the observed and expected distribution in Figure 35. The *Rmax* values are binned in 5 sm intervals, with the x-axis showing the end value of the interval.

Plot of Observed *Rmax* vs. Gamma Distribution

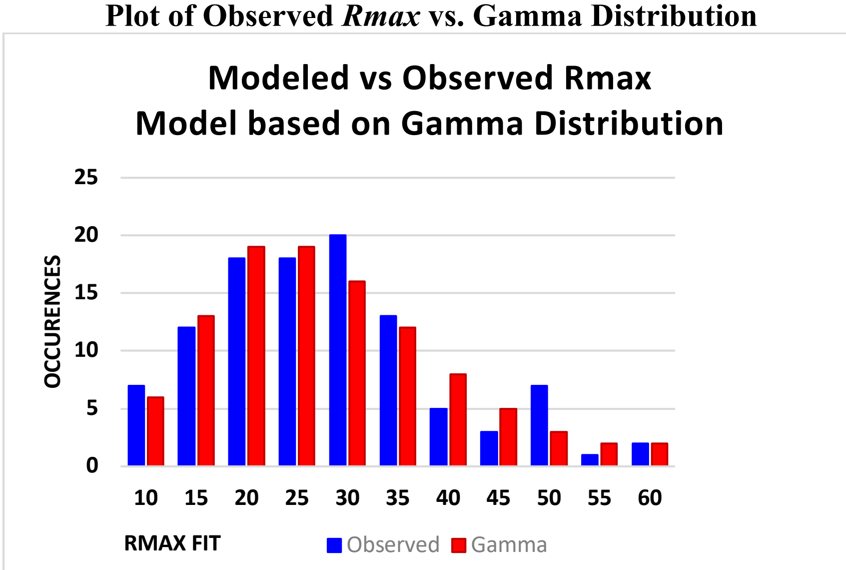


Figure 35. Observed and expected distribution using a gamma distribution.

The gamma distribution showed a reasonable fit. A chi-square goodness-of-fit test yields a p-value of 0.59 with 6 degrees of freedom (re-binning to 9 bins to ensure more than 5 expected occurrences per bin and 2 estimated parameters).

2. Describe the nature and results of the tests performed to validate the windspeeds generated.

We compared the cumulative effect of a series of modeled and observed wind fields by comparing the peak winds observed at a particular ZIP Code during the entire storm life-cycle. We also compared our modeled wind fields to those that have been constructed from all available observations which are freely available on the NOAA AOML-HRD web site. A subsequent section describes the process for recording the peak modeled and observed wind speeds (wind swaths) from which the validation statistics are generated. Our validation is based on nine hurricanes that passed by or made landfall in Florida. These hurricanes were well-observed. We will have the ability to add new storms and quickly conduct new validation studies as our validation set grows and we make enhancements to the model. In order to run the Loss Model in "scenario" mode for doing validation studies, we had to construct detailed storm track histories for recent storms affecting Florida using the HURDAT, *Rmax* and Holland B databases. The validation suite included 1992 Hurricane Andrew and the following 2004 and 2005 storms: Charley, Frances, Jeanne, Ivan, Dennis, Katrina, Rita, and Wilma. The validations make use of the Hurricane Research Division's Surface Wind Analysis System (H*Wind).

H*Wind

The HRD approach to hurricane wind analysis employed in H*Wind evolved from a series of peer-reviewed, scientific publications analyzing landfalls of major hurricanes including Frederic of 1979, Alicia of 1983, Hugo of 1989, and Andrew of 1992 (Powell et al., 1991; Powell et al., 1996; Powell et al., 1998). In Powell et al. (1991) which described Hurricane Hugo's landfall, a concept was developed for conducting a real-time analysis of hurricane wind fields. The system was first used in real-time during Hurricane Emily in 1993 (Burpee et al., 1994). Since 1994, HRD wind analyses have been conducted on a research basis to create real time hurricane wind field guidance for forecasters at the National Hurricane Center. During hurricane landfall episodes from 1995-2005, HRD scientists have conducted research side by side with hurricane specialists at NHC analyzing wind observations on a regular 3 or 6 hour schedule consistent with NHC's warning and forecast cycle.

An HRD wind analysis requires the input of all available surface weather observations (e.g., ships, buoys, coastal platforms, surface aviation reports, reconnaissance aircraft data adjusted to the surface, etc.). Observational data are downloaded on a regular schedule and then processed to fit the analysis framework. This includes the data sent by NOAA P3 and G4 research aircraft during the HRD hurricane field program, including the Step Frequency Microwave Radiometer measurements of surface winds and U.S. Air Force Reserves (AFRES) C-130 reconnaissance aircraft, remotely sensed winds from the polar orbiting SSM/I and ERS, the QuikScat platform and TRMM microwave imager satellites, and GOES cloud drift winds derived from tracking low level near-infrared cloud imagery from geostationary satellites. These data are composited relative to the storm over a 4-6 hour period. All data are quality controlled and processed to conform to a common framework for height (10 m or 33 feet), exposure (marine or open terrain over land), and averaging period (maximum sustained 1minute wind speed) using accepted methods from micrometeorology and wind engineering (Powell et al., 1996). This framework is consistent with that used by the National Hurricane Center (NHC) and is readily converted to wind load frameworks used in building codes.

Based on a qualitative examination of various observing platforms and methods used to standardize observations, Powell et al. (2005) suggest that the uncertainty of the maximum wind from a given analysis ranges from 10-20% depending on the observing platform. In general the uncertainty of a given H*Wind analysis is of the order of 10% for analysis of Hurricanes Ivan, Frances, Jeanne, and Katrina, all of which incorporated more accurate surface wind measurements from the Stepped Frequency Microwave Radiometer (SFMR) aboard the NOAA research aircraft. The SFMR data used for those analyses was post-processed during the fall of 2005 using the latest geophysical model function relating wind speed to sea surface foam emissivity. Hurricanes Charley, Dennis, Rita, Wilma, and Andrew did not have the benefit of SFMR measurements but relied on adjusting Air Force reconnaissance observations at the 3 km altitude to the surface with empirical reduction methods. The method used was based on how SFMR measurements compared to flight level winds and depended on storm relative azimuth. Preliminary results suggest that this method has an uncertainty of 15%.

We created wind swaths for both the modeled and observed winds. We also computed the maximum winds at ZIP Codes for both the observed and modeled winds; from that we derived the mean and root-mean-square error (see Table 11 and Table 12).

Wind Swaths

For each storm in the validation set, the peak sustained surface wind speed is recorded at each ZIP Code in Florida for the duration of the storm event. Observed wind fields from H*Wind and modeled wind fields from the public model are moved along the exact same tracks, which are the observed high-resolution storm tracks assembled from reconnaissance aircraft and radar data. For each storm, the recorded peak of the observed and modeled wind speed is saved at each grid point and each ZIP Code, and the resulting ZIP Code comparison pairs provide the basis for the model validation statistics. The peak grid point values are color contoured and mapped as graphics showing the "swath" of maximum winds swept out by the storm passage. Wind swaths are sometimes confused with wind fields. The winds depicted in a wind swath do not have time continuity, cannot depict a circulation, and therefore cannot be described as a wind field. A wind field represents a vector field that represents a representative instance of the surface wind circulation.

Wind swaths were constructed for both the modeled and observed winds. Maximum marine exposure winds were compared at all ZIP Codes for both the observed and modeled winds (Figure 36) from which we derived the mean and root-mean-square error statistics shown in Table 11 and Table 12. This type of comparison provides an unvarnished assessment of model performance.

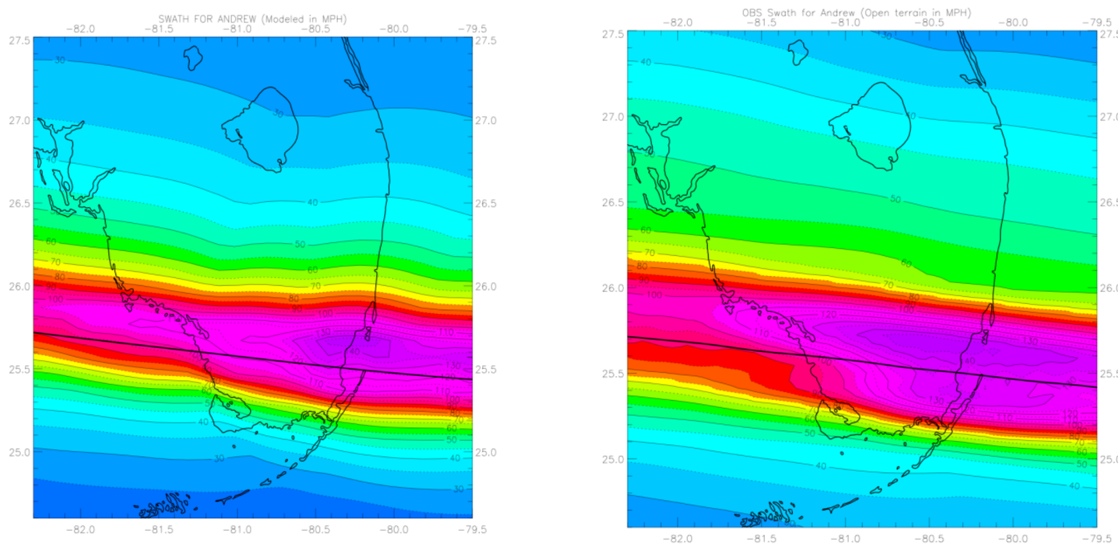


Figure 36. Comparison of modeled (left) and observed (right) swaths of maximum sustained marine surface winds for Hurricane Andrew of 1992 in South Florida. The Hurricane Andrew observed swath is based on adjusting flight-level winds with the SFMR-based wind reduction method.

Storms	Year	56-74 Model Threshol	75-112 Model Thresh.	>112mph Model Thresh.	>56mph Model Thresh.	56-74 H*Wind Thresh.	75-112 H*Wind Thresh.	>112mph H*Wind Thresh.	>56mph H*Wind Thresh.
Andrew	1992	5.25 92	13.86 107	2.73 100	7.49 299	10.26 139	12.47 54	0.66 88	7.68 281
Charley	2004	12.96 112	21.36 244	-7.36 13	17.80 369	8.58 122	-3.09 63	-8.91 17	3.47 202
Frances	2004	3.99 693	-0.99 96	None	3.38 789	-0.59 372	-4.48 96	None	-1.38 468
Ivan	2004	-6.95 20	-3.35 38	None	-4.59 58	-5.76 22	-3.73 41	None	-4.44 63
Jeanne	2004	6.78 250	3.95 190	None	5.56 440	2.67 225	-3.87 121	None	0.38 346
Dennis	2005	2.45 15	6.98 46	None	5.87 61	5.22 29	7.57 29	-4.37 3	5.87 61
Dennis Keys	2005	None	None	None	None	-12.65 5	None	None	-12.65 5
Katrina	2005	-11.43 77	-2.42 100	None	-6.34 177	-8.93 93	-11.57 149	None	-10.55 242
Rita	2005	6.28 5	14.54 3	None	9.38 8	12.01 5	None	None	12.01 5
Wilma	2005	0.44 133	-9.99 394	None	-7.35 527	6.54 87	-13.35 396	None	-9.77 483

Table 11. Validation Table based on ZIP Code wind swath comparison of the Public wind field model to H*Wind. Mean errors (bias) of model for the set of validation wind swaths. Errors (upper number in each cell) are computed as Modeled – Observed (Obs) at ZIP C Codes were modeled winds were within wind thresholds (model threshold) or where observed winds were within respective wind speed threshold (H*Wind threshold). Number of ZIP Codes for the comparisons is indicated as the lower number in each cell.

Storms	Year	56-74 Model Threshol d	75-112 Model Thresh.	>112mph Model Thresh.	>56mph Model Thresh.	56-74 H*Wind Thresh.	75-112 H*Wind Thresh.	>112mph H*Wind Thresh.	>56mph H*Wind Thresh.
Andrew	1992	6.11	15.75	7.024	10.81	12.19	14.26	5.82	11.10
Charley	2004	19.84	26.59	10.08	24.30	16.65	8.60	11.69	14.21
Frances	2004	8.08	11.20	None	8.52	4.99	10.20	None	6.41
Ivan	2004	7.07	5.20	None	5.91	6.11	5.51	None	5.72
Jeanne	2004	10.14	9.65	None	9.93	10.88	6.16	None	9.50
Dennis	2005	3.06	9.19	None	8.12	6.15	9.93	4.59	8.12
Dennis Keys	2005	None	None	None	None	12.67	None	None	12.67
Katrina	2005	14.66	8.25	None	11.49	12.50	17.97	None	16.09
Rita	2005	6.4992	14.54	None	10.28	12.41	None	None	12.41
Wilma	2005	14.73	14.05	None	14.22	12.51	14.83	None	14.44
RMS N	All	10.18 1397	14.87 1218	6.26 113	12.37 2728	9.75 1099	12.79 949	6.71 108	11.19 2156

Table 12. Validation Table based on ZIP Code wind swath comparison of the Public wind field model to H*Wind. Root mean square (RMS) wind speed errors (mph) of model for the set of validation wind swaths. Errors are based on Modeled – Observed (Obs) at ZIP Code Codes where modeled winds were within wind thresholds (model threshold) or where observed winds were within respective wind speed threshold (H*Wind threshold).

Comparison of model and H*Wind sustained marine exposure wind speeds at ZIP Codes receiving model wind speeds over the given thresholds (Table 11) indicates a positive bias. For ZIP Codes where model wind speeds exceeded 56 mph, the bias is +3.3 mph; negative bias was apparent in Hurricanes Ivan, Katrina, and Wilma. At other wind speed thresholds, low bias is evident for winds > 112 mph in Hurricane Charley, and winds of 75-112 mph in Hurricanes Frances, Ivan, Katrina, and Wilma. For winds of 56-74 mph, low bias is noted in Hurricanes Ivan, and Katrina. Errors for Hurricane Andrew are relatively high, but the lack of observations for Hurricane Andrew makes it difficult to determine if it was a Cat 4 or Cat 5 hurricane during its landfall in South Florida.

Hurricane Rita in the Keys also shows relatively high bias, but observations indicate that there were fluctuations in intensity over a short period of time during its passage past the Keys. Model errors for Hurricane Charley are also relatively high, likely due to the model producing a wind field that was too broad. When model winds are compared to H*Wind at ZIP Codes exceeding H*Wind and sustained wind speed thresholds of 56 mph are considered, the mean bias is -2.2 mph. However, bias at other wind speed thresholds is larger, primarily caused by large model - H*Wind differences in Hurricanes Andrew, Charley, and Rita.

When swaths are evaluated at ZIP Codes, a positive wind speed bias of ~3 mph is indicated. However, the model can also under-predict swaths for individual cases. While bias correction is an accepted practice for numerical weather prediction, there is no evidence that the model has a consistent bias. The swath bias is probably associated with limitations in specifying the radial pressure profile after landfall. The tendency for the Holland pressure profile parameter to produce too broad an area of strong winds near the eyewall is the most likely cause of bias and is likely a feature found in many of the current risk models. Therefore, we have decided to forgo any corrective measures at this point.

Our validation set is unique in that the values of storm position, motion, *Rmax* and *Pmin* are observed, and B is determined independently from the H*Wind field. In other words, it is impossible to fine-tune our results. Although additional validation storms are desired, we believe the positive bias for locations with winds > 56 mph is a characteristic of models that use the Holland B pressure profile parameter, which tends to produce model fields that are too broad outside the radius of maximum winds. Our validation method provides an objective means of assessing model performance by evaluating the portion of the wind field that contains damaging winds.

The root mean square (RMS) error (Table 12) provides a better estimate of model uncertainty. For ZIP Codes in which model winds were 56-74 mph, the RMS error is +/- 10 mph (~ 15%), for 75-112 mph the error is +/- 15 mph (~16%), and for winds > 112 mph the error is +/- 6 mph (~ 5%). In general, for winds > 56 mph, the RMS error is +/- 12 mph or ~ 13%. RMS errors are similar for ZIP Codes in which H*Wind wind speeds fell into the respective thresholds.

Summary of wind swath validation

Validation of the winds from the wind model against the H*WIND analyses was prepared by considering winds that would be strong enough to be associated with damage. Threshold-based comparisons could miss places where the observed winds were greater than the model and the model was below the threshold. Conversely, observed winds over the same thresholds can be compared to the co-located model grid points but would miss places where the observed winds were below the threshold. It is important to evaluate the errors both ways to see if a consistent bias is evident. According to our validation statistics, albeit for a relatively small number of cases, wind swath ZIP Code comparisons show evidence of a 3 mph positive bias, but it is not consistent for all storms. The bias is likely related to the limitations of the Holland B pressure profile specification. The model uncertainty, as estimated by the RMS error, is on the order of 15%.

3. Provide the dates of hurricane loss of the insurance claims data used for validation and verification of the hurricane model.

The following hurricane data from different insurance companies are used to validate the model:

Andrew	1992
Erin	1995
Charley	2004
Frances	2004
Jeanne	2004
Dennis	2005
Wilma	2005
Katrina	2005

4. Provide an assessment of uncertainty in hurricane probable maximum loss levels and hurricane loss costs for hurricane output ranges using confidence intervals or other scientific characterizations of uncertainty.

While the model does not automatically produce confidence intervals for the output ranges, the data do allow for the calculation of confidence intervals. We calculated the mean and the standard deviation of the losses for each county, and it was found that the standard errors were within 2.5% of the means for all counties. We also calculated the coefficient of variation (CV) for all counties and drew a histogram, which is provided in Figure 37. The range of the CVs was between 2.68 and 4.76. Finally, we computed 95% confidence intervals for the average loss for each county. Some of these intervals are reproduced in Table 13.

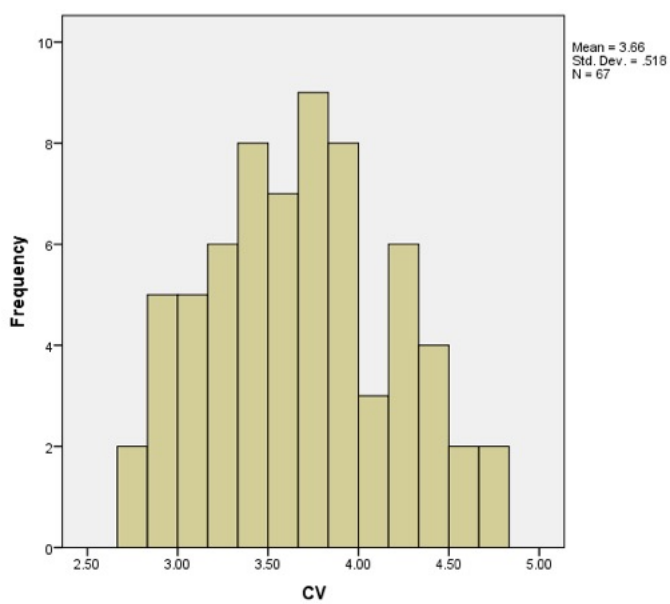


Figure 37. Histogram of CVs for all counties combined.

county	Average Loss	Standard deviation Loss	LCL	UCL
Alachua	$12,825,430.70	$50,245,829.73	$12,419,987.44	$13,230,873.96
Brevard	$150,516,598.70	$554,918,044.00	$146,038,858.20	$154,994,339.10
Broward	$446,276,830.20	$1,295,614,471.00	$435,822,267.80	$456,731,392.50
Duval	$41,746,449.67	$181,113,511.40	$40,285,009.92	$43,207,889.42
Escambia	$42,532,806.94	$141,826,767.50	$41,388,379.48	$43,677,234.40
Gulf	$1,966,093.39	$6,701,968.11	$1,912,013.92	$2,020,172.86
Hamilton	$246,108.91	$1,170,422.87	$236,664.54	$255,553.28
Hillsborough	$212,382,040.40	$681,307,035.30	$206,884,443.00	$217,879,637.90
Jackson	$1,999,282.91	$7,591,399.95	$1,938,026.44	$2,060,539.38
Jefferson	$492,890.72	$2,270,281.61	$474,571.38	$511,210.06
Lee	$220,060,552.30	$594,975,332.90	$215,259,581.90	$224,861,522.60
Leon	$13,266,295.17	$57,135,258.92	$12,805,259.78	$13,727,330.56
Madison	$455,660.76	$2,142,593.16	$438,371.76	$472,949.76
Miami-Dade	$436,475,251.90	$1,292,942,683.00	$426,042,248.80	$446,908,255.10
Monroe	$55,437,232.31	$166,641,047.50	$54,092,573.65	$56,781,890.97
Nassau	$5,906,328.69	$25,824,951.08	$5,697,942.19	$6,114,715.19
Okeechobee	$8,769,008.65	$29,566,729.41	$8,530,429.03	$9,007,588.28
Osceola	$44,184,274.75	$151,950,826.20	$42,958,154.31	$45,410,395.19
Palm Beach	$621,210,361.50	$1,867,361,519.00	$606,142,262.30	$636,278,460.70
Sarasota	$131,052,095.40	$386,931,742.70	$127,929,868.80	$134,174,322.10

Table 13. 95% Confidence intervals for mean loss for selected counties (based on 59,000) year simulation.

LCL: 95% Lower Confidence Limit for the Average Loss
UCL: 95% Upper Confidence Limit for the Average Loss

As far as uncertainties for probable maximum loss, we use the well-known result from nonparametric statistics (see Section 3.2 of Practical Nonparametric Statistics by WJ Conover) that for any $1 \leq j \leq N$, the probability that

$$P(PML_p < X_{(j)}) = \sum_{i=1}^{j-1} \frac{N!}{i!(N-i)!} p^i (1-p)^{N-i}$$

Here PMLp refers to the probable maximum loss corresponding to the pth percentile (return period $\frac{1}{1-p}$)

The above implies that for some $r < s \leq N$,

$$p(X_{(r)} < PML_p < X_{(s)})$$
$$= p(PML_p < X_{(s)}) - p(PML_p < X_{(r)})$$
$$= \sum_{i=1}^{s-1} \binom{N}{i} p^i (1-p)^{N-i} - \sum_{i=1}^{r-1} \binom{N}{i} p^i (1-p)^{N-i}$$
$$= \sum_{i=r}^{s-1} \binom{N}{i} p^i (1-p)^{N-i} \approx 0.95$$

Hence to construct an exact (1- α)100% confidence interval for PML_p, we need to find r and s with r <s (done through a numerical search) such that

$$\sum_{i=r}^{s-1} \frac{N!}{i!(N-i)!} p^i (1-p)^{N-i} \approx 1-\alpha.$$

If the solution from the computer search is not unique, the pair of r and s that minimizes s-r will be selected to give the narrowest interval.

However for large samples, the approximate 95% confidence interval of PML_p is given by (X_r, X_s) , using a binomial approximation. The large sample approximation assumes normality to obtain r and s as

$$r = Np - 1.96\sqrt{Np(1-p)}$$
$$s = Np + 1.96\sqrt{Np(1-p)}.$$

Since for our modeled losses, we use 59,000 simulation years, we can easily use the binomial approximation and compute confidence intervals for the Probable Maximum Loss. Applying the approximation to the PML values for the 2012 Cat Fund Exposure data in Form S-2A and for the 2017 Cat Fund Exposure data in Form S-2B, we obtain the corresponding confidence intervals for the PML values as shown in Table 14 for 2012 Cat Fund Exposure data and Table 15 for 2017 Cat Fund Exposure data, respectively.

Return Period (Years)	Estimated Loss Level	Lower bound of Uncertainty Interval	Upper bound of Uncertainty Interval
Top Event	$107,769,395,534	-	-
10000	$95,455,262,288	$88,304,925,078	$106,998,536,370
5000	$88,174,464,199	$85,912,227,179	$95,455,262,288
2000	$80,605,004,869	$78,830,208,202	$85,912,227,179
1000	$73,498,809,119	$72,017,490,246	$78,061,102,312
500	$66,703,755,988	$65,148,627,325	$69,619,660,615
250	$58,556,954,264	$57,559,896,287	$60,573,900,837
100	$47,740,735,748	$46,926,620,815	$48,912,471,411
50	$39,349,058,321	$38,664,118,479	$40,093,922,909
20	$27,095,280,287	$26,610,122,148	$27,573,632,642
10	$17,603,479,339	$17,281,722,056	$17,947,127,393
5	$7,119,283,722	$6,885,982,100	$7,423,785,949

Table 14. Confidence Intervals for PML values for 2012 Cat Fund Exposure Data

Return Period (Years)	Estimated Loss Level	Lower bound of Uncertainty Interval	Upper bound of Uncertainty Interval
Top Event	$110,777,351,135	-	-
10000	$97,631,739,299	$92,667,194,649	$110,060,771,459
5000	$92,511,230,371	$88,795,226,096	$97,631,739,299
2000	$85,845,404,739	$81,491,919,825	$88,795,226,096
1000	$76,669,749,764	$75,373,191,590	$80,688,541,588
500	$70,811,857,153	$68,861,970,568	$72,830,941,566
250	$61,689,275,988	$60,167,512,835	$63,295,880,571
100	$50,517,247,153	$49,520,505,183	$51,758,020,226
50	$41,596,780,882	$40,893,593,331	$42,297,546,269
20	$28,798,047,916	$28,241,555,661	$29,239,516,375
10	$18,763,087,190	$18,434,729,832	$19,128,763,920
5	$7,472,671,407	$7,185,598,630	$7,769,334,842

Table 15. Confidence Intervals for PML values for 2017 Cat Fund Exposure Data

5. Justify any differences between the historical and modeled results using current scientific and statistical methods in the appropriate disciplines.

The various statistical tests as well as other validation tests presented here and elsewhere indicate that any differences between modeled results and historical observations are not statistically significant given the large known uncertainties in the historical record.

6. Provide graphical comparisons of modeled and historical data and goodness-of-fit tests. Examples to include are hurricane frequencies, tracks, intensities, and physical damage.

For hurricane frequencies as a function of intensity by region, see Form M-1 plots. The histogram in Figure 33 compares the modeled and historical annual landfall distribution by number of events per year. The agreement between the two distributions is quite close and the histogram shows a good fit. The chi-square goodness-of-fit test gives a p-value of approximately 0.512 as described in S-1.1. Plots and goodness-of-fit tests for the radius of maximum wind and the Holland pressure profile parameter are shown in Disclosure 1 of this standard. Plots and statistical comparisons of historical and modeled losses are shown in Standard S-5, Form S-4 and Form S-5.

7. Provide a completed Form S-1, Probability and Frequency of Florida Landfalling Hurricanes per Year. Provide a link to the location of the form here.

Please see completed Form S-1 at the end of this section.

8. Provide a completed Form S-2A, Examples of Hurricane Loss Exceedance Estimates (2012 FHCF Exposure Data). Provide a link to the location of the form here.

Please see completed Form S-2A at the end of this section.

9. Provide a completed Form S-2B, Examples of Hurricane Loss Exceedance Estimates (2017 FHCF Exposure Data). Provide a link to the location of the form here.

Please see completed Form S-2B at the end of this section.

S-2 Sensitivity Analysis for Hurricane Model Output

The modeling organization shall have assessed the sensitivity of temporal and spatial outputs with respect to the simultaneous variation of input variables using current scientific and statistical methods in the appropriate disciplines and shall have taken appropriate action.

We have performed sensitivity analysis on the temporal and spatial outputs of the model using currently accepted scientific and statistical methods. We examined the effects of five input variables on the expected loss cost. The input variables were as follows:

CP = central pressure (in millibars)
Rmax = radius of maximum winds (in statute miles)
VT = translational velocity (forward speed in miles per hour)
Holland B = pressure profile parameter and
FFP = far field pressure

The effects of the above input variables on the expected loss cost were examined using the methods described by Iman et al. (2000a).

Disclosures

1. Identify the most sensitive aspect of the hurricane model and the basis for making this determination.

Figure 38 provides the graph of the standardized regression coefficients of the expected loss cost as a function of the input variables for Category 1, 3 and 5 hurricanes. From the graph, we observe that the sensitivity of expected loss cost depends on the category of the hurricanes. For a Category 1 hurricane, expected loss cost is most sensitive to Holland B. For a Category 3 hurricane, expected loss cost is most sensitive to Holland Band, and finally for a Category 5 hurricane, expected loss cost is most sensitive to *Rmax*.

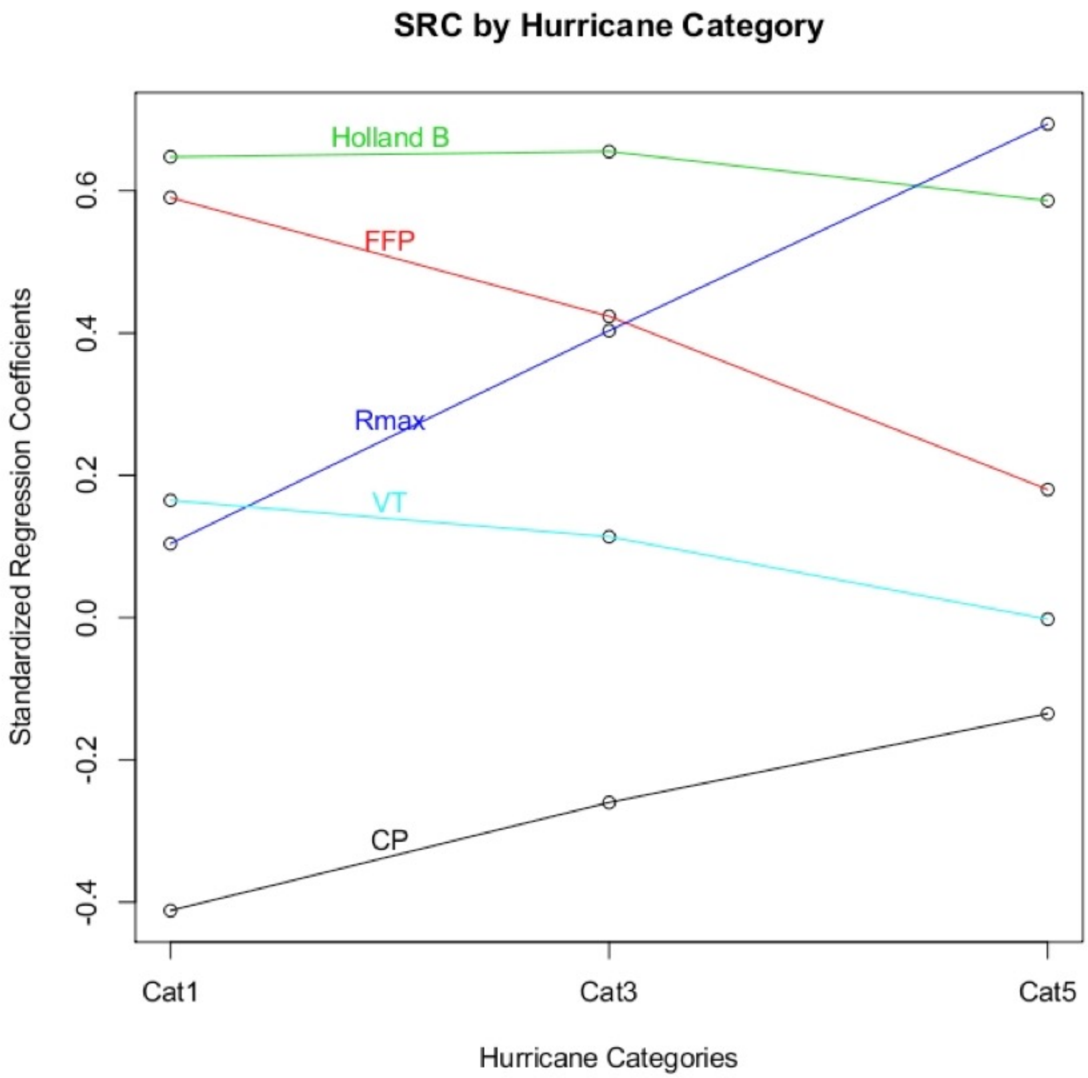


Figure 38. SRCs for Expected Loss Cost for all Input Variables for all Hurricane Categories.

2. Identify other input variables that impact the magnitude of the output when the input variables are varied simultaneously. Describe the degree to which these sensitivities affect output results and illustrate with an example.

As mentioned in disclosure 1; the input variables that impact the magnitude of the output when varied simultaneously depend on the category of the hurricanes. For a Category 1 hurricane, FFP and CP are the other two variables (in addition to Holland B) which have an impact on loss costs. For a Category 3 hurricane, expected loss cost the other variables are FFP and *Rmax* and finally for a Category 5 hurricane, these are Holland B, CP and FFP. The expected loss cost is least sensitive to *Rmax* for Category 1, while the expected loss cost is least sensitive to VT for Categories 3 and 5.

3. Describe how other aspects of the hurricane model may have a significant impact on the sensitivities in output results and the basis for making this determination.

Validation studies (described in Standard S-1.2) indicated that air density, boundary layer height, fraction of the boundary layer depth over which the turbulent stresses act, the drag coefficient, the averaging time chosen to represent the boundary layer slab winds, and the conversion of the 0-500 m layer mean wind to 10 m surface wind could all have a significant impact on the output. These quantities were evaluated during the validation process, resulting in the selection of physically consistent values. For example, the values chosen for air density, marine boundary layer height and reduction factor from the mean boundary layer to the surface are representative of near surface GPS dropsonde measurements in hurricanes. Model wind speeds (and therefore, output results) are very sensitive to surface roughness, which in turn depend on land use/land cover determined from satellite remote sensing. The assignment of roughness to mean land use / land cover classifications as well as the upstream filtering or weighting factor was applied to integrate the upstream roughness elements within a 45 degree sector to windward of the corresponding ZIP Code.

4. Describe and justify action or inaction as a result of the sensitivity analyses performed.

No actions were taken in light of the aforementioned sensitivity experiments.

5. Provide a completed Form S-6, Hypothetical Events for Sensitivity and Uncertainty Analysis. (Requirement for hurricane models submitted by modeling organizations which have not previously provided the Commission with this analysis. For hurricane models previously-found acceptable, the Commission will determine, at the meeting to review modeling organization submissions, if an existing modeling organization will be required to provide Form S-6, Hypothetical Events for Sensitivity and Uncertainty Analysis, prior to the Professional Team on-site review). If applicable, provide a link to the location of the form here.

Please see the completed Form S-6 at the end of this section.

S-3 Uncertainty Analysis for Hurricane Model Output

The modeling organization shall have performed an uncertainty analysis on the temporal and spatial outputs of the hurricane model using current scientific and statistical methods in the appropriate disciplines and shall have taken appropriate action. The analysis shall identify and quantify the extent that input variables impact the uncertainty in hurricane model output as the input variables are simultaneously varied.

We have performed uncertainty analysis on the temporal and spatial outputs of the model using currently accepted scientific and statistical methods. We examined the effects of five input variables on the expected loss cost. The input variables were as follows:

CP = central pressure (in millibars)
Rmax = radius of maximum winds (in statute miles)
VT = translational velocity (forward speed in miles per hour)
Holland B = pressure profile parameter and
FFP = far field pressure

The effects of the above input variables on the expected loss cost were examined using the methods described by Iman et al. (2000b).

Disclosures

1. Identify the major contributors to the uncertainty in hurricane model outputs and the basis for making this determination. Provide a full discussion of the degree to which these uncertainties affect output results and illustrate with an example.

Figure 39 gives the expected percentage reductions in the variance of expected loss costs for Category 1, 3 and 5 hurricanes as a function of the input variables. As with the sensitivity analysis, the category of the hurricane determines which variables contributes most to the uncertainty of the expected loss costs. For a Category 1 hurricane, the major contributor to the uncertainty in expected loss cost is the Holland B parameter followed by FFP and then CP. For a Category 3 hurricane, the major contributor to the uncertainty in loss costs is Holland B followed by *Rmax* and then FFP and finally for a Category 5 hurricane, the major contributor to the uncertainty of expected loss costs is *Rmax* followed by Holland B and then FFP and CP. The variable VT has negligible effect on the uncertainty in expected loss costs.

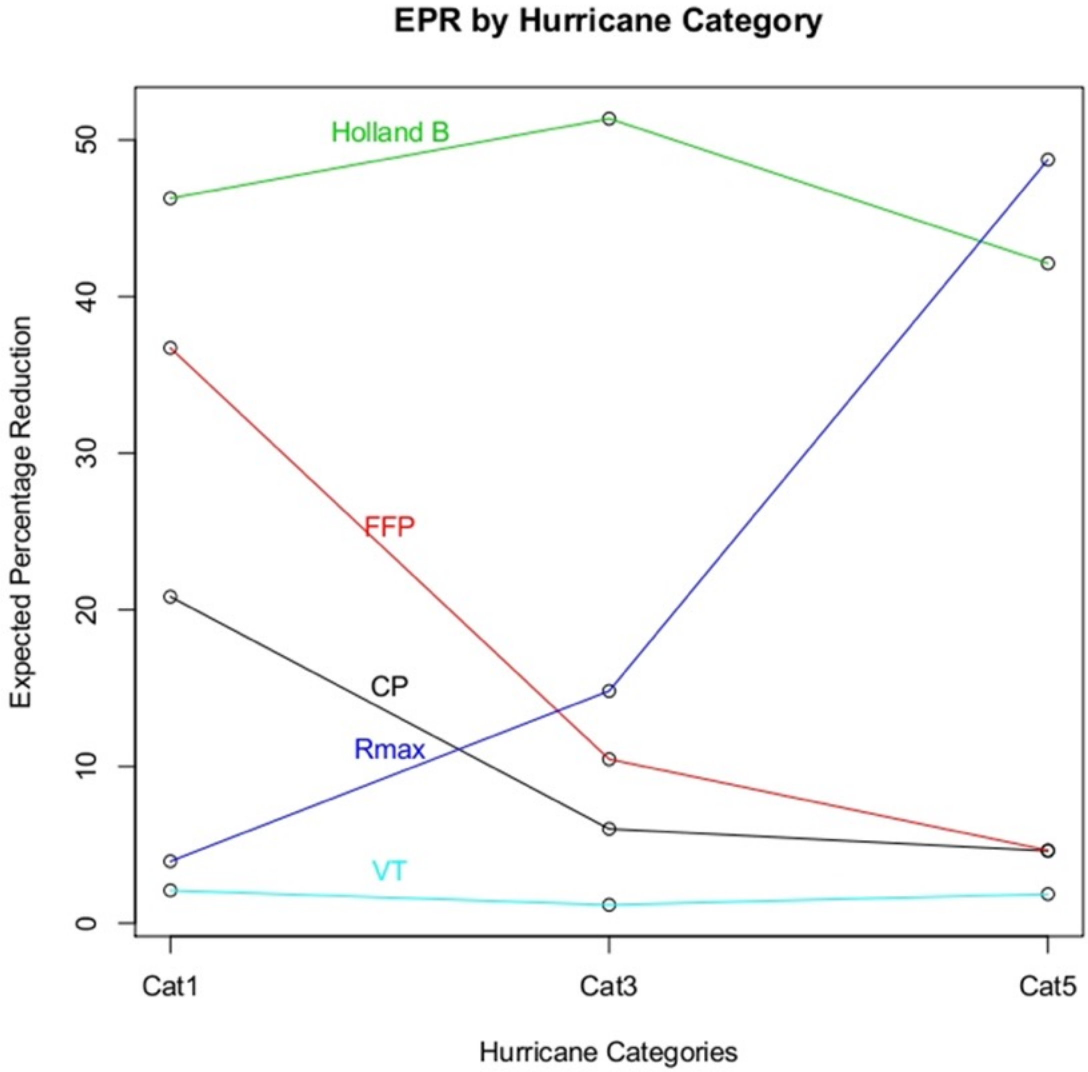


Figure 39. EPRs for Expected Loss Cost for all Input Variables for all Hurricane Categories.

2. Describe how other aspects of the hurricane model may have a significant impact on the uncertainties in output results and the basis for making this determination.

Limitations in the HURDAT record contribute to the uncertainty of modeled tracks and pressures. Surface pressure measurements are not always available in HURDAT and estimating surface pressures by pressure-wind relationships is also fraught with uncertainty since well-observed hurricanes can demonstrate a large variation in maximum wind speeds for a given minimum surface pressure. The HURDAT record prior to the advent of satellites in the mid-1960s could have missed or incorrectly classified many hurricanes that affected Florida in the early 20th century. Even today, there is still considerable uncertainty in the assessment of hurricane intensity. Recent research results based on SFMR measurements (Powell et al., 2009) indicate that some Saffir-Simpson 1-3 Category hurricanes may be rated too highly while the Category 4 and 5 storms are probably rated accurately.

Uncertainty in surface roughness has a significant impact on wind uncertainty which in turn leads to a significant impact on losses.

3. Describe and justify action or inaction as a result of the uncertainty analyses performed.

No actions were taken in light of the aforementioned uncertainty analysis.

4. Form S-6, Hypothetical Events for Sensitivity and Uncertainty Analysis, if disclosed under Standard S-2, Sensitivity Analysis for Hurricane Model Output, will be used in the verification of Standard S-3, Uncertainty Analysis for Hurricane Model Output.

Please see the completed Form S-6 at the end of this section.

S-4 County Level Aggregation

At the county level of aggregation, the contribution to the error in hurricane loss cost estimates attributable to the sampling process shall be negligible.

The error in the county level loss costs induced by the sampling process can be quantified by computing standard errors for the county level hurricane loss costs. These loss costs have been computed for all counties in the state of Florida using 59,000 years of simulation. The results indicate that the standard errors are less than 2.5% of the average loss cost estimates for all counties.

Disclosure

1. Describe the sampling plan used to obtain the average annual hurricane loss costs and hurricane output ranges. For a direct Monte Carlo simulation, indicate steps taken to determine sample size. For an importance sampling design or other sampling scheme, describe the underpinnings of the design and how it achieves the required performance.

The number of simulation years was determined through the following process:

The average loss cost, $\bar{X}_Y$, and standard deviation S_Y, were determined for each county Y using an initial run of an 11,800 years of simulation. Then the maximum error of the estimate will be 2.5% of the estimated mean loss cost, if the number of simulation years for county Y is:

$$N_Y = \left(\frac{s_Y}{0.025\bar{X}_Y} \right)^2$$

Based on the initial 11,800 year simulation runs, the minimum number of years required is N_Y = 34,107 for Hamilton County, which had the highest number of years required of all the counties. Therefore, we have decided to use 59,000 (500x118) years of simulation for our final results. For the 59,000-year simulation runs, we found that the standard errors are less than 2.5% of the average loss costs for each county.

S-5 Replication of Known Hurricane Losses

The hurricane model shall estimate incurred hurricane losses in an unbiased manner on a sufficient body of past hurricane events from more than one company, including the most current data available to the modeling organization. This standard applies separately to personal residential and, to the extent data are available, to commercial residential. Personal residential hurricane loss experience may be used to replicate structure-only and contents-only hurricane losses. The replications shall be produced on an objective body of hurricane loss data by county or an appropriate level of geographic detail and shall include hurricane loss data from both 2004 and 2005.

Table 16 compares the modeled and actual total losses by hurricane and company for personal residential coverage. Moreover, Figure 40 indicates reasonable agreement between the observed and modeled losses. This was also supported by the various statistical tests described below.

Disclosures

1. Describe the nature and results of the analyses performed to validate the hurricane loss projections generated for personal and commercial residential hurricane losses separately. Include analyses for the 2004 and 2005 hurricane seasons.

For model validation purposes, the actual and modeled losses for some selected companies and hurricanes are provided in Table 16.

Company Name	Event	Total Exposure	Total Actual Loss	Total Modeled Loss
A	Charley	$14,572,357,458.00	$274,702,333.00	$198,179,821.24
A	Frances	$9,613,407,332.00	$224,656,954.00	$141,512,861.20
B	Charley	$7,155,996,653.00	$110,471,361.00	$124,314,188.01
B	Frances	$1,847,430,290.00	$20,201,407.00	$61,499,099.10
C	Charley	$26,484,786,918.00	$524,863,315.00	$327,684,436.13
C	Dennis	$8,766,524,714.00	$20,310,806.00	$58,392,849.00
C	Frances	$17,568,485,865.00	$389,682,752.00	$272,475,153.85
C	Jeanne	$37,580,088,130.00	$176,120,223.00	$401,860,824.83
C	Katrina	$4,036,128,039.00	$19,528,669.00	$79,745,462.12
C	Wilma	$29,468,018,254.00	$335,590,883.00	$541,045,903.86
D	Charley	$1,377,700,566.00	$63,889,029.00	$22,307,062.19
D	Frances	$4,309,535,304.00	$122,776,727.00	$74,013,396.26
E	Charley	$35,580,184.00	$952,353.00	$662,609.32
E	Frances	$316,894,463.00	$10,007,410.00	$4,196,319.79
E	Charley	$2,498,971,217.00	$113,313,510.00	$47,126,067.73
E	Frances	$3,639,401,631.00	$78,377,163.00	$61,040,427.97
E	Jeanne	$4,307,858,204.00	$40,245,030.00	$71,503,863.12
F	Charley	$1,386,793,895.00	$32,316,645.00	$20,223,743.32

Company Name	Event	Total Exposure	Total Actual Loss	Total Modeled Loss
G	Charley	$587,526,292.00	$3,884,930.00	$6,619,029.79
G	Frances	$189,912,832.00	$2,918,642.00	$3,728,694.10
G	Katrina	$135,143,330.00	$464,971.00	$855,697.09
G	Wilma	$767,025,160.00	$6,120,435.00	$9,196,840.61
H	Charley	$844,602,098.00	$78,535,467.00	$51,410,383.28
H	Dennis	$28,266,337.00	$928,111.00	$2,142,032.00
H	Frances	$665,429,117.00	$59,229,372.00	$23,774,605.19
H	Jeanne	$1,854,530,377.00	$74,983,526.00	$54,175,725.15
H	Katrina	$6,903,619.00	$330,018.00	$234,366.87
H	Wilma	$727,865,863.00	$47,056,668.00	$18,751,067.87
I	Charley	$2,506,896,464.00	$62,086,256.00	$50,651,809.24
I	Frances	$74,702,419.00	$43,799,401.00	$7,138,363.35
J	Jeanne	$6,169,965,775.00	$84,545,829.00	$91,148,684.95
K	Charley	$932,092,266.00	$79,751,698.00	$56,841,903.52
K	Jeanne	$2,558,106,618.00	$81,552,694.00	$96,489,457.17
L	Charley	$41,558,803.00	$4,511,656.00	$2,566,483.69
L	Charley	$166,263,166.00	$8,645,559.00	$3,224,177.82
L	Frances	$34,908,100.00	$4,009,884.00	$1,428,840.54
L	Frances	$368,182,344.00	$11,489,176.00	$5,768,227.28
L	Jeanne	$78,735,391.00	$3,590,284.00	$3,298,610.46
L	Jeanne	$347,104,726.00	$4,812,837.00	$6,103,225.29
M	Charley	$1,517,072,812.00	$15,135,021.00	$22,381,833.66
M	Frances	$804,861,107.00	$9,399,468.00	$16,515,698.21
M	Jeanne	$2,272,770,727.00	$9,048,905.00	$27,652,669.65
N	Charley	$9,598,109,599.00	$243,787,379.00	$156,015,706.62
N	Frances	$7,762,557,563.00	$180,416,260.00	$157,821,509.41
N	Jeanne	$15,460,363,846.00	$122,112,255.00	$208,162,427.87
N	Katrina	$464,541,580.00	$1,456,613.00	$4,158,717.49
N	Wilma	$12,018,207,196.00	$148,740,764.00	$168,764,383.52
O	Charley	$475,100,767.00	$2,015,902.00	$3,090,495.42
O	Frances	$1,086,978,976.00	$2,659,551.00	$4,892,736.50
O	Jeanne	$905,676,619.00	$29,144,703.00	$36,525,360.04
O	Jeanne	$1,436,506,385.00	$2,059,383.00	$6,222,450.28
P	Jeanne	$3,434,049,257.00	$31,066,792.00	$52,352,494.70
Q	Andrew	$30,391,564,010.00	$2,984,373,067.00	$2,158,821,822.04
Q	Charley	$427,213,972.00	$23,395,988.00	$16,295,310.88
Q	Charley	$51,283,638,860.00	$1,037,108,745.00	$600,860,774.82
Q	Dennis	$8,527,804,503.00	$29,951,867.00	$56,750,821.00
Q	Erin	$3,193,215,496.00	$50,519,119.00	$59,718,545.68
Q	Frances	$482,335,774.00	$18,467,176.00	$7,891,813.22
Q	Frances	$36,447,006,477.00	$614,006,549.00	$420,848,614.43
Q	Katrina	$19,097,289,225.00	$53,610,002.00	$102,605,095.86
Q	Wilma	$76,663,257,400.00	$1,129,347,005.00	$731,098,284.25
R	Jeanne	$1,178,562,197.00	$3,125,588.00	$14,858,205.44
S	Charley	$9,721,434,560.00	$111,013,524.00	$215,906,252.91

Company Name	Event	Total Exposure	Total Actual Loss	Total Modeled Loss
S	Frances	$12,631,336,130.00	$94,272,660.00	$385,052,388.40
T	Charley	$2,685,932,544.00	$54,207,520.00	$41,602,464.36
T	Frances	$3,554,743,715.00	$121,893,725.00	$52,487,004.56

Table 16. Total Actual vs. Total Modeled Losses- Personal Residential

Figure 40 provides a comparison of total actual losses vs. total modeled losses for different hurricanes. The comparison indicates a reasonable agreement between the actual and modeled losses. The correlation between actual and modeled losses is found to be 0.970, which shows a strong positive linear relationship between actual and modeled losses. We tested whether the difference in paired mean values equals zero using the paired t test ($t = 1.386$, $df = 65$, p-value = 0.171) and Wilcoxon signed rank test ($Z = 0.910$, p-value = 0.363). Based on these tests, we failed to reject the null hypothesis of equality of paired means and concluded that there is insufficient evidence to suggest a difference between actual and modeled losses. We also observed from Table 16 that about 51% of the actual losses are more than the corresponding modeled losses, and 49% of the modeled losses are more than the corresponding actual losses. This shows that our modeling process is not biased. Following Lin (1989), the bias correction factor (measure of accuracy) is obtained as 0.946, and the sample concordance correlation coefficient is found to be 0.918, which again shows a strong agreement between actual and modeled losses.

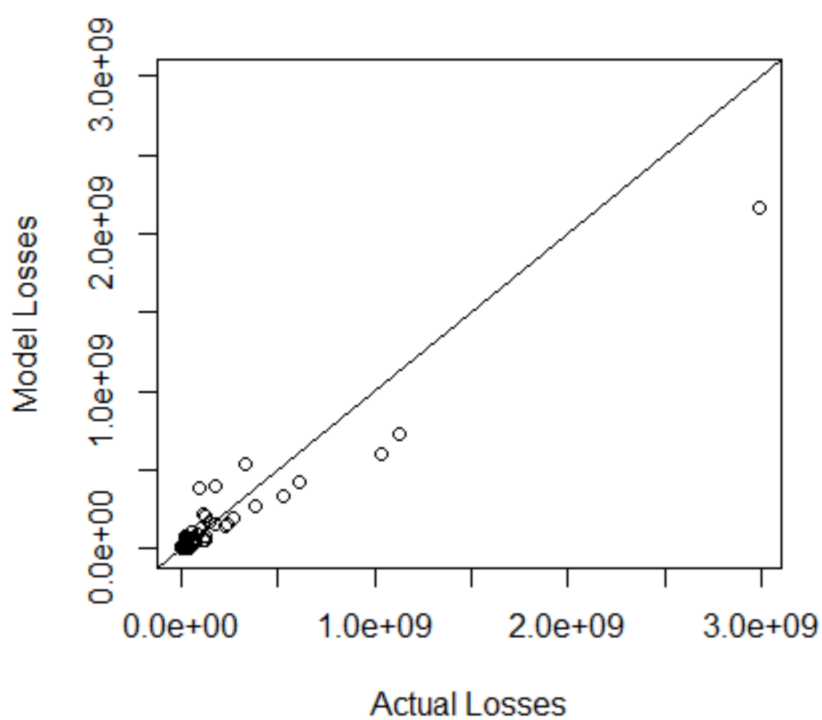


Figure 40. Scatter plot between total actual losses vs. total modeled losses – Personal Residential.

Due to the lack of a sufficient body of claims data for commercial losses, extensive statistical tests were not conducted to validate the model losses. A tabular comparison of the modeled vs. actual commercial insured loss costs is presented in Table 17 and in Figure 41 for illustration purposes only:

Company Name	Event	Total Exposure	Total Actual Loss	Total Modeled Loss
D	Charley	$ 2,344,572,547.00	$ 64,378,393.00	$29,968,683.23
D	Jeanne	$ 4,866,082,786.00	$ 34,826,257.00	$71,527,381.11
D	Katrina	$ 6,489,785,877.00	$ 11,846,697.00	$46,334,652.12
D	Wilma	$20,489,475,103.00	$318,671,056.00	$254,586,003.86
Q	Frances	$ 863,784,392.00	$ 42,238,244.00	$13,690,616.63
Q	Jeanne	$ 1,021,385,625.00	$ 8,446,718.00	$15,895,341.78
Q	Katrina	$ 224,012,300.00	$ 2,178,110.00	$8,239,112.12
Q	Wilma	$ 2,423,163,266.00	$ 62,492,371.00	$26,841,374.38

Table 17. Comparison of Total vs. Actual Losses - Commercial Residential

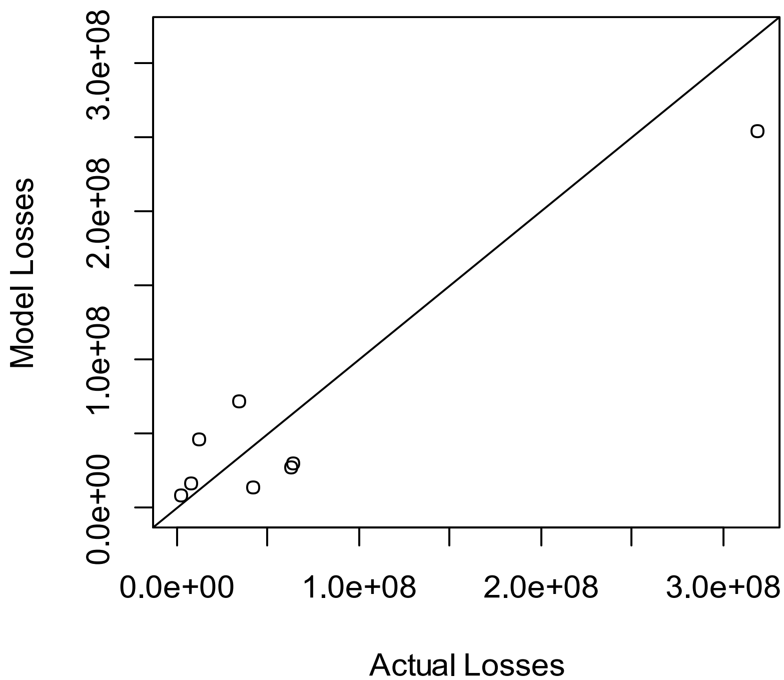


Figure 41. Scatter plot between total actual losses vs. total modeled losses – Commercial Residential

2. Provide a completed Form S-4, Validation Comparisons. Provide a link to the location of the form here.

Please see the completed Form S-4 at the end of this section.

S-6 Comparison of Projected Hurricane Loss Costs

The difference, due to uncertainty, between historical and modeled annual average statewide hurricane loss costs shall be reasonable, given the body of data, by established statistical expectations and norms.

The difference, due to uncertainty, between historical and modeled annual average statewide loss costs is reasonable as shown in the following description.

Disclosures

1. Describe the nature and results of the tests performed to validate the expected hurricane loss projections generated. If a set of simulated hurricanes or simulation trials was used to determine these hurricane loss projections, specify the convergence tests that were used and the results. Specify the number of hurricanes or trials that were used.

Loss costs are generated using a simulated number of hurricanes. The number of years used in the simulations was calculated as described in Standard S-4, and was found to be 59,000. The standard errors are within 2.5% of the means for all counties. From Form S-5 we found that the 95% confidence interval on the difference between the mean of the losses from the historical and modeled contains 0, indicating that there is no statistically significant difference. In addition, as shown in Standard S-5, modeled loss costs have also been validated against insurance company data and are in reasonable agreement with the same.

2. Identify and justify differences, if any, in how the hurricane model produces hurricane loss costs for specific historical events versus hurricane loss costs for events in the stochastic hurricane set.

The historical and stochastic storm loss costs are treated the same.

3. Provide a completed Form S-5, Average Annual Zero Deductible Statewide Hurricane Loss Costs – Historical versus Modeled. Provide a link to the location of the form here.

Please see the completed Form S-5 at the end of this section.

Form S-1: Probability and Frequency of Florida Landfalling Hurricanes per Year

A. Complete the table below showing the probability and modeled frequency of landfalling Florida hurricanes per year. Modeled probability shall be rounded to four three decimal places. The historical probabilities and frequencies below have been derived from the Base Hurricane Storm Set for the 117 year period 1900-2016 (as given in Form A-2B, Base Hurricane Storm Set Statewide Hurricane Losses (2017 FHCF Exposure Data)). Exclusion of hurricanes that caused zero modeled Florida damage or additional Florida hurricane landfalls included in the modeling organization Base Hurricane Storm Set as identified in their response to Standard M-1, Base Hurricane Storm Set, should be used to adjust the historical probabilities and frequencies provided.

B. If the data are partitioned or modified, provide the historical probabilities and frequencies for the applicable partition (and its complement) or modification as well as the modeled probabilities and frequencies in additional copies of Form S-1, Probability and Frequency of Florida Landfalling Hurricanes per Year.

C. Include Form S-1, Probability and Frequency of Florida Landfalling Hurricanes per Year, in a submission appendix.

See Appendix R. Please note that this form is based on the 1900-2017 (118 years) Base Set.

Form S-2A: Examples of Hurricane Loss Exceedance Estimates (2012 FHCF Exposure Data)

A. Provide estimates of the annual aggregate combined personal and commercial insured hurricane losses for various probability levels using the notional risk dataset specified in Form A-1, Zero Deductible Personal Residential Hurricane Loss Costs by ZIP Code, and using the 2012 Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data provided in the file named "hlpm2012c.exe." Provide the total average annual hurricane loss for the hurricane loss exceedance distribution. If the modeling methodology does not allow the hurricane model to produce a viable answer for certain return periods, state so and why.

B. Include Form S-2A, Examples of Hurricane Loss Exceedance Estimates (2012 FHCF Exposure Data), in a submission appendix.

See Appendix S.

Form S-2B: Examples of Hurricane Loss Exceedance Estimates (2017 FHCF Exposure Data)

A. Provide estimates of the annual aggregate combined personal and commercial insured hurricane losses for various probability levels using the notional risk dataset specified in Form A-1, Zero Deductible Personal Residential Hurricane Loss Costs by ZIP Code, and using the 2017 Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data provided in the file named "hlpm2017c.exe." Provide the total average annual hurricane loss for the hurricane loss exceedance distribution. If the modeling methodology does not allow the hurricane model to produce a viable answer for certain return periods, state so and why.

B. Include Form S-2B, Examples of Hurricane Loss Exceedance Estimates (2017 FHCF Exposure Data), in a submission appendix.

See Appendix T.

Form S-3: Distributions of Stochastic Hurricane Parameters

A. Provide the probability distribution functional form used for each stochastic hurricane parameter in the hurricane model. Provide a summary of the justification for each functional form selected for each general classification.

B. Include Form S-3, Distributions of Stochastic Hurricane Parameters, in a submission appendix.

See Appendix U.

Form S-4: Validation Comparisons

A. Provide five validation comparisons of actual personal residential exposures and hurricane loss to modeled exposures and hurricane loss. Provide these comparisons by line of insurance, construction type, policy coverage, county or other level of similar detail in addition to total hurricane losses. Include hurricane loss as a percentage of total exposure. Total exposure represents the total amount of insured values (all coverages combined) in the area affected by the hurricane. This would include exposures for policies that did not have a hurricane loss. If this is not available, use exposures for only those policies that had a hurricane loss. Specify which was used. Also, specify the name of the hurricane event compared.

B. Provide a validation comparison of actual commercial residential exposures and hurricane loss to modeled exposures and hurricane loss. Use and provide a definition of the hurricane model's relevant commercial residential classifications.

C. Provide scatter plot(s) of modeled versus historical hurricane losses for each of the required validation comparisons. (Plot the historical hurricane losses on the x-axis and the modeled hurricane losses on the y-axis.)

D. Include Form S-4, Validation Comparisons, in a submission appendix.

Rather than using a specific published hurricane windfield directly, the winds underlying the modeled hurricane loss cost calculations must be produced by the hurricane model being evaluated and should be the same hurricane parameters as used in completing Form A-2A, Base Hurricane Storm Set Statewide Hurricane Losses (2012 FHCF Exposure Data) and Form A-2B, Base Hurricane Storm Set Statewide Hurricane Losses (2017 FHCF Exposure Data).

See Appendix V.

Form S-5: Average Annual Zero Deductible Statewide Hurricane Loss Costs – Historical versus Modeled

A. Provide the average annual zero deductible statewide personal and commercial residential hurricane loss costs produced using the list of hurricanes in the Base Hurricane Storm Set as defined in Standard M-1, Base Hurricane Storm Set, based on the 2012 Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data found in the file named "hlpm2012c.exe."

Average Annual Zero Deductible Statewide Personal and Commercial Residential Hurricane Loss Costs

Time Period	Historical Hurricanes	Produced by Hurricane Model
Current Submission	$5,479.01	$4,774.03
Previously-Accepted Hurricane Model* (2015 Standards)	$5,388.52	$4,658.62
Percent Change Current Submission/ Previously Accepted Hurricane Model*	1.68	2.48
Second Previously-Accepted Hurricane Model* (2013 Standards)	$5,681.92	$4,921.29
Percent Change Current Submission/ Second Previously-Accepted Hurricane Model*	-3.57	-2.99

*NA if no previously-accepted hurricane model.

B. Provide a comparison with the statewide personal and commercial residential hurricane loss costs produced by the hurricane model on an average industry basis.

The loss cost produced by the hurricane model on an average industry basis is 4.8 billion dollars and the corresponding historical average loss is 5.5 billion dollars.

C. Provide the 95% confidence interval on the differences between the means of the historical and modeled personal and commercial residential hurricane loss costs.

The 95% confidence interval on the difference between the mean of the historical and the mean of the modeled losses is between -1.19 and 2.60 billion dollars. Since the interval contains 0, we are 95% confident that there is no significant difference between the historical and the modeled hurricane losses.

D. Provide the average annual zero deductible statewide personal and commercial residential hurricane loss costs produced using the list of hurricanes in the Base Hurricane Storm Set as defined in Standard M-1, Base Hurricane Storm Set, based on the 2017 Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data found in the file named "hlpm2017c.exe."

Average Annual Zero Deductible Statewide Personal and Commercial Residential Hurricane Loss Costs

Time Period	Historical Hurricanes	Produced by Hurricane Model
Current Submission	$5,792.95	$5,037.05

E. Provide a comparison with the statewide personal and commercial residential hurricane loss costs produced by the hurricane model on an average industry basis.

The loss cost produced by the model on an average industry basis is 5.0 billion dollars and the corresponding historical average loss is 5.8 billion dollars.

F. Provide the 95% confidence interval on the differences between the means of the historical and modeled personal and commercial residential hurricane loss costs.

The 95% confidence interval on the difference between the mean of the historical and the mean of the modeled losses is between -1.26 and 2.77 billion dollars. Since the interval contains 0, we are 95% confident that there is no significant difference between the historical and the modeled losses.

G. If the data are partitioned or modified, provide the average annual zero deductible statewide personal and commercial residential hurricane loss costs for the applicable partition (and its complement) or modification, as well as the modeled average annual zero deductible statewide personal and commercial residential hurricane loss costs in additional copies of Form S-5, Average Annual Zero Deductible Statewide Hurricane Loss Costs – Historical versus Modeled.

Not applicable.

H. Include Form S-5, Average Annual Zero Deductible Statewide Hurricane Loss Costs – Historical versus Modeled, in a submission appendix.

See Appendix W.

Form S-6: Hypothetical Events for Sensitivity and Uncertainty Analysis

We have provided the output in ASCII files based on running a series of hurricanes as provided in the Excel file "FormS5Input09.xls." The output files consist of wind speeds (in miles per hour for one minute sustained 10 meter winds) at hourly intervals over a 21×40 grid for the 500 combinations of initial conditions specified in the Excel file for the following model inputs:

- *CP* = central pressure (in millibars)
- *Rmax* = radius of maximum winds (in statute miles)
- *VT* = translational velocity (forward speed in miles per hour)
- Holland *B* = pressure profile parameter for other input used by the modeler ($0 \le p \le 1$)
- *FFP* = far field pressure (in millibars)

The value of *CP*, *Rmax*, *VT*, *FFP* and Quantile are used as direct inputs. Quantiles from 0 to 1 have been provided in the Excel input file. For the FPHLM (V4.1) model, we used the first quantile input for the Holland *B* parameter.

On a CD, we have provided an ASCII file and a PDF file named FPHLM09Expected Loss Costs. This file gives aggregate and expected loss costs for each input vector for each category of hurricane and contains 3x100=300 rows.

We have also provided, on a CD, the results in an ASCII file and a PDF file named FPHLM09Loss Cost Contour, which contains 3 x 682 = 2,046 rows. This file gives the mean loss cost at each of the 682 land based vertices over all 100 input vectors for each hurricane category.

Distribution of Loss Costs

Figure 42 provides the comparison of CDFs of the Expected Loss Costs for all Hurricane Categories.

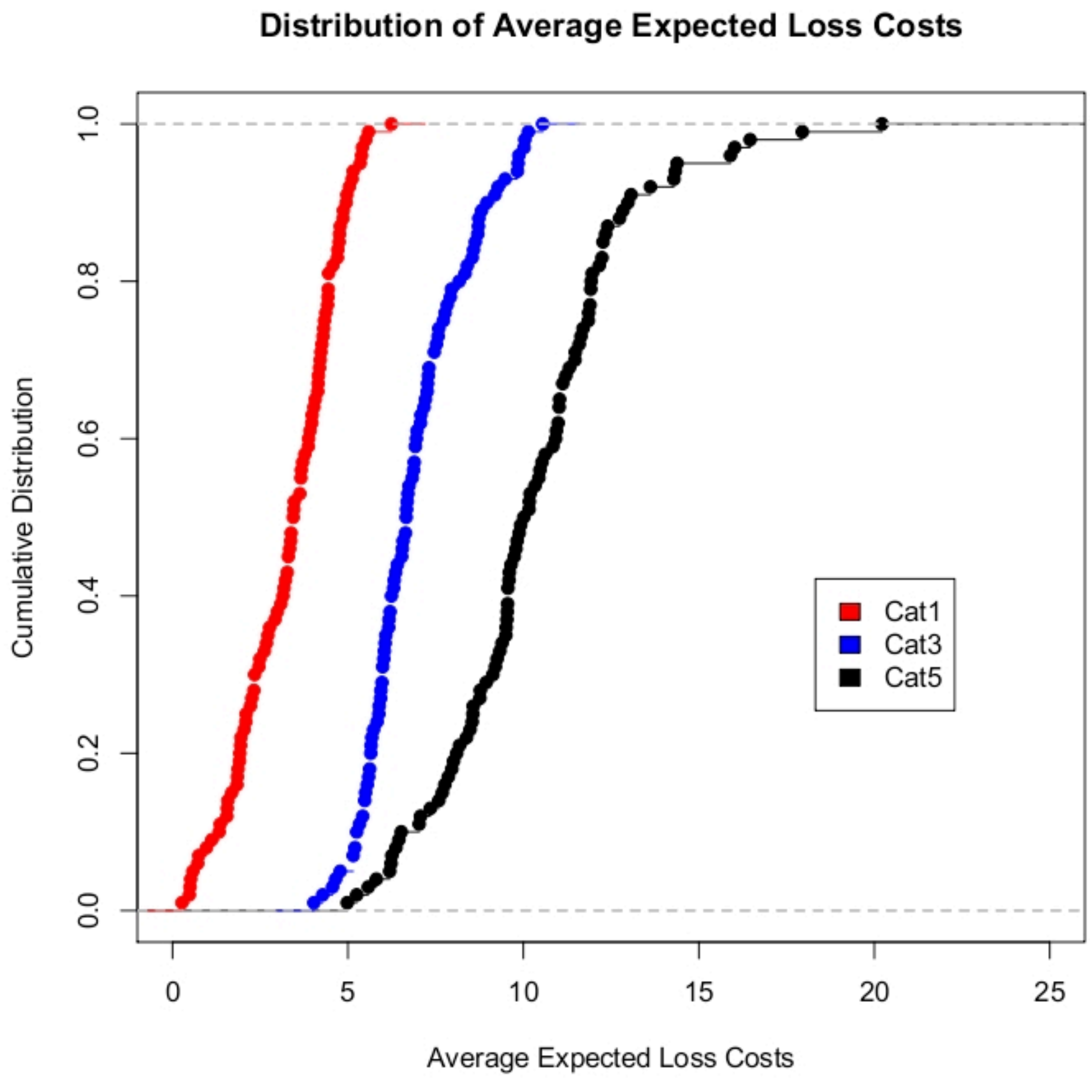


Figure 42. Comparison of CDFs of Loss Costs for all Hurricane Categories.

Figure 43 – Figure 45 show contours of the mean loss cost for Category 1, 3 and 5 hurricanes, respectively for each land based grid point. The mean percentage loss costs are found to be about between 1.14 %-8.3% for Category 1, between 3.64%-24.6% for Category 3 and between 2.57%-41.84% for Category 5 hurricanes. The largest losses occur shortly after landfall to the right of the hurricane path.

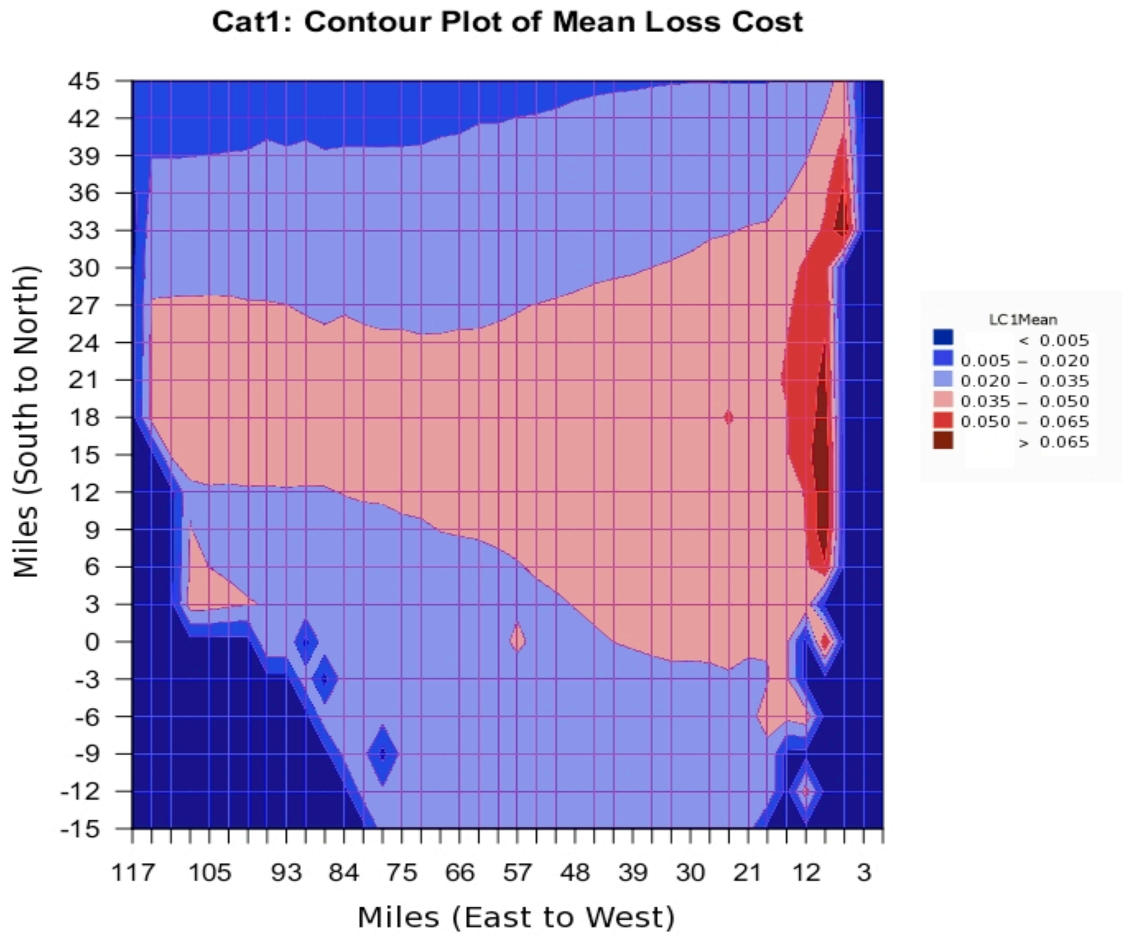


Figure 43. Contour Plot of Loss Cost for a Category 1 Hurricane.

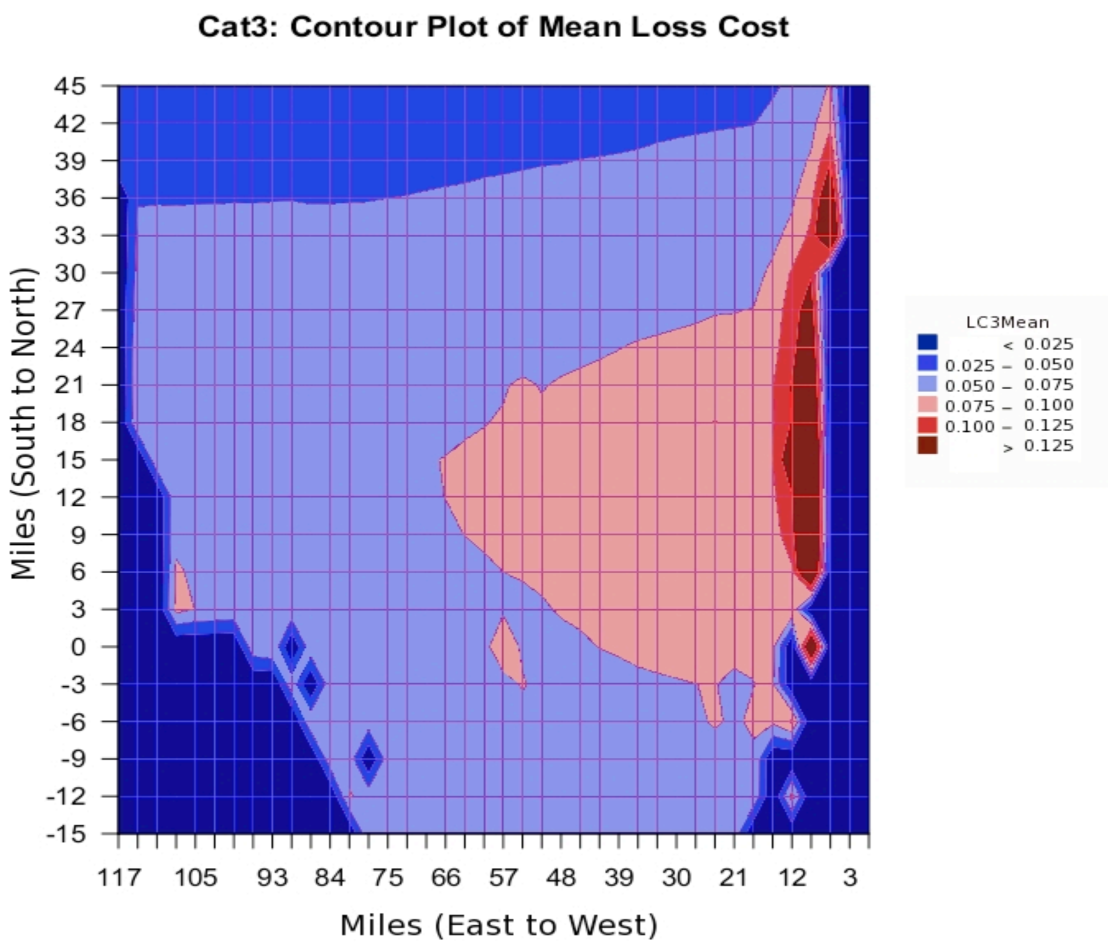


Figure 44. Contour Plot of Loss Cost for a Category 3 Hurricane.

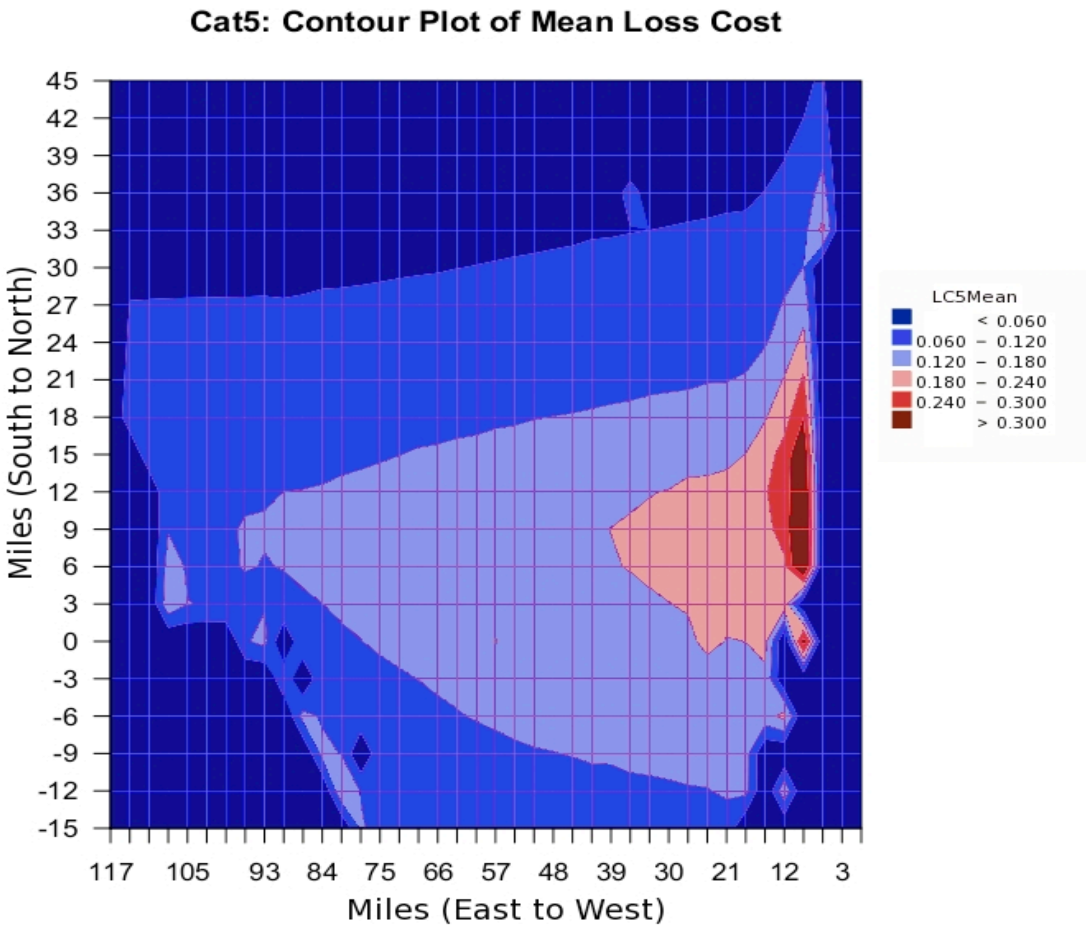


Figure 45. Contour Plot of Loss Cost for a Category 5 Hurricane.

Sensitivity and Uncertainty Analysis for Expected Loss Costs

Sensitivity analysis for the expected loss costs was conducted through the use of the standardized regression coefficients of the expected loss cost as a function of the input variables for Category, 1, 3 and 5 hurricanes. We used the methods described by Iman et al. (2000a, 2000b). The values of standardized regression coefficients are summarized in the table below.

Category	CP	Rmax	VT	Holland B	FFP
1	-0.4118	0.1039	0.1648	0.6477	0.5905
3	-0.2599	0.4033	0.1137	0.6552	0.4236
5	-0.1349	0.6939	-0.0022	0.5862	0.1801

Figure 46 gives the graph of the standardized regression coefficients for all input variables for Category 1, 3 and 5 hurricanes. From the graph, we observed that the sensitivity of expected loss cost depends on the category of the hurricanes. For a Category 1 hurricane, expected loss cost is most sensitive to Holland B parameter followed by FFP, CP and VT. For a Category 3 hurricane, expected loss cost is most sensitive to Holland B followed by FFP, *Rmax* and CP and finally for a Category 5 hurricane, expected loss cost is most sensitive to *Rmax*, followed by Holland B, CP and FFP. The expected loss cost is least sensitive to *Rmax* for Category 1 while the expected loss cost is least sensitive to VT for Categories 3 and 5.

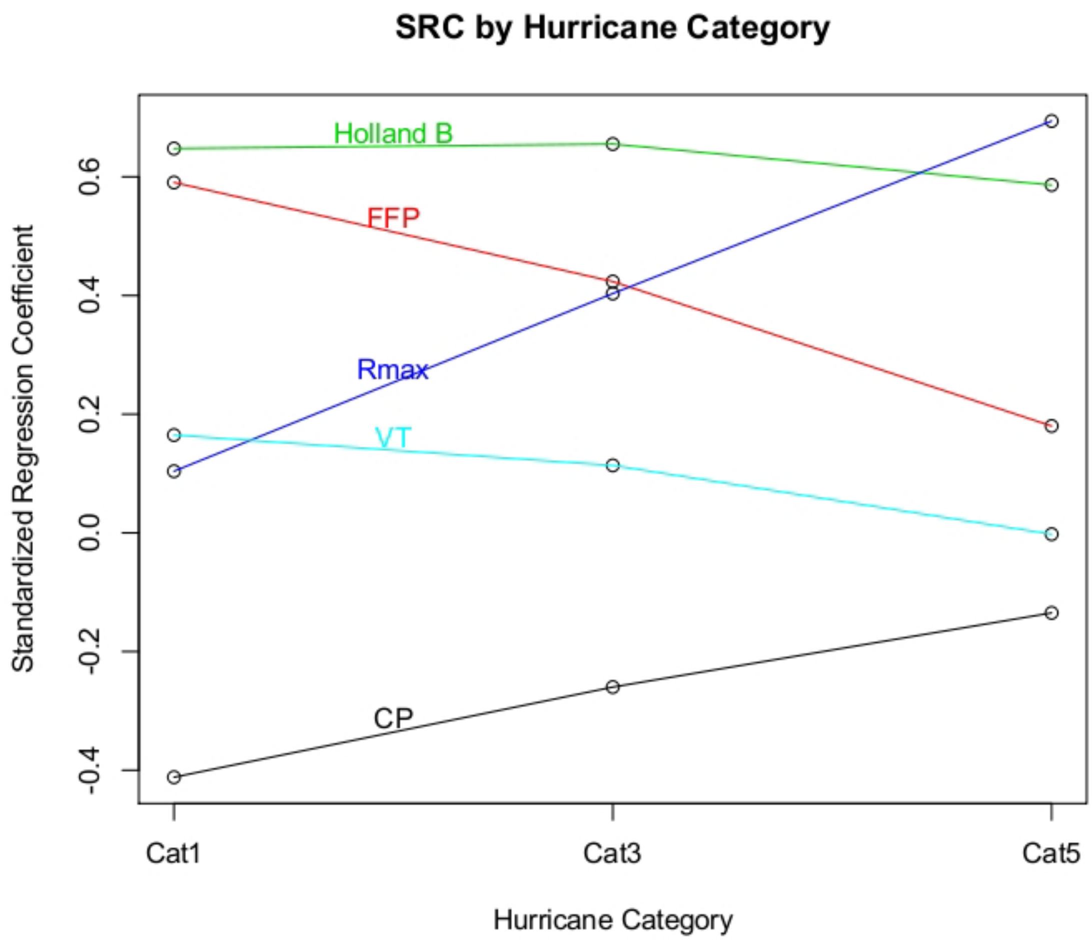


Figure 46. SRCs for expected loss cost for all input variables for all hurricane categories.

Uncertainty analysis for the expected loss costs was conducted through the use of the expected percentage reduction (EPR) in the variance of the expected loss cost as a function of the input variables for Category, 1, 3 and 5 hurricanes. We used the methods described by Iman et al. (2000a, 2000b). The values of EPR's are summarized in the table below.

Category	CP	Rmax	VT	Holland B	FFP
1	20.8398%	3.9463%	2.0921%	46.2717%	36.7245%
3	6.0155%	14.8201%	1.1625%	51.3594%	10.4668%
5	4.6087%	48.7428%	1.8529%	42.1176%	4.6455%

Figure 47 gives the expected percentage reductions in the variance of expected loss cost for Category 1, 3 and 5 Hurricanes for all input variables. As with the sensitivity analysis, the category of the hurricane determines which variable contributes most to the uncertainty of the expected loss cost. For a Category 1 hurricane, the major contributor to the uncertainty in loss cost is the Holland B parameter, followed by FFP, then CP. For a Category 3 hurricane, the major contributor to the uncertainty in loss cost is Holland B, followed by *Rmax*, then FFP. For a Category 5 hurricane, the major contributor to the uncertainty of expected loss cost is *Rmax*, followed by Holland B, then FFP, and finally CP. The variable VT has negligible effect on the uncertainty in expected loss costs.

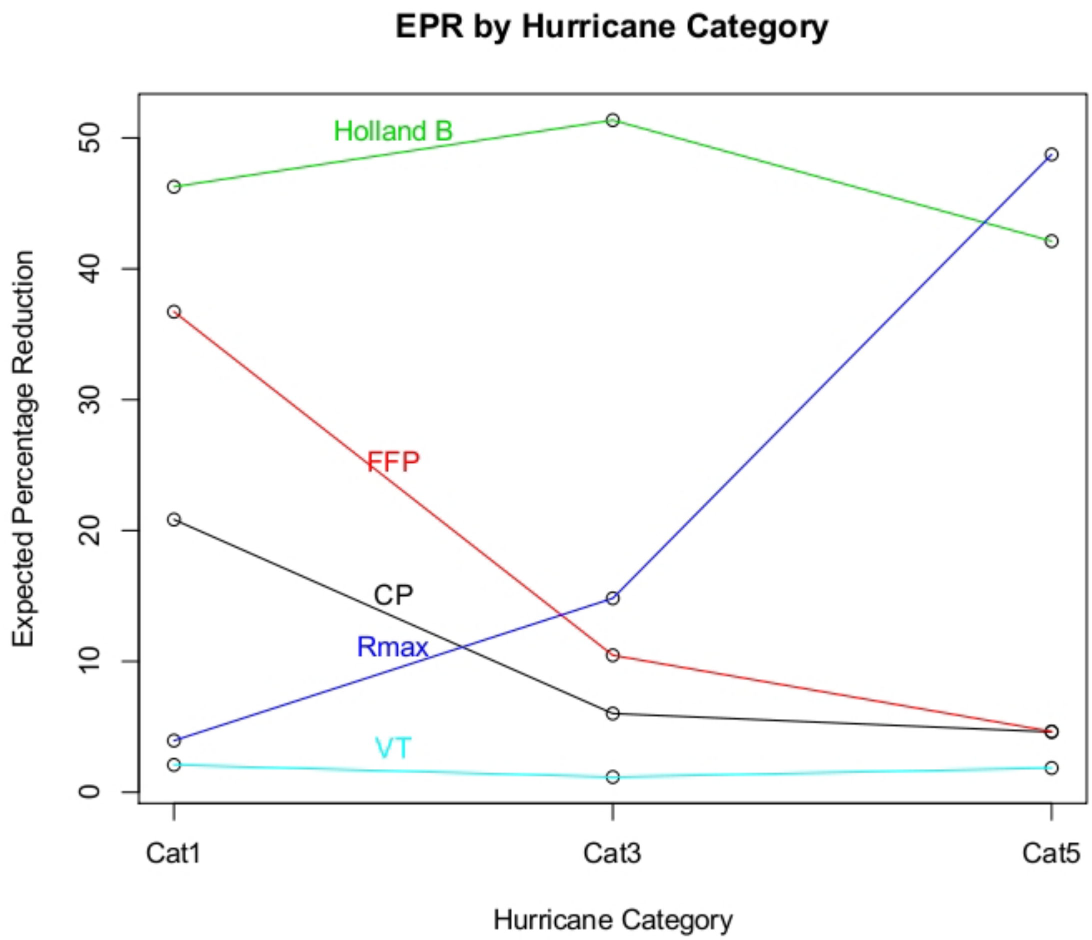


Figure 47. EPRs for Expected Loss Cost for all Input Variables for all Hurricane Categories.

VULNERABILITY STANDARDS

V-1 Derivation of Building Hurricane Vulnerability Functions

A. Development of the building hurricane vulnerability functions shall be based on at least one of the following: (1) insurance claims data, (2) laboratory or field testing, (3) rational structural analysis, and (4) post- event site investigations. Any development of the building hurricane vulnerability functions based on rational structural analysis, post-event site investigations, and laboratory or field testing shall be supported by historical data.

The development of the vulnerabilities is based on a component approach that combines engineering modeling, simulations with engineering judgment, and insurance claim data. The determination of external damage to buildings is based on structural calculations, tests, and Monte Carlo simulations. The wind loads and strength of the building components in the simulations are based on laboratory and in-situ tests, manufacturer's data, expert opinion based on post-hurricane site inspections of actual damage, and codes and standards, and are calibrated and validated against insurance claim data. The internal and content damage are extrapolated from the external damage on the basis of expert opinion and site inspections of areas impacted by recent hurricanes and are confirmed using insurance claims data.

B. The derivation of the building hurricane vulnerability functions and their associated uncertainties shall be theoretically sound and consistent with fundamental engineering principles.

The method used in the derivation is based on extrapolating the results of Monte Carlo simulations of physical exterior damage through simple equations based on engineering judgment, expert opinion, and claims data. Uncertainties at each stage are accounted for by distributing the damage according to reasonable probability distributions and are validated with claims data.
The Monte Carlo component models take into account many variations in structural characteristics, and the result clearly filters through the cost estimation model. There are also different and clearly defined costing considerations applied to each structural type. These adjustments come directly from resources developed exclusively for defining repair costs to structures and therefore are theoretically sound.

C. Residential building stock classification shall be representative of Florida construction for personal and commercial residential buildings.

A detailed exposure study was carried out to define the most prevalent construction types and characteristics in the Florida residential building stock for different regions. The corresponding engineering models were built for each of the identified common structural types. In the case of the residential model and the low-rise commercial residential model, the models include differing wall types (wood and masonry) of varying strengths (e.g., reinforced or not, various roof to wall connection types), differing roof shapes (hip and gable end), various strengths of roof-to-wall connections (toe nails, clips, straps), varying window types and sizes, opening protection systems, varying garage door pressure capacities, and one and two story houses and one-to-three story commercial residential buildings.

Models of varying combinations of the above characteristics (e.g., wood frame, gable end, no window shutters) were created for four different regions in Florida. In all cases, the probabilistic capacities of the various components were determined by a variety of sources, including testing, test results in the literature, in-field data collection (post-hurricane damage evaluations), manufacturer's specifications and manufacturer's test data, and expert opinion.

In the case of the mid-/high-rise commercial residential model (buildings with more than three stories), the models include different apartment units corresponding to different building layouts (interior or exterior entry door), different locations within the floor plan (corner or middle units), different heights (subject to different probabilities of missile impact and wind speed), and different openings (windows, doors, sliders) with different protection options (none or impact resistant).

D. Building height/number of stories, primary construction material, year of construction, location, building code, and other construction characteristics, as applicable, shall be used in the derivation and application of building hurricane vulnerability functions.

The structural models include options that allow the representation of building code revisions. Three models were derived for each structural type: weak construction, medium construction, and strong construction. For example, each model for wood frame and gable roof homes has weak, medium, and strong versions. The assignment of a given strength level is based on the assumed age of the home being modeled and the available information on construction practice in that region of the state in that era of construction. Florida Building Code requirements that apply to the repair of existing homes are also taken into consideration when computing the repair costs of a structure. Separate models were also developed for manufactured housing constructed based on pre- and post-1994 HUD regulations and for different wind zones.

In addition to the various models that reflect construction type, region of Florida, and era of construction, each model has numerous additional strength features that can be adjusted before simulations are conducted to represent various combinations of mitigation features. For example, a weak constructed home in central Florida with masonry walls (no reinforcing) may have been recently re-roofed with renailed roof decking and modern code-approved shingles. The simulation model is capable of reflecting this combination of weak original construction and new, strong roof sheathing and roof cover mitigation.

E. Hurricane vulnerability functions shall be separately derived for commercial residential building structures, personal residential building structures, manufactured homes, and appurtenant structures.

Hurricane vulnerability functions are independently derived for commercial residential building structures, personal residential building structures, manufactured homes, and appurtenant structures.

F. The minimum windspeed that generates damage shall be consistent with fundamental engineering principles.

The minimum one-minute average sustained wind speed at which some damage is observed is 38 mph (3-second gust 50 mph) for appurtenant structures. Site-built and manufactured homes have a very small probability of some very minor damage at 42 mph (3-second gust 55 mph). This probability becomes more significant at 46 mph (3-second gust 60 mph) and increases with higher wind speed. Simulations are run for 3-second gusts from 50 mph to 250 mph in 5 mph increments.

G. Building hurricane vulnerability functions shall include damage as attributable to windspeed and wind pressure, water infiltration, and missile impact associated with hurricanes. Building hurricane vulnerability functions shall not include explicit damage to the building due to flood, storm surge, or wave action.

The vulnerability functions do not explicitly include damage due to flood, storm surge, or wave action. The vulnerability functions for all models (site-built residential, manufactured homes, low-rise commercial residential, and mid-/high-rise commercial residential) include damage due to wind pressure, missile impact and water infiltration.

Disclosures

1. Describe any modifications to the building vulnerability component in the hurricane model since the previously-accepted hurricane model.

There are no modifications to report.

2. Provide a flowchart documenting the process by which the building hurricane vulnerability functions are derived and implemented.

The flow chart in summarizes the procedure used in the Monte Carlo simulations to predict the external damage to the different structural types for the case of residential buildings and commercial residential buildings. The random variables include wind speed, pressure coefficients, and the resistances of the various building components (roof cover, roof sheathing, openings, walls, connections).

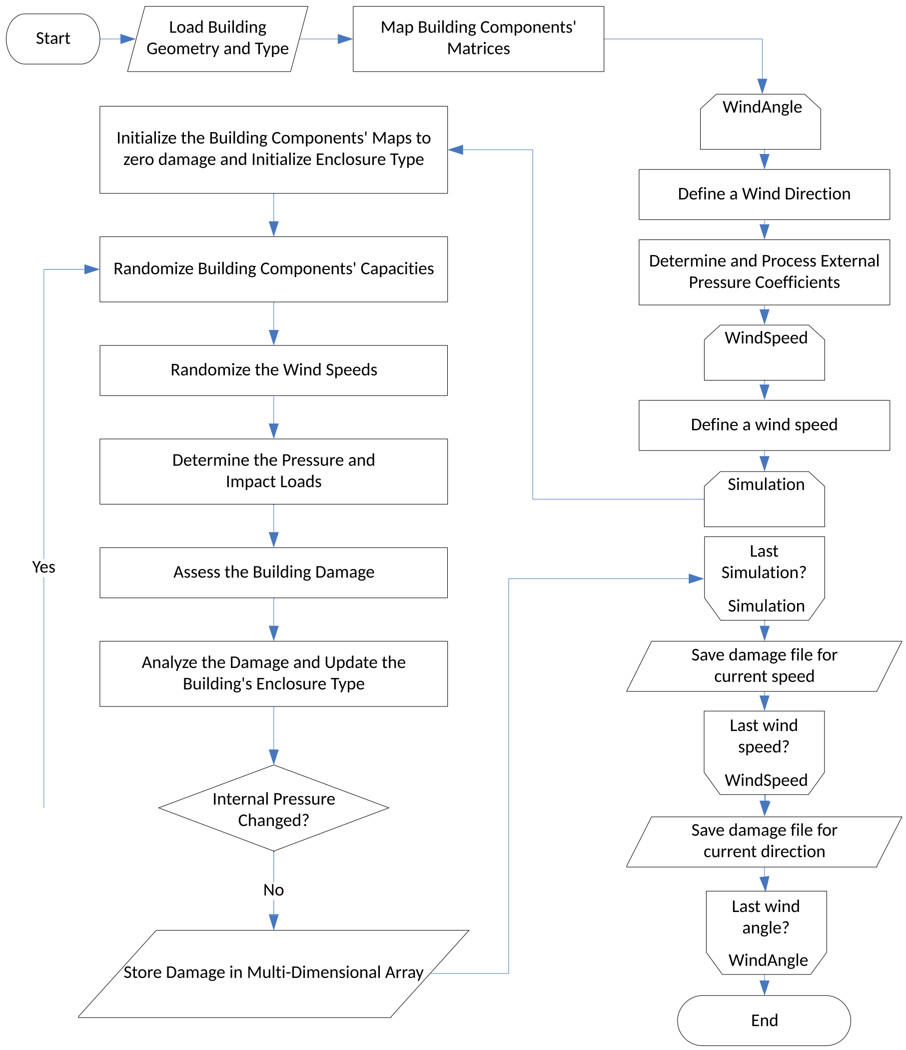


Figure 48. Monte Carlo simulation procedure to predict building damage.

The flow charts in summarize the procedure used to convert the results of the Monte Carlo simulations of physical external damage into vulnerability matrices for the cases of the personal residential model (left) and commercial residential model (right).

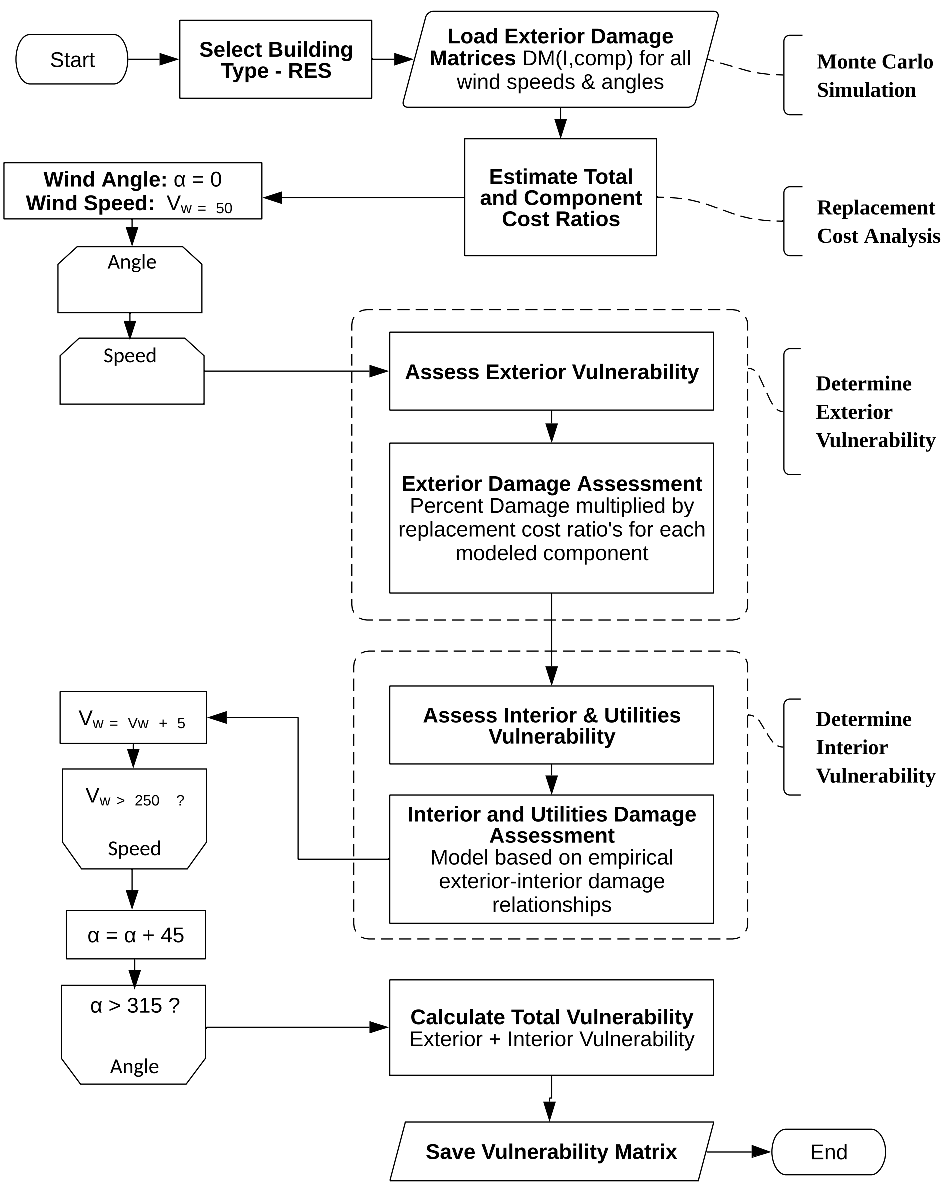


Figure 49. Procedure to create building vulnerability matrix.

The flowcharts in and are also partially applicable to the apartment facades of the mid-/high-rise commercial residential model (MHB), in which building components modeled include windows, entry doors, and balcony (sliding-glass) doors. In the case of MHB, a process similar to the one described above is followed to derive exterior vulnerability and breach curves for different openings of typical apartment units. These curves are derived for the cases of open and closed buildings, for corner and middle units, with different opening protections (with or without impact-resistant glass, with or without metal shutters). Each vulnerability curve for openings of corner or middle apartment units (window, door, or slider) gives the number or fraction of openings damaged as a function of wind speed. Each breach curve for openings of corner or middle apartment units (window, door, or slider) gives the breach area in ft2 of opening damaged as a function of wind speed.

The flow chart in summarizes the procedure used to convert the apartment unit opening vulnerability and breach curves into an overall estimate of building vulnerability. This figure is already presented in Standard G-1, as where the values represented in the flow chart are explained in detail.

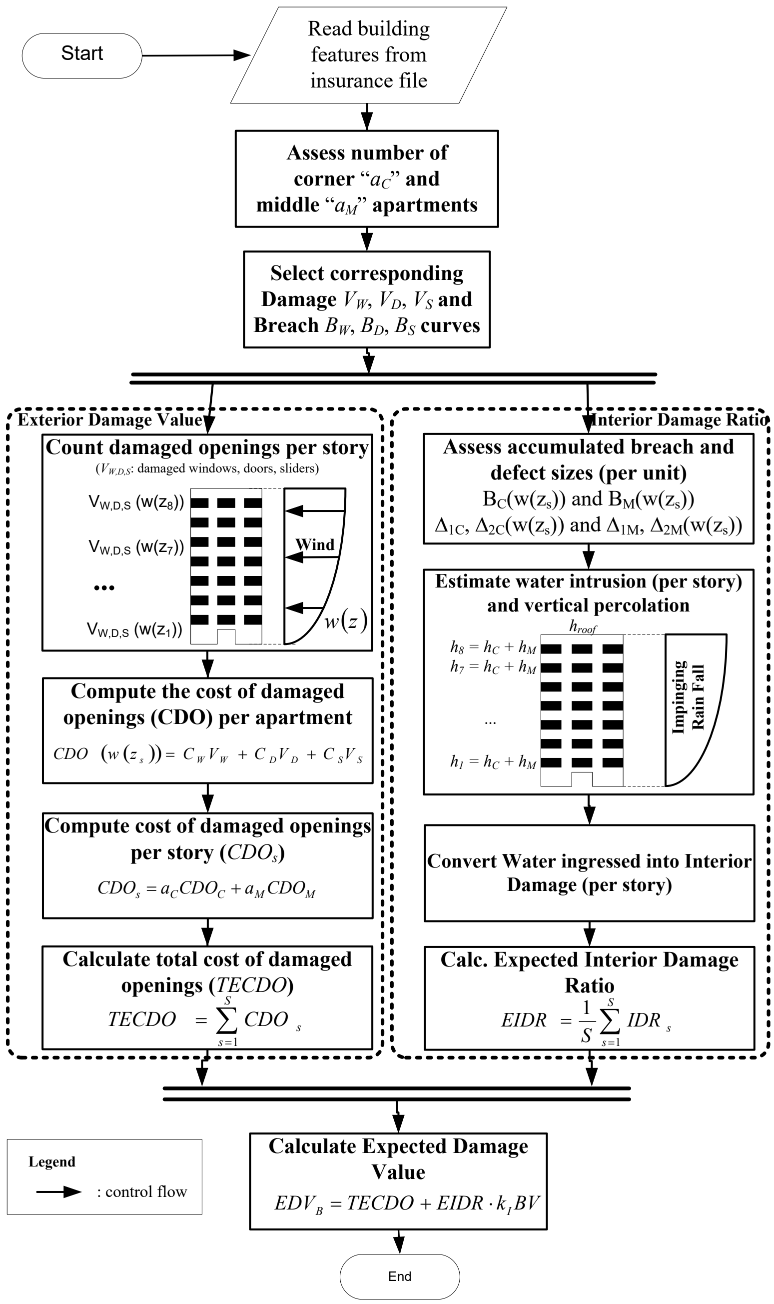


Figure 50. Exterior and interior damage assessment for MHB.

3. Describe the nature and extent of actual insurance claims data used to develop the building hurricane vulnerability functions. Describe in detail what is included, such as, number of policies, number of insurers, dates of hurricane loss, and number of units of dollar exposure, separated into personal residential, commercial residential, and manufactured homes.

Pre-2004 Personal Residential Claims Data

At the request of the Florida Department of Financial Services (FDFS), four insurance companies provided insurance claims data for several hurricanes that impacted Florida prior to 2004, including Andrew. The companies provided the following two types of files:

1. Sample files with 10% of the exposure selected at random, plus the claims on this 10% exposure since 1996
2. Hurricane files with premium files for all hurricane claims since 1996, plus all the corresponding claims data since 1996

Because of a confidentiality agreement, these companies will be referred to as Company A, B, C, or D. These companies represent between 75% and 85% of the insured exposure in the state and approximately 70% of the claims. Most of the data provided come from minor hurricanes and tropical storms that impacted Florida between 1994 and 2002.

Company A provided the only significant data for storms prior to 2004, in particular for Hurricane Andrew, as shown in Table 18. Wind speed estimates are also available, so validation efforts were primarily concentrated on the use of these data. Attempts were made to make use of additional data from Hurricane Opal and other storms. However, the amount of processed data available was too small to be statistically significant for validation.

	Hurricane Andrew	Hurricane Georges	Hurricane Opal	Tropical Storm Irene	Tropical Storm Earl	Hurricane Erin
Company A						
Masonry	78636	266	1973	3638	59	11460
Timber	1603	1078	9166	776	89	11878
Manufactured	1775	0	256	184	16	690

Table 18. Summary of processed claims data (number of claims provided).

Note: Only building, contents, and appurtenant structure claims were provided by Company A (ALE was not provided).

2004 Personal Residential Claims Data

Claims data for the 2004 hurricane season from a series of insurance companies were also used to validate the FPHLM. Although 21 companies submitted data for a total of almost 675,000 claims, only two main companies are detailed here. These two companies (referred to as Company 1 and Company 2) represent 386,000 claims, mainly for site-built homes. These claims are divided between Hurricanes Charley, Frances, and Jeanne for central Florida, and Hurricane Ivan for the Panhandle. The validation consists of a series of comparisons between the actual claims data and the FPHLM results. The claims files were provided by the insurance companies. Table 19, Table 20, and Table 21 show the number of policies provided by the two companies for the four different hurricanes in 2004. As expected, there are more masonry claims in central Florida and more timber claims in the Panhandle. The claims data for Ivan was not used in the validation process because it was contaminated by storm surge damage.

Company	Hurricane	Construction	Year Built	Number of Claims
Company 1	Charley	Masonry	yb<1970	5026
Company 1	Charley	Masonry	1970<=yb<1984	8216
Company 1	Charley	Masonry	1984<=yb<1994	11850
Company 1	Charley	Masonry	yb>=1994	8110
Company 1	Charley	Frame	yb<1970	956
Company 1	Charley	Frame	1970<=yb<1984	1232
Company 1	Charley	Frame	1984<=yb<1994	3044
Company 1	Charley	Frame	yb>=1994	677
Company 1	Charley	Manufactured	yb<1994	2966
Company 1	Charley	Manufactured	yb>=1994	212
Company 1	Frances	Masonry	yb<1970	5009
Company 1	Frances	Masonry	1970<=yb<1984	6989
Company 1	Frances	Masonry	1984<=yb<1994	7903
Company 1	Frances	Masonry	yb>=1994	4384
Company 1	Frances	Frame	yb<1970	902
Company 1	Frances	Frame	1970<=yb<1984	2081
Company 1	Frances	Frame	1984<=yb<1994	5648
Company 1	Frances	Frame	yb>=1994	721
Company 1	Frances	Manufactured	yb<1994	3186
Company 1	Frances	Manufactured	yb>=1994	222
Company 1	Ivan	Masonry	yb<1970	2029
Company 1	Ivan	Masonry	1970<=yb<1984	2099
Company 1	Ivan	Masonry	1984<=yb<1994	1719
Company 1	Ivan	Masonry	yb>=1994	1769
Company 1	Ivan	Frame	yb<1970	3048
Company 1	Ivan	Frame	1970<=yb<1984	3956
Company 1	Ivan	Frame	1984<=yb<1994	4829
Company 1	Ivan	Frame	yb>=1994	3890
Company 1	Ivan	Manufactured	yb<1994	634
Company 1	Ivan	Manufactured	yb>=1994	79
Company 1	Jeanne	Masonry	yb<1970	3601
Company 1	Jeanne	Masonry	1970<=yb<1984	5274
Company 1	Jeanne	Masonry	1984<=yb<1994	5698
Company 1	Jeanne	Masonry	yb>=1994	4999
Company 1	Jeanne	Frame	yb<1970	825
Company 1	Jeanne	Frame	1970<=yb<1984	1386
Company 1	Jeanne	Frame	1984<=yb<1994	3430
Company 1	Jeanne	Frame	yb>=1994	674
Company 1	Jeanne	Manufactured	yb<1994	2717
Company 1	Jeanne	Manufactured	yb>=1994	177

Table 19. Company 1: Claim number for each year-build category

Company	Hurricane	Construction	Year Built	Number of Claims
Company 2	Charley	Masonry	yb<1970	8677
Company 2	Charley	Masonry	1970<=yb<1984	15085
Company 2	Charley	Masonry	1984<=yb<1994	18324
Company 2	Charley	Masonry	yb>=1994	6376
Company 2	Charley	Frame	yb<1970	1920
Company 2	Charley	Frame	1970<=yb<1984	1782
Company 2	Charley	Frame	1984<=yb<1994	3786
Company 2	Charley	Frame	yb>=1994	443
Company 2	Charley	Manufactured	yb<1994	1843
Company 2	Charley	Manufactured	yb>=1994	159
Company 2	Frances	Masonry	yb<1970	8276
Company 2	Frances	Masonry	1970<=yb<1984	11978
Company 2	Frances	Masonry	1984<=yb<1994	11394
Company 2	Frances	Masonry	yb>=1994	3224
Company 2	Frances	Frame	yb<1970	1453
Company 2	Frances	Frame	1970<=yb<1984	3202
Company 2	Frances	Frame	1984<=yb<1994	7731
Company 2	Frances	Frame	yb>=1994	601
Company 2	Frances	Manufactured	yb<1994	1590
Company 2	Frances	Manufactured	yb>=1994	131
Company 2	Ivan	Masonry	yb<1970	1399
Company 2	Ivan	Masonry	1970<=yb<1984	746
Company 2	Ivan	Masonry	1984<=yb<1994	449
Company 2	Ivan	Masonry	yb>=1994	275
Company 2	Ivan	Frame	yb<1970	4004
Company 2	Ivan	Frame	1970<=yb<1984	5546
Company 2	Ivan	Frame	1984<=yb<1994	4637
Company 2	Ivan	Frame	yb>=1994	2229
Company 2	Ivan	Manufactured	yb<1994	171
Company 2	Ivan	Manufactured	yb>=1994	41
Company 2	Jeanne	Masonry	yb<1970	6907
Company 2	Jeanne	Masonry	1970<=yb<1984	10767
Company 2	Jeanne	Masonry	1984<=yb<1994	9629
Company 2	Jeanne	Masonry	yb>=1994	4176
Company 2	Jeanne	Frame	yb<1970	1555
Company 2	Jeanne	Frame	1970<=yb<1984	2087
Company 2	Jeanne	Frame	1984<=yb<1994	4561
Company 2	Jeanne	Frame	yb>=1994	484
Company 2	Jeanne	Manufactured	yb<1994	1401
Company 2	Jeanne	Manufactured	yb>=1994	128

Table 20. Company 2: Claim number for each year-built category.

Company	Hurricane	Construction	Number of Claims
Company 1	Charley	Masonry	33202
Company 1	Charley	Frame	5909
Company 1	Charley	Manufactured	3178
Company 1	Charley	Other	260
Company 1	Frances	Masonry	24285
Company 1	Frances	Frame	9352
Company 1	Frances	Manufactured	3408
Company 1	Frances	Other	566
Company 1	Ivan	Masonry	7616
Company 1	Ivan	Frame	15723
Company 1	Ivan	Manufactured	713
Company 1	Ivan	Other	100
Company 1	Jeanne	Masonry	19572
Company 1	Jeanne	Frame	6315
Company 1	Jeanne	Manufactured	2894
Company 1	Jeanne	Other	331
Company 2	Charley	Masonry	48462
Company 2	Charley	Frame	7931
Company 2	Charley	Manufactured	2002
Company 2	Charley	Other	582
Company 2	Frances	Masonry	34872
Company 2	Frances	Frame	12987
Company 2	Frances	Manufactured	1721
Company 2	Frances	Other	1134
Company 2	Ivan	Masonry	2869
Company 2	Ivan	Frame	16416
Company 2	Ivan	Manufactured	212
Company 2	Ivan	Other	87
Company 2	Jeanne	Masonry	31479
Company 2	Jeanne	Frame	8687
Company 2	Jeanne	Manufactured	1529
Company 2	Jeanne	Other	1167

Table 21. Company 1 and Company 2: Claim numbers combined.

The claims are divided by the type of coverage for structure and contents. Company 1 has two types of coverage, replacement cost and actual cash value, but does not specify whether both structure and contents have the same coverage for each claim.

For Company 2, there are six types of coverage, as shown below.

ACV S/ACV C	Structure Actual-Cash-Value, Contents Actual-Cash-Value
ACV S/RC C	Structure Actual-Cash-Value, Contents Replacement-Cost
RC S/ACV C	Structure Replacement-Cost, Contents Actual-Cash-Value
RC S/RC C	Structure Replacement-Cost, Contents Replacement-Cost
SV S/RC C	Structure Stated-Value, Contents Replacement-Cost

SV S/SV C Structure Stated-Value, Contents Stated-Value

Table 22 and Table 23 summarize the distribution of claims in both companies.

Coverage	Premium Policy Count		Claim Policy Count	
A	44020	1%	2759	2%
R	3706219	99%	163692	98%
Total	3750240		166451	

Table 22. Distribution of coverage for Company 1.

Coverage	Premium Policy Count		Claim Policy Count	
ACV S/ACV C	13173	3%	3496	3%
ACV S/RC C	44805	10%	12150	9%
RC S/ACV C	162122	35%	41484	30%
RC S/RC C	232688	51%	77146	57%
SV S/RC C	235	0%	69	0%
SV S/SV C	6019	1%	1717	1%
Total	459042	100%	136062	100%

Table 23. Distribution of coverage for Company 2.

There are 29,372 claims with $0 losses (i.e., Loss structure + Loss app + Loss contents + Loss ALE = 0), though they are listed in the claim file of Company 2. They probably correspond to claims whose losses were lower than the deductible.

2004 Personal Residential Claims Data

Claims data for the 2004 hurricane season from a series of insurance companies were also used to validate the FPHLM. Four new insurance companies provided claims data for the 2004 hurricane season. They will be referred to as companies PR2 to 5-2004. Company PR5-2004 has only manufactured homes. See Table PR04a to q. The claims data for Ivan was not used in the validation process because it was contaminated by storm surge damage.

Table 24. 2004 Personal Residential Claims Data

PR04a. Distribution of claims per hurricane for PR-2004 Companies.

	PR2-2004	PR3-2004	PR4-2004	PR5-2004
Charley	12641	34149	289	8030
Frances	12731	27866	200	7,301
Ivan	6202	21424	31	817
Jeanne	11547	19975	248	10,390

PR04b. Distribution of claims per coverage for PR-2004 Companies.

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
A	0	155	0	0
R	43121	103414	768	26,538

PR04c. Distribution of claims per construction type for PR-2004 Companies.

Exterior Wall	PR2-2004	PR3-2004	PR4-2004	PR5-2004
Frame	10760	23471	198	0
Manuf. Homes	0	0	0	26,538
Masonry	31673	79911	569	0
Other	688	32	1	0

PR04d. Distribution of claims per story for PR-2004 Companies.

Stories	PR2-2004	PR3-2004	PR4-2004	PR5-2004
1	0	0	0	26,538
2	0	0	0	0
Unknown	43121	103,414	768	0

PR04e. Distribution of claims per era for PR-2004 Companies.

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	1785	7854	125	0
1960-1970	3983	12033	102	0
1971-1980	8312	19,772	145	0
1981-1993	18621	46,525	276	0
1994-2001	5545	14,436	91	0
2002-present	4875	2,785	29	0
MH pre-1994	0	0	0	22172
MH 1994-present	0	0	0	4366

PR04f. Distribution of claims per era for PR-2004 Companies, for hurricane Charley, and construction types Frame and Manufactured Homes.

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	119	535	20	0
1960-1970	80	190	2	0
1971-1980	212	471	3	0
1981-1993	956	2752	31	0
1994-2001	128	247	8	0
2002-present	237	29	1	0
MH pre-1994	0	0	0	6665
MH 1994-present	0	0	0	1365

PR04g. Distribution of claims per era for PR-2004 Companies, for hurricane Charley, and construction type Masonry

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	409	1870	32	0
1960-1970	972	3051	37	0
1971-1980	1909	5478	46	0
1981-1993	4674	13668	64	0
1994-2001	1580	4877	34	0
2002-present	1271	968	10	0

PR04h. Distribution of claims per era for PR-2004 Companies, for hurricane Charley, and construction type Other

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	0	0	0	0
1960-1970	5	0	0	0
1971-1980	35	0	0	0
1981-1993	35	8	0	0
1994-2001	3	1	0	0
2002-present	16	0	0	0

PR04i. Distribution of claims per era for PR-2004 Companies, for hurricane Frances, and construction type Frame and Manufactured Homes

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	110	419	7	0
1960-1970	96	218	4	0
1971-1980	555	922	6	0
1981-1993	2845	5689	24	0
1994-2001	265	311	8	0
2002-present-	358	30	3	0
MH pre-1994	0	0	0	6145
MH 1994-present	0	0	0	1156

PR04j. Distribution of claims per era for PR-2004 Companies, for hurricane Frances, and construction type Masonry

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	348	1433	15	0
1960-1970	1043	3181	27	0
1971-1980	1906	4770	34	0
1981-1993	3129	8165	56	0
1994-2001	954	2206	15	0
2002-present	864	511	1	0

PR04k. Distribution of claims per era for PR-2004 Companies, for hurricane Frances, and construction type Other

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	0	0	0	0
1960-1970	8	0	0	0
1971-1980	50	2	0	0
1981-1993	114	4	0	0
1994-2001	5	3	0	0
2002-present	81	0	0	0

PR04l. Distribution of claims per era for PR-2004 Companies, for hurricane Ivan, and construction type Frame and Manufactured Homes

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	140	914	4	0
1960-1970	117	538	2	0
1971-1980	174	759	2	0
1981-1993	626	3292	4	0
1994-2001	302	1636	0	0
2002-present-	273	223	0	0
MH pre-1994	0	0	0	620
MH 1994-present	0	0	0	197

PR04m. Distribution of claims per era for PR-2004 Companies, for hurricane Ivan, and construction type Masonry

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	151	1,207	4	0
1960-1970	624	2,557	4	0
1971-1980	1279	3,573	3	0
1981-1993	1320	4,087	6	0
1994-2001	676	2,251	2	0
2002-present	467	378	0	0

PR04n. Distribution of claims per era for PR-2004 Companies, for hurricane Ivan, and construction type Other

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	1	0	0	0
1960-1970	0	0	0	0
1971-1980	12	1	0	0
1981-1993	23	2	0	0
1994-2001	3	3	0	0
2002-present	13	1	0	0

PR04o. Distribution of claims per era for PR-2004 Companies, for hurricane Jeanne, and construction type Frame and Manufactured Homes

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	137	376	16	0
1960-1970	81	166	2	0
1971-1980	399	493	9	0
1981-1993	1983	2939	30	0
1994-2001	276	296	10	0
2002-present-	290	24	2	0
MH pre-1994	0	0	0	8742
MH 1994-present	0	0	0	1648

PR04p. Distribution of claims per era for PR-2004 Companies, for hurricane Jeanne, and construction type Masonry

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	369	1,100	26	0
1960-1970	951	2,132	24	0
1971-1980	1716	3,303	42	0
1981-1993	2795	5,915	61	0
1994-2001	1340	2,604	14	0
2002-present	926	619	12	0

PR04q. Distribution of claims per era for PR-2004 Companies, for hurricane Jeanne, and construction type Other

Year Built	PR2-2004	PR3-2004	PR4-2004	PR5-2004
pre1960	1	0	0	0
1960-1970	5	0	0	0
1971-1980	65	0	0	0
1981-1993	121	4	0	0
1994-2001	13	1	0	0
2002-present	79	2	0	0

2005 Personal Residential Claims Data

Claims data for the 2005 hurricane season from a series of insurance companies were also used to validate the FPHLM. Five insurance companies provided claims data for the 2005 hurricane season. They will be referred to as companies PR1 to 5-2005. Company PR5-2005 has only manufactured homes. See Table PR05a to q. The data for hurricane Rita was not used given the small number of claims.

Table 18. 2005 Personal Residential Claims Data

PR05a. Distribution of claims per hurricane for PR-2005 Companies.

	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
Dennis	3968	1251	3,467	9	232
Katrina	5382	201	2,379	30	78
Rita	56	34	0	1	4
Wilma	62677	9247	21328	264	5,302

PR05b. Distribution of claims per coverage for PR-2005 Companies.

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
A	5990	10733	43	304	0
R	66093	0	27,131	0	5616

PR05c. Distribution of claims per construction type for PR-2005 Companies.

Exterior Wall	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
Frame	6920	1629	2,881	44	0
Manuf. Homes	1402	0	0	0	5616
Masonry	60475	8538	24,292	258	0
Other	3286	566	1	2	0

PR05d. Distribution of claims per story for PR-2005 Companies.

Stories	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
1	664	0	0	0	0
2	146	0	0	0	0
Unknown	71273	10733	27,174	304	0

PR05e. Distribution of claims per era for PR-2005 Companies.

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	6204	233	2,526	47	0
1960-1970	10865	770	3,715	58	0
1971-1980	18922	2441	7172	69	0
1981-1993	26412	4498	10202	98	0
1994-2001	7172	1571	2,908	28	0
2002-present	1106	1220	649	4	0
MH pre-1994	1274	0	0	0	4227
MH 1994-present	128	0	0	0	1389

PR05f. Distribution of claims per era for PR-2005 Companies, for hurricane Dennis, and construction type Frame.

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	242	26	106	1	0
1960-1970	541	26	73	1	0
1971-1980	815	33	128	2	0
1981-1993	1046	112	452	0	0
1994-2001	573	77	422	0	0
2002-present	66	45	59	0	0
MH pre-1994	36	0	0	0	162
MH 1994-present	18	0	0	0	70

PR05g. Distribution of claims per era for PR-2005 Companies, for hurricane Dennis, and construction type Masonry

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	93	21	150	1	0
1960-1970	175	110	324	1	0
1971-1980	140	237	537	2	0
1981-1993	124	255	535	1	0
1994-2001	70	218	562	0	0
2002-present-	12	89	118	0	0

PR05h. Distribution of claims per era for PR-2005 Companies, for hurricane Dennis, and construction type Other

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	0	0	0	0	0
1960-1970	0	0	0	0	0
1971-1980	6	0	0	0	0
1981-1993	11	1	0	0	0
1994-2001	0	0	1	0	0
2002-present	0	1	0	0	0

PR05i. Distribution of claims per era for PR-2005 Companies, for hurricane Katrina, and construction type Frame

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	60	1	25	0	0
1960-1970	40	1	8	0	0
1971-1980	43	3	10	0	0
1981-1993	91	9	52	0	0
1994-2001	44	3	20	0	0
2002-present	8	4	6	0	0
MH pre-1994	45	0	0	0	68
MH 1994-present	1	0	0	0	10

PR05j. Distribution of claims per era for PR-2005 Companies, for hurricane Katrina, and construction type Masonry

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	969	10	410	12	0
1960-1970	1137	26	456	10	0
1971-1980	1428	48	583	4	0
1981-1993	1297	53	727	4	0
1994-2001	133	27	74	0	0
2002-present	23	12	8	0	0

PR05k. Distribution of claims per era for PR-2005 Companies, for hurricane Katrina, and construction type Other

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	1	0	0	0	0
1960-1970	14	0	0	0	0
1971-1980	31	1	0	0	0
1981-1993	13	2	0	0	0
1994-2001	4	0	0	0	0
2002-present	0	1	0	0	0

PR05l. Distribution of claims per era for PR-2005 Companies, for hurricane Rita, and construction type Frame

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	0	0	0	0	0
1960-1970	1	0	0	0	0
1971-1980	1	2	0	0	0
1981-1993	0	1	0	1	0
1994-2001	0	0	0	0	0
2002-present	0	2	0	0	0
MH pre-1994	1	0	0	0	4
MH 1994-present	0	0	0	0	0

PR05m. Distribution of claims per era for PR-2005 Companies, for hurricane Rita, and construction type Masonry

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	6	1	0	0	0
1960-1970	13	2	0	0	0
1971-1980	14	7	0	0	0
1981-1993	17	7	0	0	0
1994-2001	2	10	0	0	0
2002-present	0	1	0	0	0

PR05n. Distribution of claims per era for PR-2005 Companies, for hurricane Rita, and construction type Other

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	0	0	0	0	0
1960-1970	0	0	0	0	0
1971-1980	1	0	0	0	0
1981-1993	0	1	0	0	0
1994-2001	0	0	0	0	0
2002-present	0	0	0	0	0

PR05o. Distribution of claims per era for PR-2005 Companies, for hurricane Wilma, and construction type Frame

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	323	32	99	2	0
1960-1970	151	51	47	1	0
1971-1980	546	213	212	7	0
1981-1993	2136	786	1084	25	0
1994-2001	164	114	70	4	0
2002-present	29	88	8	0	0
MH pre-1994	1192	0	0	0	3993
MH 1994-present	109	0	0	0	1309

PR05p. Distribution of claims per era for PR-2005 Companies, for hurricane Wilma, and construction type Masonry

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	4484	142	1736	31	0
1960-1970	8567	542	2,807	45	0
1971-1980	14288	1721	5702	54	0
1981-1993	20430	3079	7352	65	0
1994-2001	6089	1103	1759	24	0
2002-present-	964	817	450	4	0

PR05q. Distribution of claims per era for PR-2005 Companies, for hurricane Wilma, and construction type Other

Year Built	PR1-2005	PR2-2005	PR3-2005	PR4-2005	PR5-2005
pre1960	26	0	0	0	0
1960-1970	226	12	0	0	0
1971-1980	1609	176	0	0	0
1981-1993	1247	192	0	2	0
1994-2001	93	19	0	0	0
2002-present-	4	160	0	0	0

Commercial Residential Claims Data

Claims data from the 2004 and the 2005 hurricane seasons for commercial residential from four insurance companies (referred to as companies CR1 to 4) were used to validate the commercial residential module of the FPHLM. The details are given below for low rise commercial and for mid/high rise commercial in Tables CR04-LRa to q, CR05-LRa to n, CR04-MRa to q, and CR05-MRa to k. The vast majority of the claims are for low-rise 1 and 2 story buildings.

The policies for company CR2 included commercial line accounts (CLA) for condominium association, apartment building, and homeowners association policies, and the policies for company CR3 included high risk accounts (HRA) in coastal areas.

2004 Low Rise Commercial Residential Claims Data

It is clear from Tables CR04-LRa to q that the vast majority of LR 2004 claims data consists of masonry one and two story tall pre-1994 buildings.

Table 25. 2004 Low Rise Commercial Residential Claims Data

CR04-LRa. Distribution of claims per hurricane for CR LR 2004 companies.

	CR1-LR04	CR2-LR04	CR3-LR04
Charley	575	11	182
Frances	691	78	808
Ivan	166	0	0
Jeanne	285	12	280

CR04-LRb. Distribution of claims per coverage for CR LR 2004 companies.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
A	0	0	0
R	1717	0	0
Not Provided	0	101	1270

CR04-LRc. Distribution of claims per construction type for CR LR 2004 companies.

Exterior Wall	CR1-LR04	CR2-LR04	CR3-LR04
Frame	405	28	240
Masonry	1204	73	1030
Other	108	0	0

CR04-LRd. Distribution of claims per story for CR LR 2004 companies.

Stories	CR1-LR04	CR2-LR04	CR3-LR04
1	806	24	441
2	789	69	677
3	122	8	152

CR04-LRe. Distribution of claims per era for CR LR 2004 companies.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	69	1	273
1960-1970	155	28	279
1971-1980	452	31	389
1981-1993	987	41	286
1994-2001	51	0	34
2002-present	3	0	9

CR04-LRf. Distribution of claims per era for CR LR 2004 companies, for hurricane Charley, and construction type Frame.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	12	0	20
1960-1970	1	0	11
1971-1980	6	7	19
1981-1993	50	4	20
1994-2001	2	0	2
2002-present	0	0	0

CR04-LRg. Distribution of claims per era for CR LR 2004 companies, for hurricane Charley, and construction type Masonry.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	10	0	12
1960-1970	33	0	17
1971-1980	153	0	45
1981-1993	290	0	26
1994-2001	9	0	10
2002-present	0	0	0

CR04-LRh. Distribution of claims per era for CR LR 2004 companies, for hurricane Charley, and construction type Other.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	0	0	0
1960-1970	0	0	0
1971-1980	3	0	0
1981-1993	6	0	0
1994-2001	0	0	0
2002-present	0	0	0

CR04-LRi. Distribution of claims per era for CR LR 2004 companies, for hurricane Frances, and construction type Frame.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	8	1	58
1960-1970	3	0	11
1971-1980	6	3	22
1981-1993	119	7	33
1994-2001	12	0	3
2002-present	0	0	0

CR04-LRj. Distribution of claims per era for CR LR 2004 companies, for hurricane Frances, and construction type Masonry.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	11	0	111
1960-1970	69	25	169
1971-1980	152	17	214
1981-1993	206	25	165
1994-2001	11	0	16
2002-present	2	0	6

CR04-LRk. Distribution of claims per era for CR LR 2004 companies, for hurricane Frances, and construction type Other.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	0	0	0
1960-1970	0	0	0
1971-1980	6	0	0
1981-1993	85	0	0
1994-2001	1	0	0
2002-present	0	0	0

CR04-LRl. Distribution of claims per era for CR LR 2004 companies, for hurricane Ivan, and construction type Frame.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	5	0	0
1960-1970	11	0	0
1971-1980	49	0	0
1981-1993	66	0	0
1994-2001	6	0	0
2002-present-	0	0	0

CR04-LRm. Distribution of claims per era for CR LR 2004 companies, for hurricane Ivan, and construction type Masonry.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	5	0	0
1960-1970	9	0	0
1971-1980	9	0	0
1981-1993	5	0	0
1994-2001	0	0	0
2002-present-	0	0	0

CR04-LRn. Distribution of claims per era for CR LR 2004 companies, for hurricane Ivan, and construction type Other.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	0	0	0
1960-1970	0	0	0
1971-1980	0	0	0
1981-1993	1	0	0
1994-2001	0	0	0
2002-present-	0	0	0

CR04-LRo. Distribution of claims per era for CR LR 2004 companies, for hurricane Jeanne, and construction type Frame.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	12	0	47
1960-1970	1	0	69
1971-1980	2	1	85
1981-1993	32	5	34
1994-2001	2	0	1
2002-present-	0	0	3

CR04-LRp. Distribution of claims per era for CR LR 2004 companies, for hurricane Jeanne, and construction type Masonry.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	6	0	47
1960-1970	28	3	69
1971-1980	64	3	85
1981-1993	124	0	34
1994-2001	7	0	1
2002-present-	1	0	3

CR04-LRq. Distribution of claims per era for CR LR 2004 companies, for hurricane Jeanne, and construction type Other.

Year Built	CR1-LR04	CR2-LR04	CR3-LR04
pre1960	0	0	0
1960-1970	0	0	0
1971-1980	2	0	0
1981-1993	3	0	0
1994-2001	0	0	0
2002-present-	0	0	0

2005 Low Rise Commercial Residential Claims Data

It is clear from Tables CR05-LRa to n that the vast majority of LR 2005 claims data consists of masonry one and two story tall pre-1994 buildings for hurricane Wilma.

Table 26. 2005 Low Rise Commercial Residential Claims Data

CR05-LRa. Distribution of claims per hurricane for CR LR 2005 companies.

	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
Dennis	22	0	0	0
Katrina	68	81	186	0
Wilma	1117	1356	2080	410

CR05-LRb. Distribution of claims per coverage for CR LR 2005 companies.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
A	0	0	0	0
R	1207	0	0	0
Not Provided	0	1437	2266	410

CR05-LRc. Distribution of claims per construction type for CR LR 2005 companies.

Exterior Wall	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
Frame	180	168	102	47
Masonry	933	1269	2164	363
Other	94	0	0	0

CR05-LRd. Distribution of claims per story for CR LR 2005 companies.

Stories	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
1	645	458	955	180
2	498	863	1111	221
3	64	116	200	9

CR05-LRe. Distribution of claims per era for CR LR 2005 companies.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	3	112	644	0
1960-1970	98	229	743	0
1971-1980	279	501	559	6
1981-1993	811	578	270	119
1994-2001	16	17	35	196
2002-present	0	0	15	89

CR05-LRf. Distribution of claims per era for CR LR 2005 companies, for hurricane Dennis, and construction type Frame.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	0	0	0	0
1960-1970	0	0	0	0
1971-1980	2	0	0	0
1981-1993	12	0	0	0
1994-2001	7	0	0	0
2002-present-	0	0	0	0

CR05-LRg. Distribution of claims per era for CR LR 2005 companies, for hurricane Dennis, and construction type Masonry.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	0	0	0	0
1960-1970	0	0	0	0
1971-1980	1	0	0	0
1981-1993	0	0	0	0
1994-2001	0	0	0	0
2002-present-	0	0	0	0

CR05-LRh. Distribution of claims per era for CR LR 2005 companies, for hurricane Dennis, and construction type Other.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	0	0	0	0
1960-1970	0	0	0	0
1971-1980	0	0	0	0
1981-1993	0	0	0	0
1994-2001	0	0	0	0
2002-present	0	0	0	0

CR05-LRi. Distribution of claims per era for CR LR 2005 companies, for hurricane Katrina, and construction type Frame.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	0	0	2	0
1960-1970	0	0	0	0
1971-1980	1	0	1	0
1981-1993	2	6	1	0
1994-2001	0	0	0	0
2002-present	0	0	0	0

CR05-LRj. Distribution of claims per era for CR LR 2005 companies, for hurricane Katrina, and construction type Masonry.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	0	13	62	0
1960-1970	3	9	61	0
1971-1980	4	29	29	0
1981-1993	54	23	23	0
1994-2001	0	1	5	0
2002-present	0	0	2	0

CR05-LRk. Distribution of claims per era for CR LR 2005 companies, for hurricane Katrina, and construction type Other.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	0	0	0	0
1960-1970	0	0	0	0
1971-1980	0	0	0	0
1981-1993	4	0	0	0
1994-2001	0	0	0	0
2002-present	0	0	0	0

CR05-LRl. Distribution of claims per era for CR LR 2005 companies, for hurricane Wilma, and construction type Frame.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	2	4	46	0
1960-1970	93	0	20	0
1971-1980	248	11	12	0
1981-1993	525	147	19	9
1994-2001	4	0	1	29
2002-present	0	0	0	9

CR05-LRm. Distribution of claims per era for CR LR 2005 companies, for hurricane Wilma, and construction type Masonry.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	1	95	534	0
1960-1970	93	220	662	0
1971-1980	248	461	517	6
1981-1993	525	402	227	110
1994-2001	4	16	29	167
2002-present	0	0	13	80

CR05-LRn. Distribution of claims per era for CR LR 2005 companies, for hurricane Wilma, and construction type Other.

Year Built	CR1-LR05	CR2-LR05	CR3-LR05	CR4-LR05
pre1960	0	0	0	0
1960-1970	1	0	0	0
1971-1980	21	0	0	0
1981-1993	64	0	0	0
1994-2001	4	0	0	0
2002-present	0	0	0	0

2004 Mid/High Rise Commercial Residential Claims Data

It is clear from Tables CR04-MRa to n that the number of MHR 2004 claims is very small. It consists mainly of masonry or other four to eleven story tall pre-1994 buildings.

Table 20. 2004 Mid/High Rise Commercial Residential Claims Data

CR04-MRa. Distribution of claims per hurricane for CR MHR 2004 companies.

	CR1-MHR04	CR2-MHR04	CR3-MHR04
Charley	23	4	34
Frances	21	5	56
Jeanne	4	0	15

CR04-MRb. Distribution of claims per coverage for CR MHR 2004 companies.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
A	0	0	0
R	48	0	0
Not Provided	0	9	105

CR04-MRc. Distribution of claims per construction type for CR MHR 2004 companies.

Exterior Wall	CR1-MHR04	CR2-MHR04	CR3-MHR04
Frame	2	0	2
Masonry	34	9	103
Other	12	0	0

CR04-MRd. Distribution of claims per story for CR MHR 2004 companies.

Stories	CR1-MHR04	CR2-MHR04	CR3-MHR04
4	11	1	23
5	14	7	28
6	5	0	8
7	6	0	15
8	2	1	7
9	2	0	4
10	8	0	2
11	0	0	2
12	0	0	1
13	0	0	1
15	0	0	1
26	0	0	1
36	0	0	1
42	0	0	1

CR04-MRe. Distribution of claims per era for CR MHR 2004 companies.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	1	0	4
1960-1970	1	1	8
1971-1980	21	4	35
1981-1993	25	4	50
1994-2001	0	0	7
2002-present	0	0	1

CR04-MRf. Distribution of claims per era for CR MHR 2004 companies, for hurricane Charley, and construction type Frame.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	0	0	0
1960-1970	0	0	0
1971-1980	0	0	0
1981-1993	0	0	0
1994-2001	0	0	0
2002-present	0	0	0

CR04-MRg. Distribution of claims per era for CR MHR 2004 companies, for hurricane Charley, and construction type Masonry.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	0	0	0
1960-1970	0	0	2
1971-1980	10	4	9
1981-1993	10	0	20
1994-2001	0	0	3
2002-present	0	0	0

CR04-MRh. Distribution of claims per era for CR MHR 2004 companies, for hurricane Charley, and construction type Other.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	0	0	0
1960-1970	0	0	0
1971-1980	1	0	0
1981-1993	2	0	0
1994-2001	0	0	0
2002-present	0	0	0

CR04-MRi. Distribution of claims per era for CR MHR 2004 companies, for hurricane Frances, and construction type Frame.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	0	0	1
1960-1970	0	0	0
1971-1980	0	0	0
1981-1993	2	0	0
1994-2001	0	0	0
2002-present	0	0	0

CR04-MRj. Distribution of claims per era for CR MHR 2004 companies, for hurricane Frances, and construction type Masonry.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	1	0	3
1960-1970	0	1	3
1971-1980	9	0	23
1981-1993	3	4	22
1994-2001	0	0	3
2002-present	0	0	1

CR04-MRk. Distribution of claims per era for CR MHR 2004 companies, for hurricane Frances, and construction type Other.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	0	0	0
1960-1970	0	0	0
1971-1980	1	0	0
1981-1993	5	0	0
1994-2001	0	0	0
2002-present	0	0	0

CR04-MRl. Distribution of claims per era for CR MHR 2004 companies, for hurricane Jeanne, and construction type Frame.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	0	0	0
1960-1970	0	0	0
1971-1980	0	0	0
1981-1993	0	0	1
1994-2001	0	0	0
2002-present	0	0	0

CR04-MRm. Distribution of claims per era for CR MHR 2004 companies, for hurricane Jeanne, and construction type Masonry.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	0	0	0
1960-1970	0	0	3
1971-1980	0	0	3
1981-1993	1	0	7
1994-2001	0	0	1
2002-present	0	0	0

CR04-MRn. Distribution of claims per era for CR MHR 2004 companies, for hurricane Jeanne, and construction type Other.

Year Built	CR1-MHR04	CR2-MHR04	CR3-MHR04
pre1960	0	0	0
1960-1970	1	0	0
1971-1980	0	0	0
1981-1993	2	0	0
1994-2001	0	0	0
2002-present	0	0	0

2005 Mid/High Rise Commercial Residential Claims Data

It is clear from Tables CR05-MRa to k that the number of MHR 2005 claims is very small. It consists mainly of masonry four to ten story tall pre-1994 buildings for hurricane Wilma.

Table 20. 2005 Mid/Hid Rise Commercial Residential Claims Data

CR05-MRa. Distribution of claims per hurricane for CR MHR 2005 companies.

	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
Katrina	0	0	10	0
Wilma	125	118		42

CR05-MRb. Distribution of claims per coverage for CR MHR 2005 companies.

Year Built	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
A	0	0	0	0
R	126	0	0	0
Not Provided	0	118	127	42

CR05-MRc. Distribution of claims per construction type for CR MHR 2005 companies.

Exterior Wall	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
Frame	0	0	1	0
Masonry	107	118	127	42
Other	19	0	0	0

CR05-MRd. Distribution of claims per story for CR MHR 2005 companies.

Stories	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
4	64	70	54	40
5	17	37	29	0
6	8	3	12	0
7	13	2	6	0
8	9	1	7	0
9	4	4	3	0
10	11	1	3	0
11	0	0	1	0
14	0	0	2	0
15	0	0	2	0
16	0	0	2	0
17	0	0	0	2
18	0	0	1	0
19	0	0	1	0
22	0	0	1	0
23	0	0	1	0
29	0	0	1	0
31	0	0	1	0

CR05-MRe. Distribution of claims per era for CR MHR 2005 companies.

Year Built	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
pre1960	1	0	8	0
1960-1970	1	6	42	0
1971-1980	52	52	38	0
1981-1993	65	60	34	28
1994-2001	7	0	3	12
2002-present	0	0	2	2

CR05-MRf. Distribution of claims per era for CR MHR 2005 companies, for hurricane Katrina, and construction type Frame.

Year Built	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
pre1960	0	0	0	0
1960-1970	0	0	0	0
1971-1980	0	0	0	0
1981-1993	0	0	0	0
1994-2001	0	0	0	0
2002-present	0	0	0	0

CR05-MRg. Distribution of claims per era for CR MHR 2005 companies, for hurricane Katrina, and construction type Masonry.

Year Built	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
pre1960	0	0	1	0
1960-1970	0	0	4	0
1971-1980	0	0	3	0
1981-1993	0	0	1	0
1994-2001	0	0	1	0
2002-present	0	0	0	0

CR05-MRh. Distribution of claims per era for CR MHR 2005 companies, for hurricane Katrina, and construction type Other

Year Built	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
pre1960	0	0	0	0
1960-1970	0	0	0	0
1971-1980	0	0	0	0
1981-1993	0	0	0	0
1994-2001	0	0	0	0
2002-present	0	0	0	0

CR05-MRi. Distribution of claims per era for CR MHR 2005 companies, for hurricane Wilma, and construction type Frame

Year Built	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
pre1960	0	0	0	0
1960-1970	0	0	0	0
1971-1980	0	0	0	0
1981-1993	0	0	1	0
1994-2001	0	0	0	0
2002-present	0	0	0	0

CR05-MRj. Distribution of claims per era for CR MHR 2005 companies, for hurricane Wilma, and construction type Masonry

Year Built	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
pre1960	1	0	7	0
1960-1970	1	6	38	0
1971-1980	40	52	35	0
1981-1993	57	60	32	28
1994-2001	7	0	2	12
2002-present	0	0	2	2

CR05-MRk. Distribution of claims per era for CR MHR 2005 companies, for hurricane Wilma, and construction type Other

Year Built	CR1-MHR05	CR2-MHR05	CR3-MHR05	CR4-MHR05
pre1960	0	0	0	0
1960-1970	0	0	0	0
1971-1980	11	0	0	0
1981-1993	8	0	0	0
1994-2001	0	0	0	0
2002-present	0	0	0	0

4. Describe the assumptions, data (including insurance claims data), methods, and processes used for the development of the building hurricane vulnerability functions.

A detailed discussion of the assumptions, data (including insurance claim data), methods, and processes used for the development of the building vulnerability functions is contained within Standard G.1 and other disclosure items in Standard V.1.

5. Summarize post-event site investigations, including the sources, and provide a brief description of the resulting use of these data in the development or validation of building hurricane vulnerability functions.

The documentation and statistical analysis of damage caused by landfalling hurricanes has been conducted by a variety of stakeholders, including home builder trade associations (NAHB Research Center, 1993, 1996, 1999; Crandell, 1998), practicing engineers (Keith & Rose, 1994), government agencies (Oliver & Hanson, 1994; FEMA, 1992, 2006), and academic researchers (Kareem, 1985, 1986; Gurley, 2006; Gurley et al., 2006). Some of these studies provide a broad overview of structural performance (FEMA and NAHB reports). Others focus on a particular building component such as roofing (Croft et al., 2006; Meloy et al., 2007) or address a specific building type such as wood frame residential construction (van de Lindt et al., 2007). All such available public access literature regarding the performance of residential infrastructure in hurricane winds was reviewed and used as guidance for the development of the vulnerability model. Those studies that provide statistical assessments of damage to specific building components (Gurley, 2006; Gurley et al., 2006; Gurley and Masters, 2011; Meloy et al., 2007) were used as a means of validating the physical damage estimates of the model. Studies that are more qualitative in nature (e.g., FEMA reports) were used to provide guidance regarding the potential failure modes that were important to replicate in the model. For example, the common observation of gable end failures resulted in a gable end failure component in the model.

Several damage surveys were done in 2004. Damage from Hurricane Charley was reported across the state, and the most severe damage occurred where the eye made landfall near the cities of Punta Gorda and Port Charlotte. A team that consisted of approximately 30 members from UF, FIU, Clemson, and FIT, under the leadership of the Insurance Institute for Business & Home Safety (IBHS), surveyed the extent of the structural damage to homes and manufactured homes in these cities. For several days following the storm the team conducted a detailed statistical survey of damage in the impacted areas. Results of this survey can be found on the IBHS website http://www.ibhs.org/. Other information regarding the damage of Charley and other storms can be found at the Florida Tech Wind and Hurricane Impact Research Laboratory website, http://www.fit.edu/research/whirl/.

Damage from Hurricane Frances was surveyed in areas from Cocoa Beach to Stuart in eastern Florida. Although damage from Hurricane Frances was not as severe as that from Hurricane Charley, the same extensive survey conducted in Punta Gorda and Port Charlotte was also conducted in the impacted areas. Great efforts were made to monitor the strength and resulting damage from the storm as part of the Florida Coastal Monitoring Program. Towers were set up to record wind speeds along the coast in locations where the storm was forecasted to make landfall. Sensors to record the wind-induced pressure were deployed on the roofs of several homes. Following the storm, members of the same team that surveyed damage from Charley photographed and recorded damage throughout the area. Areas of Fort Pierce appeared to be hardest hit and damage was severe to many homes in some areas.

Similar efforts to monitor the winds and survey the damage were made for Hurricane Jeanne. Towers and pressure sensors were again deployed at various locations near where landfall was forecasted. After the storm, members of the team surveyed areas from Stuart to Cocoa Beach. These surveys consisted primarily of cataloging and photographing various observations of damage in the impacted areas, as was done with Hurricane Frances. Damage from Hurricane Jeanne in many locations was very similar to what was seen from Hurricane Frances. In many cases damage to structures that was initially caused by Frances was compounded by Hurricane Jeanne. Fatigue of structures from the winds of two hurricanes within three weeks most likely played a role in the most severe cases of damage in the areas such as Vero Beach and Fort Pierce. In some areas most of the weak trees and components of homes (shingles, screened porches, fences, etc.) were already damaged by Hurricane Frances, so when Hurricane Jeanne hit little or no further damage was seen. It is very difficult to tell what damage was caused by Hurricane Jeanne and what was caused by Hurricane Frances.

Additionally, engineers working on the physical damage model performed a detailed residential damage study after the 2004 hurricane season to assess the performance of housing built to the Florida Building Code and the Standard Building Code (Gurley, 2006; Gurley et al., 2006; Gurley and Masters, 2011). The data were collected as a part of a study conducted by UF and sponsored by the Florida Building Commission. Site-built single-family homes constructed after Hurricane Andrew-related changes to the standard building code went into effect were targeted for a detailed investigation of damage as a result of the 2004 hurricane season. This study provided a quantitative statistical comparison of the relative performance of homes built between 1994 and 2001 with the performance of those built after the 2001 Florida Building Code replaced the Standard Building Code. This evaluation was accomplished through a systematic survey of homes built from 1994 to 2004 in the areas that experienced the highest wind speeds from the 2004 storms (Charlotte, St. Lucie, Escambia, and Santa Rosa counties). Close to 200 homes were surveyed in these regions to define correlations between damage, age, and construction type. These relationships are referenced to maximum three-second gust wind speed via wind swath maps. An expanded and more detailed version of the conference publication (Gurley, 2006; Gurley et al., 2006) has appeared in the ASCE journal Natural Hazards Review (Gurley and Masters, 2011). The data from this study were used to modify the residential component capacities as this model evolved. Another source of field data is the aerial imagery collected by NOAA after Hurricane Katrina. These images provided a quantification of shingle damage relative to estimated wind speed and were used to validate the roof cover damage output from the physical damage model.

More recently, damage from hurricane Irma was surveyed in Florida, especially in the land-falling areas of the Florida Keys and South-West Florida (Pinelli et al., 2018). Following the storm, several team including FPHLM engineers and students deployed in the affected areas. Around 1000 properties were surveyed (Kijewski-Correa et al., 2018). Preliminary findings are available, pending further curating of the data. In most mainland areas, the observations catalogued minor to moderate property damage, consistent with the moderate wind speeds of the hurricane during its passage across mainland Florida. While in the Keys, subjected to higher winds, 25% of the observed damage was severe or collapse. All things being equal, the actual peak 3-s gust wind speeds recorded in Hurricane Irma produced wind loads ranging from 24% to 97% of prescribed design wind loads of the specific FL areas. Although most, if not all, structures built or retrofitted to the current FBC performed well, older non-retrofitted structures exhibited substantial wind damage, especially in the roof cover. This is consistent with the vulnerability models of the FPHLM for different building strengths.

6. Describe the categories of the different building hurricane vulnerability functions. Specifically, include descriptions of the building types and characteristics, building height, number of stories, regions within the state of Florida, year of construction, and occupancy types for which a unique building hurricane vulnerability function is used. Provide the total number of building hurricane vulnerability functions available for use in the hurricane model for personal and commercial residential classifications.

Vulnerability functions were derived for manufactured and site-built homes, for low-rise commercial residential buildings (one to three stories), and for apartment units of mid-/high-rise commercial residential buildings (four stories and higher).

A total of 4356 un-weighted vulnerability matrices were developed for site-built homes for building. The matrices correspond to different combinations of wall type (frame or masonry), region (north, central, south), subregion (high velocity hurricane zone, wind-borne debris region, inland), roof type (gable or hip), roof cover (metal, tile or shingle), window protection (shuttered or not shuttered), number of stories (one or two), and strength (weak, modified weak, retrofitted weak; medium, modified medium, retrofitted medium; strong for inland and WBDR, strong for HVHZ—see Table 1 and Table 2 in the General Standards).

These 4356 building un-weighted matrices were then combined to produce 5226 weighted matrices, and 291 age weighted matrices for site-built homes for building, for each county.

A total of 648 un-weighted vulnerability matrices were developed for low-rise, commercial residential buildings for building. They correspond to different combinations of wall type (frame or masonry), sub-region (high velocity hurricane zone, wind-borne debris region, inland), roof shape (gable or hip), roof cover (metal, tile or shingle), window protection (shuttered or not shuttered), number of stories (one, two, or three), and strength (weak, medium, or strong).

These 648 matrices were then combined to produce 144 weighted curves for low-rise, commercial residential buildings for building.

180 opening vulnerability curves and 180 associated breach curves were developed for openings of apartment units of mid-/high-rise commercial residential buildings. They correspond to different combinations of building layout (open or closed), unit floor location (corner or middle unit), impact debris zone (high density impact for stories 1 to 3, medium density impact for stories 4 to 7, and low density impact for stories 8 and higher), balconies (with or without sliders) and opening protection (none, impact resistant glass, or shutters).

4 un-weighted vulnerability matrices were developed for manufactured homes for building. They correspond to four manufactured home types: (1) pre-1994—fully tied down, (2) pre-1994—not tied down, (3) post-1994—Housing and Urban Development (HUD) Zone II, and (4) post-1994—HUD Zone III. The partially tied-down homes are assumed to have a vulnerability that is an average of the vulnerabilities of fully tied-down and not tied-down homes. Because little information is available regarding the distribution of manufactured home types by size or geometry, it is assumed that all model types are single-wide manufactured homes. The modeled single-wide manufactured homes are 56 ft x 13 ft, have gable roofs, eight windows, a front entrance door, and a sliding-glass back door. The un-weighted matrices are combined into 6 weighted matrices for building, for pre-1994 (4 regions: North, Central, South, Key) and post-1994 (2 zones: II and III) manufactured homes.

7. Describe the process by which local construction practices and statewide and county building code adoption and enforcement are considered in the development of the building hurricane vulnerability functions.

In addition to a classification of building by structural types (wood or masonry walls, hip or gable roof), the buildings are classified by relative strength. Residential construction methods have evolved in Florida as experience with severe winds drives the need to reduce vulnerability.

To address this, the vulnerability team has developed strong, medium, and weak models for each site-built home and low-rise, commercial residential building structural type to represent relative quality of original construction as well as post-construction mitigation. In each region of Florida, local construction and building code criteria are reflected in the mix of weak, medium, and strong buildings.

In the case of site-built single-family homes, the models are further refined with a modified weak to reflect pre-1960s decking practices, a retrofitted weak to model weak (older) buildings that have been reroofed and decking re-nailed, a modified medium to reflect loss of quality in the construction process in the high velocity hurricane zone before Andrew, a retrofitted medium to model medium buildings that have been reroofed and decking re-nailed, a strong model to reflect modern code requirements for inland structures and those in the WBDR but outside the HVHZ, and a strong model to reflect modern code requirements for structures within the HVHZ . A discussion of these models are provided in the Standard G-1 in the section describing the building models, and Table 1 and Table 2 (also in G-1) provide an overview of the relative strength among the models stratified by the exterior components included in the models. These additions to the model inventory were prompted by detailed interviews with several experts on the evolution of construction practice (common practice, codes and enforcement) in Florida. Details of this interview process and its outcomes are addressed in the next section, and in the "Models' Distribution in Time" section in Standard G-1. Regional differences in codes and enforcement are accounted for as described in the next section.

On the basis of the exposure study, it was also decided to model four manufactured home (MH) types. These types include pre-1994—fully tied down, pre-1994—not tied down, post-1994—HUD Zone II, and post-1994—HUD Zone III, where 1994 delineates older, much weaker styles of manufactured home construction than the post-1994 homes that meet minimum federal construction standards established by HUD.

Models' Distribution in Time: Regionally Varying Construction Practice

Over time, engineers and builders learned more about the interaction between wind and structures. More stringent building codes were enacted, which, when properly enforced, resulted in stronger structures. The weak, medium, and strong models represent this evolution of relative quality of construction in Florida. Each set of models is representative of the prevalent wind vulnerability of buildings for a certain historical period. It is therefore important to define the cut-off dates between the different periods since the overall aggregate losses in any region are determined as a mixture of homes of various strengths (ages). The cut-off dates depend on the evolution of the building code as well as the prevailing local code enforcement.

This issue of code enforcement has also evolved over time, and the State of Florida took an active role in uniform enforcement relatively recently. Thus, a given county may have built to standards that were worse than or better than the code in place at the time. After consulting with building code development experts, the team concluded that the load provisions have had some wind provisions since at least the 1970s. The classifications shown in Table 27 were adopted for characterizing the regions by age and model. The specific building eras and classifications per region are based on the evolution of the building codes in Florida and the opinions of the experts consulted. The strength descriptions within Table 27 are provided at the bottom of Table 27 in terms of the nomenclature used in Table 1 and Table 2 (Standard G-1).

	Pre-1960	1960-1970	1971-1980	1981-1993	1994-2001	2002-pres.
HVHZ	⅔ modified Weak, ⅓ Medium	⅔ Weak, ⅓ Medium	½ Weak, ½ modified Medium	⅔ Weak, ⅓ modified Medium	Modified Strong	Modified Strong
Keys	½ modified Weak, ½ Medium	Medium	Medium	Medium	⅓ Medium ⅔ Strong OP	Strong OP
WBDR	modified Weak	⅔ Weak, ⅓ Medium	⅓ Weak, ⅔ Medium	⅓ Weak, ⅔ Medium	½ Medium, ½ Strong OP	Strong OP
Inland	modified Weak	⅔ Weak, ⅓ Medium	½ Weak, ½ Medium	½ Weak, ½ Medium	½ Medium, ½ Strong	Strong

Table 27 Nomenclature with respect to Table 1 and Table 2.	
Strong:	S00
Strong OP:	S00-OP
Modified Strong:	S01
Medium:	M00
Modified Medium:	M10
Weak:	W00
Modified Weak:	W10

Table 27. Age classification of the models per region.

Note: HVHZ is high velocity hurricane zone; WBDR is wind-borne debris region. The boundaries of the WBDR vary depending on the year built, and the edition of the FBC which applies, as explained in Standard G-1, in the description of the site-built models.

Analysis of changes to the Florida Building Code

The Florida Building Code (FBC) typically updates on a three year cycle. In conjunction with the release of an updated Code, the Florida Building Commission creates an 'Analysis of Changes' document for every subcode in the FBC (Accessibility, Building, Energy, Existing Building, Fuel Gas, Mechanical, Plumbing, Residential, Test Protocols for High-Velocity Hurricane Zones). These documents are arranged such that the comparable provision in the previous code can be identified for comparison, and a brief description of the change is provided. These 'Analysis of Changes' documents provide a convenient means to determine whether any of the hundreds of changes in the next generation FBC warrant investigation with respect to vulnerability model development (e.g. new or modified vulnerability functions).

The subcodes potentially relevant to the vulnerability model are the FBC-Residential and FBC-Test Protocols for High-Velocity Hurricane Zones (see vulnerability references: Florida Building Commission). Each change is evaluated by the vulnerability team to determine if it meets the following criteria: 1) the change indicates a clear improvement in wind resistance of building components, 2) The components affected by the change fall within the granularity of the model, and 3) data are available that would allow a quantitative implementation of that change within the model.

This analysis revealed that no model modifications are warranted in response to FBC changes in the 2014 and 2017 versions of the FBC.

8. Describe the relationship between building structure and appurtenant structure hurricane vulnerability functions and their consistency with insurance claims data.

Appurtenant structures are not attached to the dwelling or main residence of the home, but are located on the insured property. These types of structures could include detached garages, guesthouses, pool houses, sheds, gazebos, patio covers, patio decks, swimming pools, spas, etc. Insurance claims data reveal no obvious relationship between building damage and appurtenant structure claims. The variability of the structures covered by an appurtenant structure policy may be responsible for this result. Consequently, building structures and appurtenant structures vulnerability functions were developed independently from each other.

Figure 51 and Figure 52 compare the masonry and timber building structure and appurtenant structure hurricane vulnerability curves, while Figure 53 compares the appurtenant structure hurricane vulnerability curve with insurance claims data from one company for the case of hurricanes Charley, Ivan, and Wilma. Notice that in each case the claim data includes many claims with insured appurtenant losses above the appurtenant limit (i.e. app damage ratios above 100%). For Charley, 0.5% of the claims had an app ratio between 100% and 1151%. For Ivan, 1% of the claims had an app ratio between 100% and 621%. For Wilma, 5% of the claims had an app ratio between 100% and 458%. It is not clear why the insurance company would pay more than 100% of the limit, but this happens for all the insurance companies. Figure 53 a) shows the comparison with all the claim data included. Figure 53 b) shows the comparison with the claim data above 100% excluded. Since the FPHLM does not model losses above 100%, the second plot is a better comparison. The FPHLM modelers have observed that there is no clear trend in the claim losses, and this is true across all the insurance companies, with appurtenant losses varying widely between companies and between hurricanes.

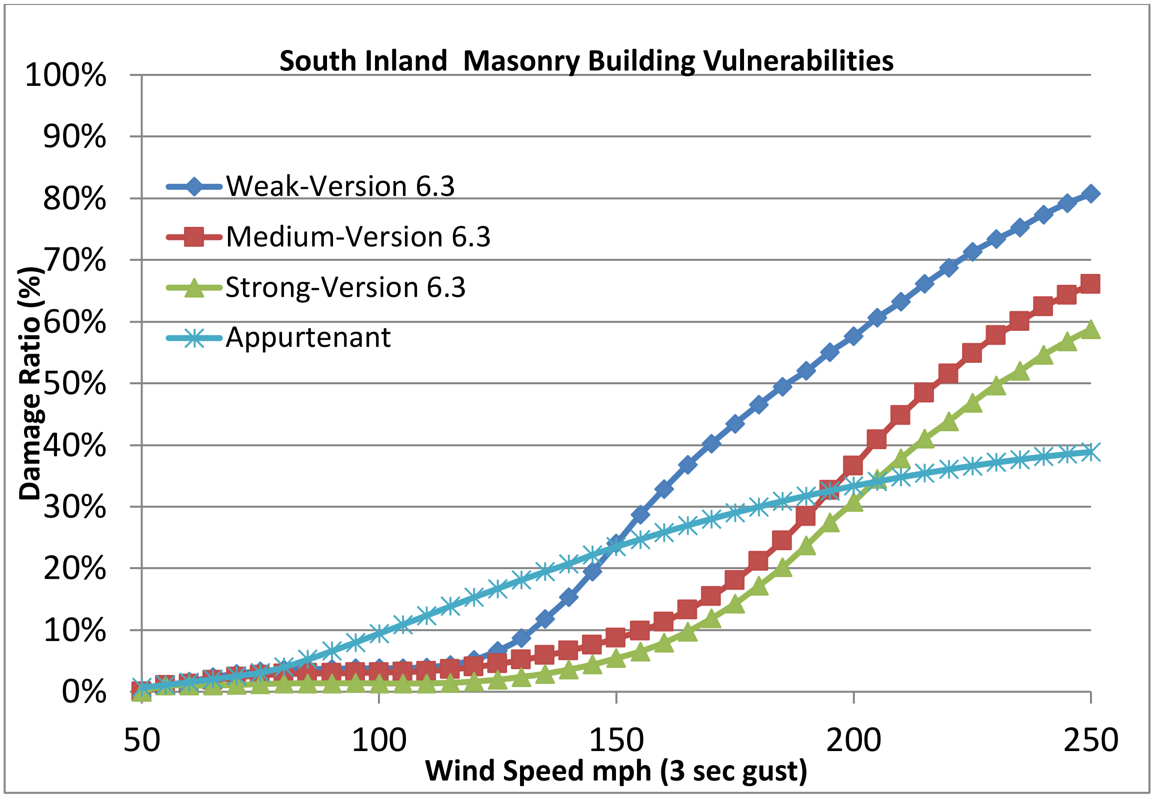


Figure 51. Masonry building structure and appurtenant structure hurricane vulnerability functions

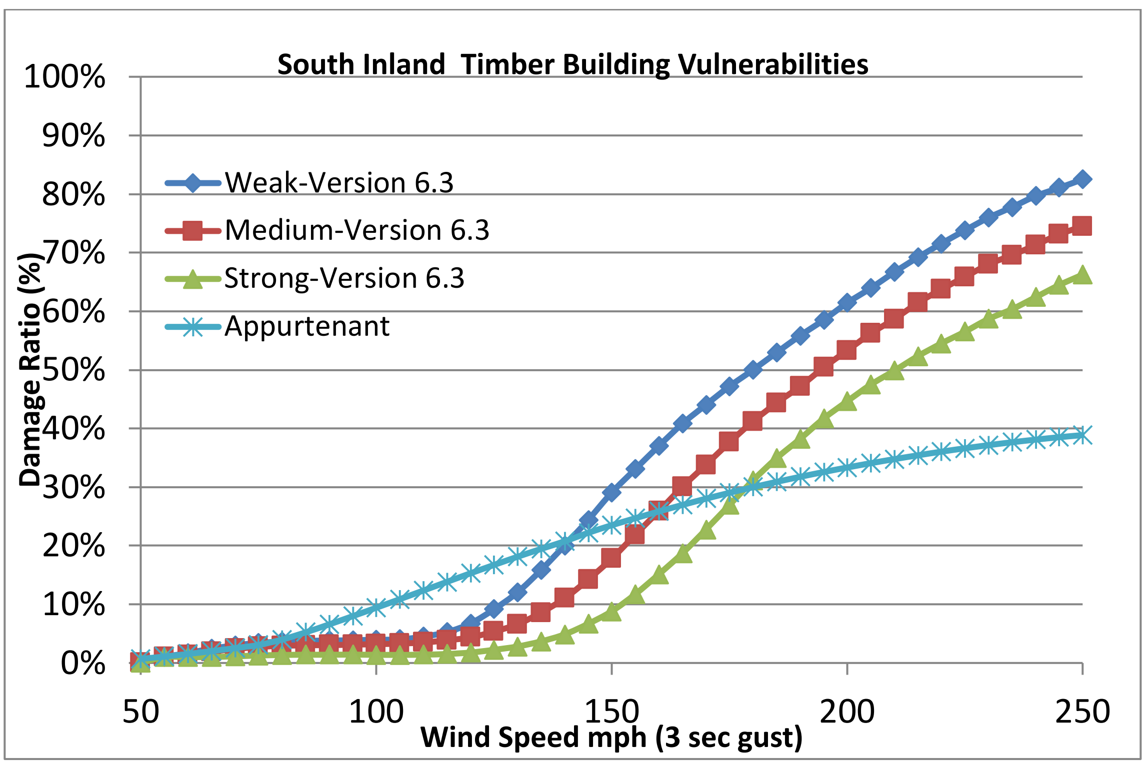
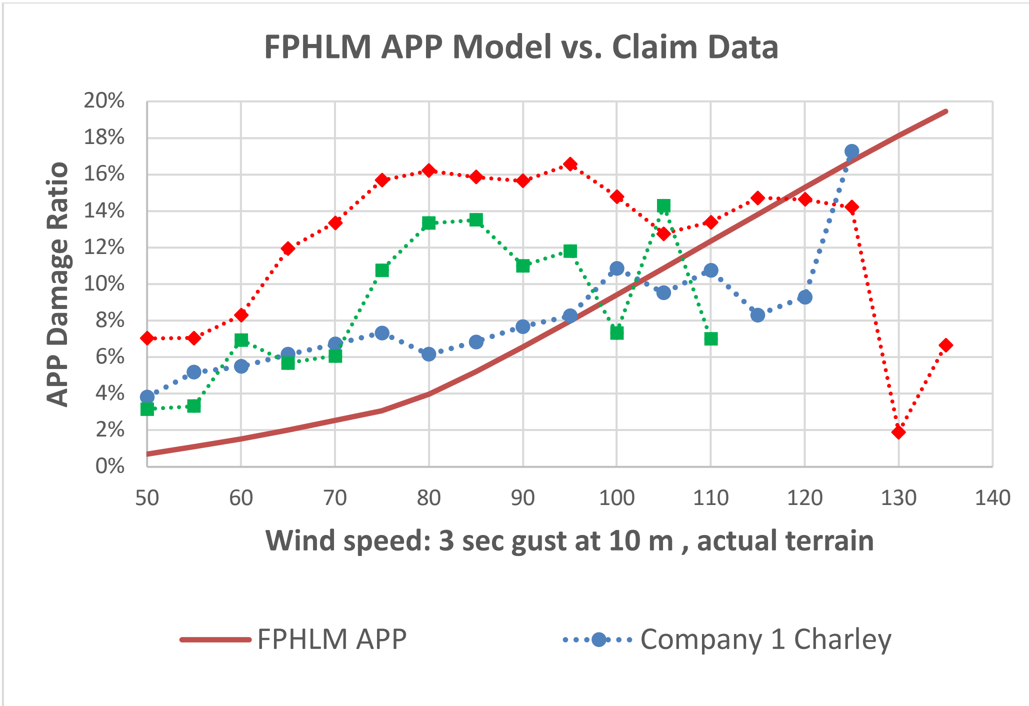


Figure 52. Timber building structure and appurtenant structure hurricane vulnerability functions

a)


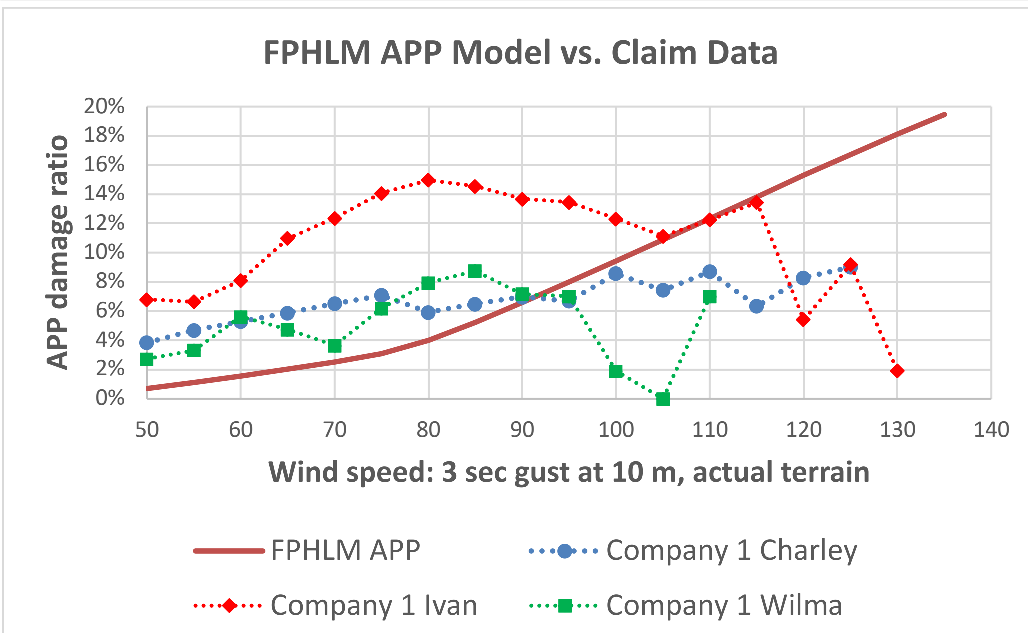
b)


Figure 53. Appurtenant structure hurricane vulnerability function vs. insurance claims data – a) all claim data included; b) claim data above 100% excluded

9. Describe the assumptions, data (including insurance claims data), methods, and processes used to develop building hurricane vulnerability functions when:

a. unknown residential construction types are unknown, or

b. or for when someone or more primary building characteristics are unknown, or

c. one or more secondary characteristics are known, or

d. building input characteristics are conflicting.

The engineering team designed a mapping tool to read a policy and assign building characteristics, if unknown or other, on the basis of building population statistics and year built, where the year built serves as a proxy for the strength of the building. The process is summarized in Table 28. Once all the unknown parameters in the policy have been defined, an unweighted vulnerability matrix based on the corresponding combination of parameters can then be assigned. If the number of unknown parameters exceeds a certain threshold defined by the actuarial team, a weighted matrix or age-weighted matrix is used instead. If the building input characteristics are conflicting, the policy is flagged, and the insurer is contacted to attempt to resolve the conflict. If the conflict is not resolved, the rules of the FPHLM will prevail. For example, if a building with a year built of 2000 has toe-nail roof to wall connections, either the year built or the connection is incorrect. If the insurer cannot resolve the conflict, the FPHLM will resolve based on the additional information available.

Data in Insurance Portfolio	Year Built	Exterior Wall	No. of Story	Roof Shape	Roof Cover	Opening Protection	Vulnerability Matrix
Case 1	known	known	known	known	known	known	Use unweighted vulnerability matrix
Case 2	known	known or unknown	Any combination of the four parameters is either unknown or other				use weighted matrix or replace all unknown and others based on stats and use unweighted vulnerability matrix
Case 3	known	other	Any combination of the four parameters is either unknown or other				use the "other" weighted matrix
Case 4	unknown	known	Any combination of the four parameters is either unknown or other				use age weighted matrix or replace all unknown and others based on stats and use unweighted vulnerability matrix
Case 5	unknown	other	Any combination of the four parameters is either unknown or other				Use age weighted matrices for "other"

Table 28. Age classification of the models per region

10. Identify the one-minute average sustained windspeed and the windspeed reference height at which the hurricane model begins to estimate damage.

The wind speeds used in the damage model are three-second gusts at 10 m. The lowest three-second gust is 50 mph. The minimum one-minute sustained wind is approximately 40 mph.

11. Describe how the duration of windspeeds at a particular location over the life of a hurricane is considered.

Duration of the storm is not explicitly modeled. The damage accumulation procedures assume sufficient duration of peak loads to account for duration dependent failures.

12. Describe how the hurricane model addresses wind-borne missile impact damage and water infiltration.

Treatment of wind borne missile impact damage

Windborne debris is considered as a source of potential damage to building openings (windows and doors). Based on post-storm damage investigations (e.g. Gurley and Masters, 2011), the model assumes that damaged roof cover from adjacent buildings is the dominant source of windborne debris. The vulnerability of an opening to windborne debris damage is modeled as a function of the density of the surrounding buildings (e.g. open vs. suburban terrain), wind speed and direction, building age (roof cover strength), height of the opening relative to building height, and opening protection (glass type and / or shutters). If an opening fails as a result of windborne debris impact, the internal pressure and associated building component loads are adjusted and failure checks are repeated. The breached opening is recorded in the damage matrix for use in costing as well as wind driven rain water ingress calculations.

For a given structural type and assigned peak 3-second wind speed (v_{wind}), the probability of damage to an opening (PD(v_{wind})) as:

$$P_D(v_{wind}) = 1 - e^{-N_A * A(v_{wind}) * B(v_{wind}) * C * D(v_{wind})}$$

where:

- N_A is the total number of available missile objects in the area upwind of the structure being analyzed. For example, the total number of shingles on the neighboring upwind house.
- A(v_{wind}) is the fraction of potential missile objects that are in the air at a given 3-second gust wind speed (v_{wind}). For example, the percentage of the shingles on the upwind neighboring roof that were damaged and available for flight.
- B(v_{wind}) is probability of the missile hitting the structure. A free shingle upwind of the structure may or may not strike the subject building. A trajectory model is used to determine this parameter.
- C is the fraction of the total area of a particular opening (window, entry door or sliding door) to area of the impact wall in which it exists. If a shingle does strike the building, C is the probability that it struck the subject opening.
- D(v_{wind}) is the probability that the impacting missile has enough momentum to damage the component impacted.

Each of the above parameters is considered in more detail below.

NA is the total number of potential missiles that are upwind of the target structure. It is assumed that surrounding buildings are similar to that of the target building and therefore have approximately the same roof cover. The total number of potential missiles is dependent on the exposure category of the area and the wind direction. The particular exposure category chosen by the user determines the location of the surrounding buildings. There are eight building surrounding the structure in “Urban” and “Suburban” exposures while there are only four buildings cornering the target building in “Open” exposures. Distances from the surrounding buildings to the subject building also changes from urban to suburban to open. NA is evaluated for each of 8 directions (Figure 54). For wind directions that are perpendicular or parallel to ridgeline of the buildings, it is assumed that NA is equal to the number of shingles from the adjacent building. For wind directions diagonal to the ridgeline of the building it is assumed that there is full contributions from the building diagonal to ridgeline and a partial contribution from the adjacent structures (25% contribution).

A(v_{wind}) is the percentage of the number of potential missiles (NA) that are assumed to become airborne and become actual missiles in the wind field upwind of the subject building. Roof cover is assumed to become airborne if it is damaged in the wind field. Thus $A(v_{wind})$ is determined by assuming the neighboring structures are of the same age as the subject with respect to the capacity of the roof cover. The vulnerability of the roof cover at the speed v_{wind} being evaluated is used to populate $A(v_{wind})$. A matrix of mean percent roof cover damage for various roof cover strengths was created and used as the input for the $A(v_{wind})$ variable. The appropriate $A(v_{wind})$ for a given simulation is selected via table lookup and randomized for implementation. In this manner, homes with older and weaker roof cover are assumed to be subjected to a higher $A(v_{wind})$ value than homes with newer and stronger roof cover. This is consistent with post-storm investigation studies that have identified a correlation between roof cover age and vulnerability (e.g. Gurley and Masters, 2011; Liu and Pogorzelski et al., 2010).

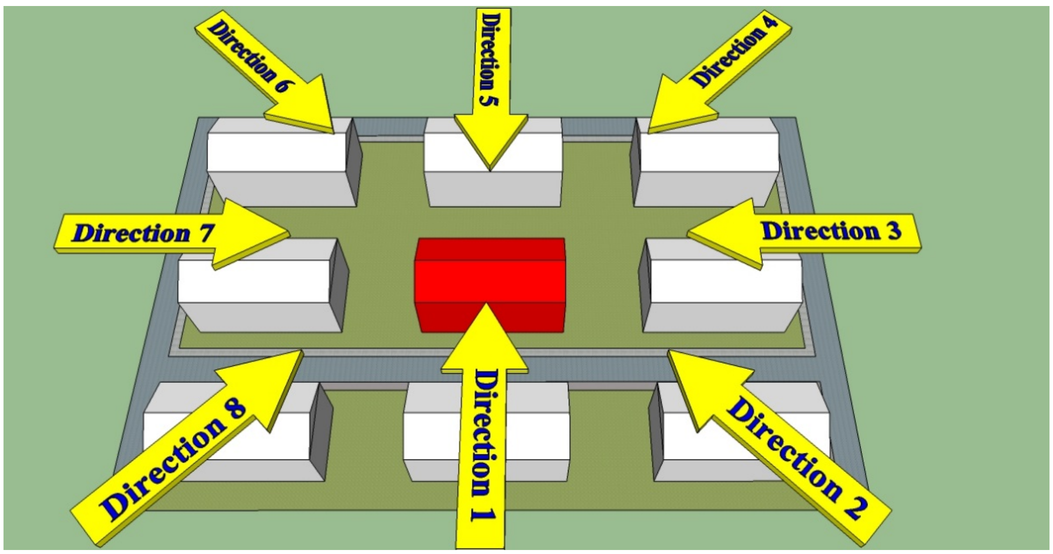


Figure 54. Evaluating NA for eight approach directions

$B(v_{wind})$ is probability of a airborne missile hitting the subject building. Referring to Figure 54, for a given direction, any airborne shingles that approach the subject building may fall short of, fly over, or strike the building. This is a function of the missile object, distance (sparse or dense neighborhoods), and wind speed and turbulence. A stochastic flight trajectory model (Laboy et al., 2013) is employed in a Monte Carlo framework (100,000 simulations). Inputs to this model include the flight object parameters (e.g. shingles), distance from source to target (dense or sparse neighborhoods), local wind turbulence (suburban or open terrain), and wind speed. A series of curves were developed to determine the mean probability of available debris striking the subject building (stratified by floor) as a function of the above mentioned variables, and are stored in a library to access for a given vulnerability simulation.

C is the fraction of the total area of a particular opening category (window, entry door or sliding door) to area of the impacted wall in which it exists. Now that the probability of a floor being hit has been determined ($B(v_{wind})$), the probability of the debris hitting the opening of interest is assessed. This is the area of the opening divided by the total wall area of the floor. The C value for a 4ft by 4ft window on a wall with dimensions 10ft by 40ft is equal to .04. Based on this value, if a projectile was to strike this wall, there is 4% chance of it hitting the window being evaluated.

$D(v_{wind})$ is the probability that a window impacted by debris will be damaged. It is a function of the missile object, impact velocity, angle of incidence, and material being impacted. The missile object is roof cover (shingles). The impact velocity and angle of incidence is captured by the flight trajectory model used to determine parameter B. The material being impacted is either standard annealed or impact resistant glass. A recent experimental study evaluated the momentum threshold required for shingles to break unprotected residential window glass. The study concluded that the wind speed necessary to remove and transport shingles a sufficient distance to the target convey sufficient momentum to break annealed glass (Masters et al., 2010). This is incorporated in the current model by assigning a value of 1.0 (100%) to the D parameter. That is, shingles will break standard glass if impact occurs.

Mitigation of damage from debris impact can be achieved via impact resistant glazing products (i.e. impact resistant glass) and / or exterior impact protection (plywood or metal shutters). This is implemented by reducing the probability of missile impact rather than adjusting the impact damage capacity (B is adjusted rather than D). The effect is combinatorial, such that impact resistant glass with shutters is less vulnerable than standard glass with shutters.

The implementation of the above components results in a probability of debris damage value as a function of wind speed, direction, building density / terrain, height of the opening on the building face, and window protection. A random number draw from a uniform distribution then determines the occurrence of damage for each opening on the subject building.

Treatment of water infiltration in the commercial residential model

The modelers developed a novel approach to assess interior damage. The method complements the component approach described above to compute the damage to the building envelope (Weekes et al., 2009). The method is summarized in . The model estimates the amount of wind-driven rain that enters through the breaches and defects (also referred to as pre-existing deficiencies) in the building envelope and converts it to interior damage. The approach is described below.

The building components that the model considers for low rise buildings are roof cover, roof sheathing, wall cover, wall sheathing, gable cover, gable sheathing, windows, entry doors and sliding doors. For an initial wind speed, the model starts loading the exterior damage array, expressed as breach areas of each component for thousands of simulation runs. It has been demonstrated that in buildings subjected to hurricane winds, the interior damage may start well before there are any breaches in the envelope (Mullens et al., 2006). The interior damage at this early stage is non-negligible and is caused by the building's existing defects that may be hidden or not, such as cracks, poorly caulked electrical outlets and ventilation ducts, inadequately sealed windows and doors, soffits, baseboards, door thresholds, etc. (Lstiburek, 2005). An estimated area of existing defects or deficiencies in envelope components is accounted for.

The quantification of existing defects is based on the surveys published in Mullens et al. (2006) and the American Society of Heating, Refrigerating and Air-Conditioning (ASHRAE) Handbook (2001) for estimating the infiltration area. To capture the quality of the construction, the model applies defect densities depending on the building's strength, which is related to the year built. Thus, strong buildings will have fewer defects than medium and weak buildings.

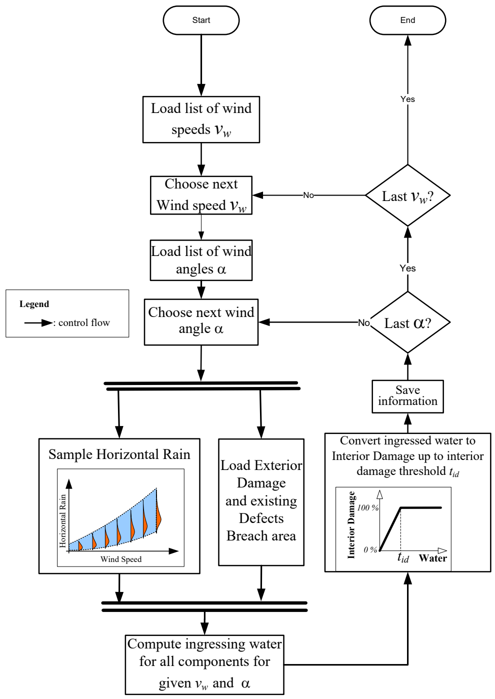


Figure 55. Flowchart of the interior damage model

Recent studies have shown that water ingress via wind driven rain cannot be attributed exclusively to envelope breach, installation, or product defects. Properly manufactured, installed, and caulked fenestration may nonetheless offer leakage paths in extreme wind conditions, the severity of which is highly dependent on the specific product (Salzano et al., 2010). As this line of research matures, its findings will be incorporated within the above framework.

In order to estimate water intrusion into the buildings, a study was performed to estimate the likely accumulated wind driven impinging rain on a structure during a hurricane event. This study used a simulation model that is composed of a simplified wind model and the R-CLIPER rain rate model developed at NOAA HRD (Lonfat et al., 2007) and is used operationally at NHC. The simplified wind model is based on Holland (1980) and includes parameters for the pressure profile ("B"), Rmax, translation speed and central pressure. Additionally, the Vickery (2005) pressure filling model was used to decay the storms. Storm parameters are sampled from distributions relevant to Florida. The R-CLIPER model determines the vertically free-falling rain rates at each time step of the simulation. The R-CLIPER rain rate is essentially an azimuthally averaged rain rate that varies as a function of radius and maximum intensity of the storm. A detailed presentation of this study is given in Pita et al. (2012a) and Pita (2012).

The study simulates the duration of the event from the time a location enters the storm affected area (within 450 km of the storm center) until exit. The number of storm simulations was 100,000 and for each simulation, 91 locations were selected to record the accumulated wind driven rain ("WDR") and maximum three-second wind gust at 10 m. Each location was specified to be a multiple of 10 km away from the storm closest approach to center (from 450 km to the left of the storm to 450 km to the right of the storm, in steps of 10 km. A direct hit is at 0 km). The time step of the model was 0.1 hr. In addition to the total wind driven rain during the event, separate accumulations were recorded starting at the time that a location experiences the peak wind of the storm event ("WDR2"). The wind driven rain accumulated prior to the maximum peak gust ("WDR1") is computed as the difference: WDR1=WDR-WDR2. The resulting accumulations are then distributions of wind driven rain as a function of the peak three-second wind gust for 10 meter height.

Since WDR1 and WDR2 are not uniformly distributed through time (with higher concentration around the max wind speed), not all surfaces of a building will be subject to equal shares of wind driven rain as the storm rotates around the building. To account for this, we developed a directionality scheme where, during the rain simulation process, we record and calculate the WDR1 and WDR2 values while the wind direction falls into successive 45° octants.

The distribution of the wind driven rain at a particular location as a function of time is illustrated in Figure 56. αm is the fraction of WDR1 (i.e. the fraction of the area under the curve) while the wind direction is in a particular octant "m" (where m = 1, 2 … i represents the possible total number of changes in the wind direction prior to the occurrence of max wind speed). Similarly, βn represents the fraction of WDR2 while the wind direction is in a particular octant "n" (where n= 1,2,3….j represents the possible total number of changes in the wind direction after the occurrence of max wind speed). The vulnerability model assumes the peak wind to occur at the center angle of the sector or octant (at time t_{wmax} in Figure 56). For the sake of consistency with the damage model, in the rain study, the sectors are defined so that the peak wind occurs at the center of the sector which contains the max wind.

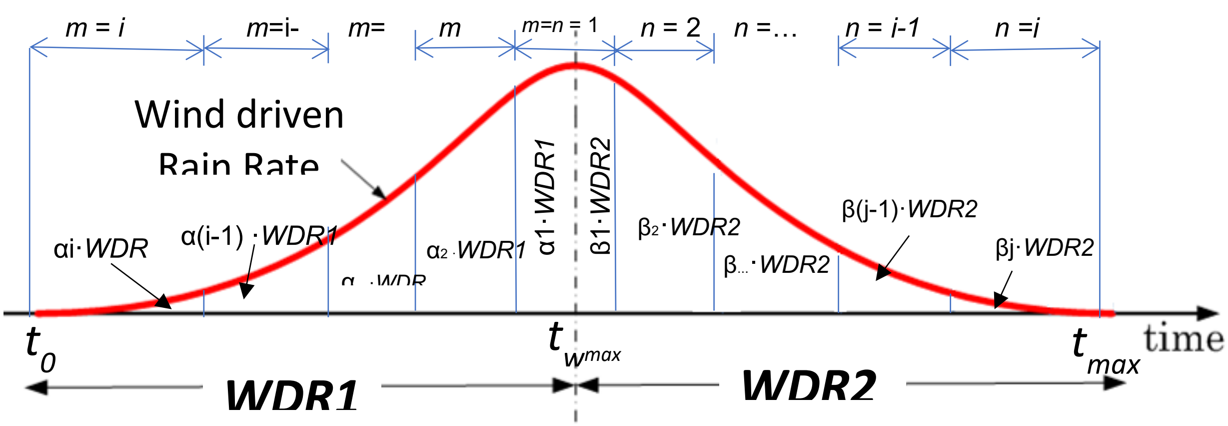


Figure 56. Wind driven rain rate as a function of storm duration

The overall volume of free stream wind driven rain (WDR) expected at a particular location can be reduced to the following equation:

$$WDR = \sum_{m=1}^{i} \alpha_m * WDR_1 + \sum_{n=1}^{j} \beta_n * WDR_2$$

where α_m is the fraction of WDR1 for a given wind direction octant and i is the total number of wind direction changes between the initial start of the storm (t_0) and the time of max wind speed (t_{wmax}). Consequently, $\sum_{m=1}^{i} \alpha_m = 1$ and m = 1 represents the wind direction octant at t_{wmax}, and m=i represents the wind direction at the beginning of the storm, t_0. If i=1 it means that the wind has blown in the same octant from t_0 to t_{wmax}.

Similarly, β_n is the fraction of WDR2 for a given wind direction octant and j is the total number of wind direction changes from the time of max wind speed to the end of the storm. Consequently, $\sum_{n=1}^{j} \beta_n = 1$ and n = 1 represents the wind direction at the time of maximum wind velocity (t_{wmax}), while n= j represents the wind direction at the end of the storm t_{max}.

Water intrusion model for low-rise CR building

The FPHLM interior damage model performs Monte Carlo simulations to estimate the total volume of water that penetrates through a building envelope on a component by component basis, through either defects in the component or breaches. Each simulation corresponds to a given wind direction octant (from 0° to 315° in 45° increments) and a given maximum wind speed (from 50 to 250 mph, in 5 mph increments). Each component is evaluated for both the directly impinging and the surface runoff rain. The total volume of water V_($_{totCi}$) for each component C_i can therefore be expressed by the general equation.

$$V_{tot_{Ci}} = V_{IR_{Ci}} + V_{SR_{Ci}} = RAF \cdot WDR \cdot A_{o_{Ci}} + SRC \cdot WDR \cdot A_{SR_{Ci}}$$

where:

- $V_{IR_{Ci}}$ is the volume of wind driven impinging water penetrating through the component Ci
- $V_{SR_{Ci}}$ is he volume of surface run-off water penetrating through the component Ci
- RAF is the rain admittance factor, which transforms the wind driven rain in impinging rain
- SRC is the surface runoff coefficient, which transforms the wind driven rain in surface run-off
- A_{oCi} is the open area of the component Ci, either through defect and/or breach
- A_{SRCi} is the reference surface runoff area or upstream area of the defect or breach collecting water, for component Ci, which is a function of the wind direction;
- WDR is the wind driven rain, either WDR1 or WDR2 (before or after the occurrence of the maximum wind speed), sampled for each maximum wind speed from the full distribution of wind driven rain from the simulation.

The rain admittance factor (RAF) is the fraction of the approaching wind driven rain that strikes the building. It accounts for the effect of a large portion of the rain moving around the structure with the wind rather than striking the building surface and is dependent on the building shape. Both RAF and SRC are independent of the wind speed, but both are a function of the wind direction with respect to the building. The values of RAF and SRC are the result of an extensive testing program carried on at the Wall of Wind at FIU (Baheru et al., 2014a, 2014b).

For any given simulation, the link between the rain study and the vulnerability model is the maximum wind speed w_{max}. As the storm rotates before and after the occurrence of the maximum wind speed, it subjects any given defect or breach on a particular surface to all the fractions of impinging rain corresponding to the different wind directions (or octants) from the storm rotation.

Consequently, before t_{wmax} (i.e. before the occurrence of w_{max} and the occurrence of any breach in the model for that simulation), the total value of impinging rain penetrating through a component defect area A_{d_Ci} is the sum of the corresponding fractions of impinging rain over the wind direction octants θ_m, as the storm rotates from its start to t_{wmax}.

$$V_{IR1_{Ci}} = \left[\sum_{m=1}^{4} RAF_{\theta m} * \overline{a_m}(w_{max})\right] * WDR_1 * A_{d\_Ci}$$

where:

- $\overline{a_m}(w_{max})$ is the mean fraction of WDR1 for the the wind direction octants θm. It is a function of wmax.
- $RAF_{\theta m}$ is the rain admittance factor for the the wind direction octant θm, which transforms the free field horizonal rain into impinging rain.

Similarly, the total value of surface run-off water penetrating through a defect is the sum of the corresponding fractions of surface run-off water over the wind direction octants θ_m, as the storm rotates from its start to t_{wmax}. The total quantity WDR1 can be factored out of the summation, since it is independent of the angle.

$$V_{SR1_{Ci}} = \left[\sum_{m=1}^{4} SRC_{\theta m} * \overline{a_m}(V_{max}) \; * A_{SR\,Ci_{\theta m}}\right] * WDR_1$$

where:

$SRC_{\theta m}$ is the surface run-off coefficient for a wind direction octant θ_m, which transforms the free field horizonal rain into run-off water.

For each damage simulation, θ_1 is the wind direction or octant at t_{wmax}, θ_2 is the previous octant in the rotation (45 degrees), and so on.

After t_{wmax} (i.e. after the occurrence of w_{max} and the occurrence of some breaches in the model for that simulation), the total amount of impinging rain penetrating through the breach and the remaining defects of componnet C_i is the sum of the corresponding fractions of impinging rain over the wind direction octants θ_n, as the storm rotates from t_{wmax} to its end.

$$V_{IR2_{Ci}} = \left[\sum_{n=1}^{5} RAF_{\theta n} * \overline{\beta_n}(w_{max})\right] * WDR_2 * A_{oCi}$$

where:

$\overline{\beta_n}(w_{max})$ is the mean fraction of WDR_2 for the the wind direction octants θ_n. It is a function of w_{max}. $RAF_{\theta n}$ is the RAF value for a wind direction octant θ_n.

Similarly, the total value of surface run-off penetrating through a component breach and its remaining defects is the sum of the corresponding fractions of surface run-off water over the wind direction octants θ_n, as the storm rotates from t_{wmax} to its end. The total quantity *WDR2* can be factored out of the sumation, since it is independent of the angle.

$$V_{SR2_{Ci}} = \left[\sum_{n=1}^{5} SRC_{\theta n} * \overline{\beta_n(w_{max})} \; * A_{SR\,Ci_{\theta n}}\right] * \; WDR_2$$

where $SRC_{\theta n}$ is the SRC value for a wind direction octant θ_n. For each damage simulation, θ_1 is the wind direction or octant at t_{wmax}, θ_2 is the next octant in the rotation (45 degrees), and so on.

Over the entire duration of the storm, the total amount of water penetrating through a component will be:

$$V_{tot_{Ci}} = V_{IR_{Ci}} + V_{SR_{Ci}} = V_{IR1_{Ci}} + V_{SR1_{Ci}} + V_{IR2_{Ci}} + V_{SR2_{Ci}}$$

The volume of water in the equation above can be transformed in heights of water at each story by dividing by the floor area of the story A_b.

$$h_{tot_{Ci}} = \frac{V_{tot_{Ci}}}{A_b}$$

Water intrusion model for mid/high-rise CR buildings

There is no data available on RAF and SRC for mid/high-rise buildings at this point. Therefore the water intrusion model has not changed and is the same as the previous version 5.0 of the FPHLM. The product of the areas of the breaches and defects by the impinging rain conveys the amount of water that enters the building. The water penetration at each story is computed as follows.

Water penetration through components defects or pre-existing deficiencies:

$$h_{C_i}^{d} = \frac{f_{sim} \cdot f_{Run} \cdot RAF \left[WDR_1 \underbrace{\left(d_{C_i} A_{C_i}\right)}_{\text{Total Defects Area}} + WDR_2 \underbrace{\left(d_{C_i} A_{C_i} S_{C_i}\right)}_{\text{Post-breach Defects Area}} \right]}{A_b}$$

Water penetration through breaches:

$$h_{C_i}^{b} = \frac{f_{sim} \cdot f_{Run} \cdot RAF\left[WDR_2 \cdot A_{C_i}^{B}\right]}{A_b}$$

where:

h^d_{Ci}: height of water that accumulates due to defects in component *i*, in inches
h^b_{Ci}: height of water that accumulates due to envelope breaches in component *i*, in inches
f_{sim}: adjustment factor which takes into account that defects and breaches will progressively change from windward to leeward or vice-versa as the storm rotates
f_{Run}: adjustment factor for the water that runs-off the external surfaces of the building and ingress through the defects and breaches and into the building
RAF: rain admittance factor
d_{Ci}: defects percentage
A_{Ci}: area of component *i*
A^B_{Ci}: breach area of component *i*
A_b: floor area
WDR_1 : mean value of the accumulated wind driven rain prior to maximum wind speed
WDR_2 : mean value of the accumulated wind driven rain after the occurrence of maximum wind speed
S_{Ci} : survival factor for component $i = 1 - A^B_{Ci} / A_{Ci}$

Rain admittance factor, RAF

Straube and Burnett (2000) and Blocken and Carmeliet (2010) suggest values for RAF between 0.5 and 1.0 for mid-/high-rise buildings. Accordingly, the FPHLM adopted a value of 0.6 for mid/high-rise buildings, except for the last story where a value of 1.0 was adopted.

Water percolation for both LR and MHR CR

In multi-story low-rise buildings, a portion of the ingressed water percolates downward from story to story. The interior damage model assumes the percolation ρ to be 12% of the ingressed water at each story for low rise building (plywood floors) and 10 % for mid/high rise building (concrete slabs). These values of percolation are based on engineering judgment, supported by calibration of the model with the insurance claims data, and thus can be updated when new research becomes available.

Figure 57 illustrates the percolation mechanism for water ingressing at a given story from pre-existing deficiencies and breaches in any component C_i. Upper story "*j*" gets rain from the pre-existing deficiencies and the breached openings, which is converted into the heights of ingressed water, $h^d_{C_j}$ and $h^b_{C_j}$, respectively. A fraction of these water heights percolates down as $\rho h^d_{C_j}$ and $\rho h^b_{C_j}$. Rain also enters in the second story "*k*" through pre-existing deficiencies and the openings as $h^d_{C_k}$ and $h^b_{C_k}$, respectively.

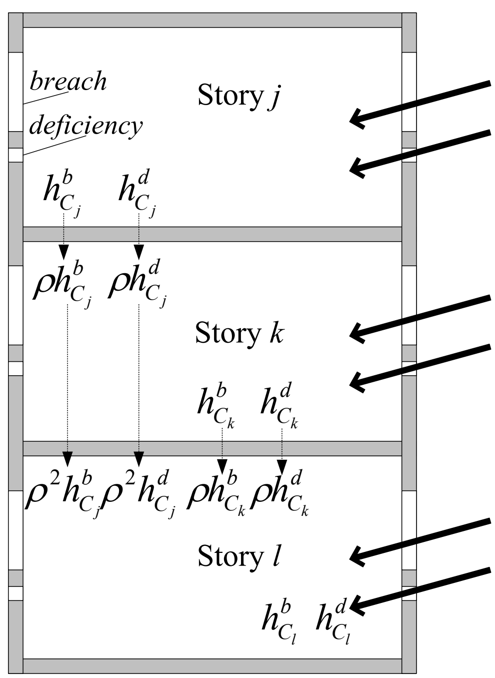


Figure 57. Diagram of water intrusion through breaches, deficiencies and percolation in a 3-story building

The total amount of water in story *k* of Figure 57 is:

$$h_k = \sum_C \left\lfloor \rho\left(h^b_{C_j} + h^d_{C_j}\right) + \left(h^b_{C_k} + h^d_{C_k}\right)\right\rfloor$$

Likewise, the total water height at the first story "*l*" of a 3-story building is:

$$h_l = \sum_C \left[\rho^2 \left(h_{C_j}^b + h_{C_j}^d \right) + \rho \left(h_{C_k}^b + h_{C_k}^d \right) + \left(h_{C_l}^b + h_{C_l}^d \right) \right]$$

Thus in 2-story and 3-story buildings, the first story gets the percolated water from the second story by adding a $\rho h_{C_2}^d$ or $\rho h_{C_2}^b$ to the water coming from deficiencies and breaches respectively. The amount of water percolating downward is not subtracted from the total amount of water at the story where it originated. It is assumed that even if water percolates downward, it still has the potential to produce damage before leaking downward.

In conclusion, these approaches for LR and MHR CR estimate the amount of water that enters through each component of the envelope. The total amount of water is calculated by adding the contributions of all components for a given wind speed, including percolation. The final step maps water inside the building to interior damage with a bilinear relationship, where total interior damage is achieved for a certain threshold of height of accumulated water (currently set at 1 inch).

Treatment of water infiltration in the personal residential model

The overall building damage is the sum of external damage plus interior damage plus utilities damage. In the PR model, the interior damage is extrapolated from the external damage, and the utilities damage is proportional to the interior damage, based on heuristics derived from engineering judgment validated with claims data. This model implicitly includes water infiltration at moderate to high wind speeds.

In damage surveys of past hurricanes (Gurley, 2006), it was observed that a number of houses that were not damaged on the outside did experience losses from water penetration. The heuristic interior damage model was adjusted to address these observations. In order to model rain induced damage, even in the absence of external damage at low wind speeds, a leak internal damage model was developed, which is independent of external damage at low wind speeds, while at higher wind speeds, the relationship between internal and external damage was maintained.

The leak model creates a smooth transition between interior damage at low wind speed (governed by leaks) and interior damage at high wind speed (governed by water penetration through breaches) by means of a polynomial equation coupled with an exponential decay function. The shape of the polynomial model was defined based on engineering judgment and calibrated and validated based on damage observed during the 2004 hurricane season, and the corresponding claims data (Artiles, 2006; Johnson, 2011). The model was first implemented in V3.1 of the FPHLM.

13. Provide a completed Form V-1, One Hypothetical Event. Provide a link to the location of the form here.

See Form V-1.

The model computes the damage based on actual terrain three-second gust winds at 10 m, that are obtained from the given open terrain one-minute sustained winds, and the losses are aggregated twice: once among the ZIP Codes with the same actual terrain three-second gust wind and once among the ZIP Codes with the same open terrain one-minute sustained wind. Because all the ZIP Codes do not have the same roughness, identical open terrain one-minute sustained winds result in different actual terrain three-second gust winds. Occasional bumps in the one-minute sustained winds plot are due to this process of conversion and re-aggregation. The modelers do confirm that the structures used in completing the form are identical to those in the table provided in the Standard.

The insured value for the condo association of the 20 story concrete structure with 8 apartments per story was changed from \$100,000 to \$15,000,000 since this is a more realistic insured value for a condo association for a building of these characteristics. The change was necessary since the value of the external damage in the model is computed on the basis of the actual replacement value of the damage openings. The actual value of these repairs can be disproportionally high if compared to an arbitrarily low and unrealistic insured value. The adjustment in the insured value of the 20 story concrete structure then provides more realistic damage ratios. The resulting large discrepancies in damage ratios vs. wind speed between the personal residential reference structures in Form V-1 (i.e. timber, masonry, and manufactured home) and the engineered commercial residential reference structure are due to the fact that they correspond to widely different types of structures. Therefore, it is informative to report them separately, which is done in the last two tables of Part A of the form.

V-2 Derivation of Contents and Time Element Hurricane Vulnerability Functions

A. Development of the contents and time element hurricane vulnerability functions shall be based on at least one of the following: (1) insurance claims data, (2) tests, (3) rational structural analysis, and (4) post-event site investigations. Any development of the contents and time element hurricane vulnerability functions based on rational structural analysis, post-event site investigations, and tests shall be supported by historical data.

The development of the hurricane vulnerabilities is based on a component approach that combines engineering modeling, simulations with engineering judgment, and insurance claims data. The content and time element hurricane vulnerabilities are extrapolated from the building damage on the basis of expert opinion and post-events site investigations of areas impacted by recent hurricanes and are confirmed using historical claims data.

B. The relationship between the modeled building and contents hurricane vulnerability functions and historical building and contents hurricane losses shall be reasonable.

The relationship between the modeled structure and the contents hurricane vulnerability functions is reasonable, on the basis of the relationship between historical structure and contents hurricane losses.

C. Time element hurricane vulnerability function derivations shall consider the estimated time required to repair or replace the property.

Time element hurricane vulnerability function derivations consider the estimated time required to repair or replace the property.

D. The relationship between the hurricane model building, contents, and time element hurricane vulnerability functions and historical building, contents, and time element hurricane losses shall be reasonable.

For Personal Residential risks the hurricane vulnerability functions for building, contents, and additional living expense have been calibrated using historical claims data on building, contents, and additional living expense.

For Commercial Residential risks the relationship between model building, contents, and time element loss costs is reasonable. Since no historical loss data were available for calibration, the relationship combines engineering and actuarial judgment.

E. Time element hurricane vulnerability functions used by the hurricane model shall include time element hurricane losses associated with wind, missile impact, flood, and storm surge damage to the infrastructure caused by a hurricane.

The time element vulnerability functions produced by the model consider time element claims arising from wind, flood, and storm surge damage to the infrastructure. The model does not distinguish explicitly between direct and indirect loss. For Personal Residential risks the time element vulnerability functions were calibrated against claims data that include both types of losses. For Commercial Residential risks the recognition of claims due to indirect loss is based on judgment since no historical loss data were available for calibration.

Disclosures

1. Describe any modifications to the contents and time element vulnerability component in the hurricane model since the previously-accepted hurricane model.

- No change to report for Personal Residential home owners.
- No change to report for Commercial Residential.

2. Provide a flowchart documenting the process by which the contents hurricane vulnerability functions are derived and implemented.

Personal Residential model

Contents include anything in the home that is not attached to the structure itself. Like the interior and utilities, the contents of the home are not modeled in the exterior damage Monte Carlo simulations. Contents damage is modeled as a function of the interior damage caused by each exterior component failure that causes a breach of the building envelope. The function is based on engineering judgment and validated using claims data. The resulting computation of contents vulnerability functions is a 3 stage process as described in , and discussed in disclosure 3 below.

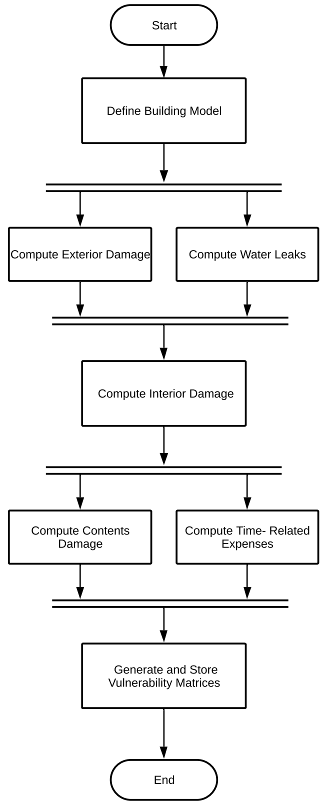


Figure 58. Derivation of contents and additional living expenses vulnerabilities for PR.

Commercial Residential model

The contents vulnerability functions for commercial residential structures are derived from the interior vulnerabilities (which are described in disclosure 13 of standard V-1), and it is represented by below. In other words, the contents vulnerability functions are set to be proportional to the interior vulnerabilities.

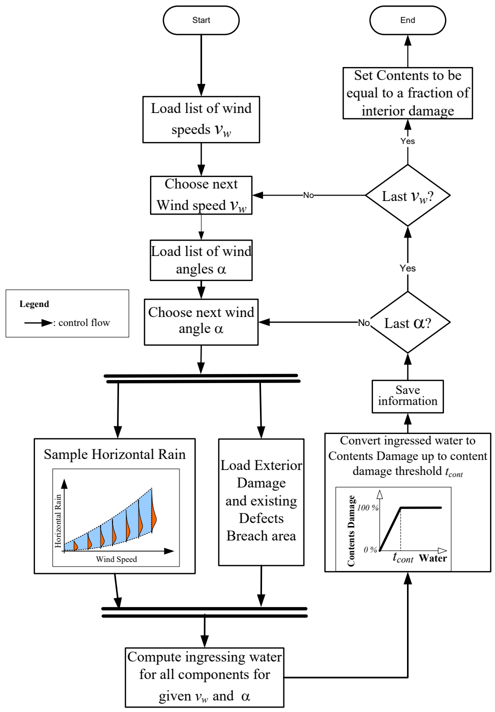


Figure 59. Derivation of contents vulnerabilities for CR.

3. Describe the assumptions, data (including insurance claims data), methods, and processes used to develop and validate the contents hurricane vulnerability functions.

Personal Residential model

For each building model, the first stage in the development of contents vulnerability functions corresponds to the external damage assessment through Monte Carlo simulations as discussed in standards G-1 and V-1. In the personal residential model, this is complemented by an empirical estimate of water penetration from wind driven rain due to exterior breaches or leakage paths in undamaged structures (see disclosure 13 of standard V-1). The second stage corresponds to the computation of internal damage. Damage to the interior occurs when the building envelope is breached, allowing wind and rain to ingress. Damage to roof sheathing, roof cover, walls, windows, doors, and gable ends present the possible sources of water ingress. Interior damage equations are derived as heuristic functions of each of these components failure. These relationships are developed primarily on the basis of experience and engineering judgment. Observations of homes damaged during the 2004 hurricane season (Gurley, 2006) helped to validate the predictions. The third stage in the damage estimation () extrapolates the damage to contents from the interior damage, based on a heuristic function. This empirical function is based on engineering judgment and was validated against claims data for Hurricanes Andrew, Charley, and Frances, among others.

Commercial Residential model

Contents damage is assumed to be proportional to interior damage. Therefore, the methods used to develop vulnerability functions for contents coverage associated with commercial residential structures are the same as the methods used for interior damage vulnerability functions. The contents damage is determined by vulnerability functions which correspond to different combinations of wall type (frame or masonry), sub-region (high velocity hurricane zone, wind-borne debris region, inland), roof shape (gable or hip), roof cover (metal, tile or shingle), window protection (shuttered or not shuttered), number of stories (one, two, or three), and strength (weak, medium, or strong).

Based on engineering judgment, contents damage ratio in mid/high-rise buildings (more than three stories) is also estimated to be proportional to the total estimated interior damage ratio for the building.

4. Provide the total number of contents hurricane vulnerability functions. Describe whether different contents hurricane vulnerability functions are used for personal residential, commercial residential, manufactured homes, unit location for condo owners and apartment renters, and various building classes.

Contents vulnerability functions were derived for manufactured and site-built homes, and for low-rise commercial residential buildings (one to three stories).

A total of 4356 un-weighted contents vulnerability matrices were developed for site-built homes. The matrices correspond to different combinations of wall type (frame or masonry), region (north, central, south), subregion (high velocity hurricane zone, wind-borne debris region, inland), roof type (gable or hip), roof cover (metal, tile or shingle), window protection (shuttered or not shuttered), number of stories (one or two), and strength (weak, modified weak, retrofitted weak; medium, modified medium, retrofitted medium; strong for inland and WBDR, strong for HVHZ—see Table 1 and Table 2 in the General Standards).

These 4356 contents un-weighted matrices were then combined to produce 5226 contents weighted matrices, and 291 contents age weighted matrices for site-built homes for building, for each county. Many of the matrices are repeated because many of the counties use the same regional statistics for the weighting.

A total of 648 un-weighted contents vulnerability matrices were developed for low-rise, commercial residential buildings for building. They correspond to different combinations of wall type (frame or masonry), sub-region (high velocity hurricane zone, wind-borne debris region, inland), roof shape (gable or hip), roof cover (metal, tile or shingle), window protection (shuttered or not shuttered), number of stories (one, two, or three), and strength (weak, medium, or strong).

These 648 matrices were then combined to produce 144 contents weighted curves for low-rise, commercial residential buildings for building.

4 un-weighted contents vulnerability matrices were developed for manufactured homes for building. They correspond to four manufactured home types: (1) pre-1994—fully tied down, (2) pre-1994—not tied down, (3) post-1994—Housing and Urban Development (HUD) Zone II, and (4) post-1994—HUD Zone III. The partially tied-down homes are assumed to have a vulnerability that is an average of the vulnerabilities of fully tied-down and not tied-down homes. The un-weighted matrices are combined into 6 weighted matrices for building, for pre-1994 (4 regions: North, Central, South, Key) and post-1994 (2 zones: II and III) manufactured homes.

The contents vulnerability functions used for condo unit owners and apartment unit renters are the contents vulnerability functions for personal residential buildings, as explained in disclosure 13 of standard V-1.

5. Provide a flowchart documenting the process by which the time element hurricane vulnerability functions are derived and implemented.

Personal residential model

Additional living expenses are assumed to be a function of the interior damage caused by each exterior component failure that causes a breach of the building envelope. The function is based on engineering judgment and validated using claims data. The resulting computation of additional living expenses vulnerability functions is a 3 stage process as described in of disclosure 2, and discussed in disclosure 6 below.

Commercial Residential

The process by which the time element expenses vulnerability functions are derived and implemented for commercial residential structures is similar to the process for interior damage already described in disclosure 18 of standard V-1, and is represented in .

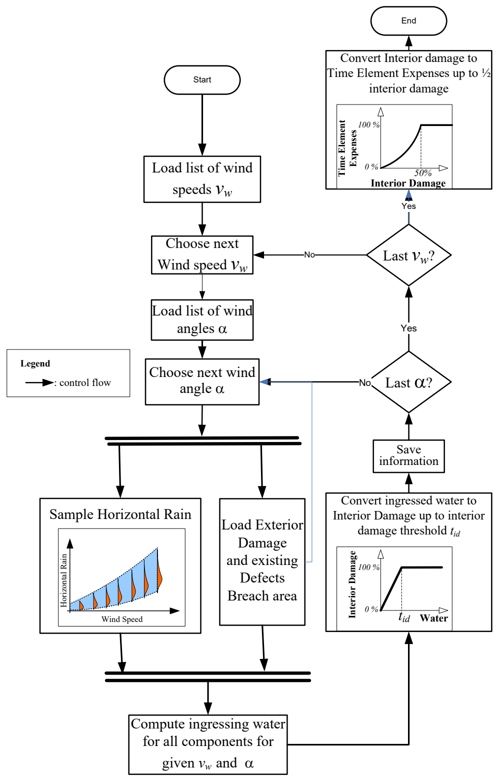


Figure 60. Derivation of time related expenses vulnerabilities for CR.

6. Describe the assumptions, data (including insurance claims data), methods, and processes used to develop and validate the time element hurricane vulnerability functions.

Personal Residential

Additional Living Expense (ALE) is coverage for expenses that arise when an individual must live away from the damaged home. ALE coverage comprises expenses actually paid by the insured. This coverage does not pay all living expenses, only the increase in living expense that results from the covered damage. The value of an ALE claim is dependent on the time needed to repair a damaged home as well as the utilities and infrastructure. Time element or Additional Living Expenses (ALE) are modeled as a function of interior damage. All the losses are based on a combination of engineering principles, empirical equations, and engineering judgment. The equations and methods used for manufactured and residential homes are identical. However, it seems logical to reduce the manufactured home ALE predictions because typically a faster repair or replacement time may be expected for these home types. Therefore, an ALE multiplier factor of 0.75 was introduced into the manufactured home model.

Commercial Residential

Owners of apartment buildings may purchase Time Element coverage in addition to wind coverage on the structure and contents. For commercial properties Time Element is an optional coverage and is therefore not purchased by all insured. It is generally a relatively expensive coverage. Some insurance carriers may not even offer Time Element coverage on commercial properties. The coverage will reimburse the owner of the building for business income lost or extra expenses incurred after a hurricane. Both “business income” and “extra expense” are subject to specific definitions and limitations within the coverage form.

We estimate Time Element (TE) losses as a heuristic function of interior damage (ID) as follows:

$$TE = 2ID^2 + ID$$

We do not allocate any portion of the structure deductible to the Time Element loss. We are assuming that Time Element Limits will be exhausted once interior damage reaches approximately 50%. From an underwriting perspective, it is necessary to restrict Time Element coverage limits in order to avoid any disincentive to rapid repairs.

In the case of mid/high rise condominium association policies no time element coverage is assumed, so it is not modeled.

Validation

The 2004 hurricane insurance provided a wealth of claim data, used to validate and calibrate the FPHLPM (Artiles, 2006; Pinelli et al., 2006). First, the consistency and validity of the data itself was investigated (see standard A-1), and the associated wind speed data was sought from NOAA. The results from the model were then compared to the claim data for hurricanes Charley and Frances. The comparisons were done for the different structural types, for different age categories, and for different insurance companies. They included comparisons of aggregated losses and of vulnerability curves. The comparisons took into account the fact that the actual wind data that caused the damage was not always available, and there was some unknowns regarding the true nature of coverage of many insurance policies. Based on these comparisons, the engineering team recalibrated the engineering model to produce a more accurate and credible predictive capability.

In subsequent years, for every new version of the FPHLM, and as new claim data became available, comparisons of aggregated losses between actual claim data and FPHLM output were performed to validate and calibrate the model. All the claim data is described in disclosure 3 of Standard V-1. The results are shown in Figure 61 below. Each dot represents an insurance portfolio.

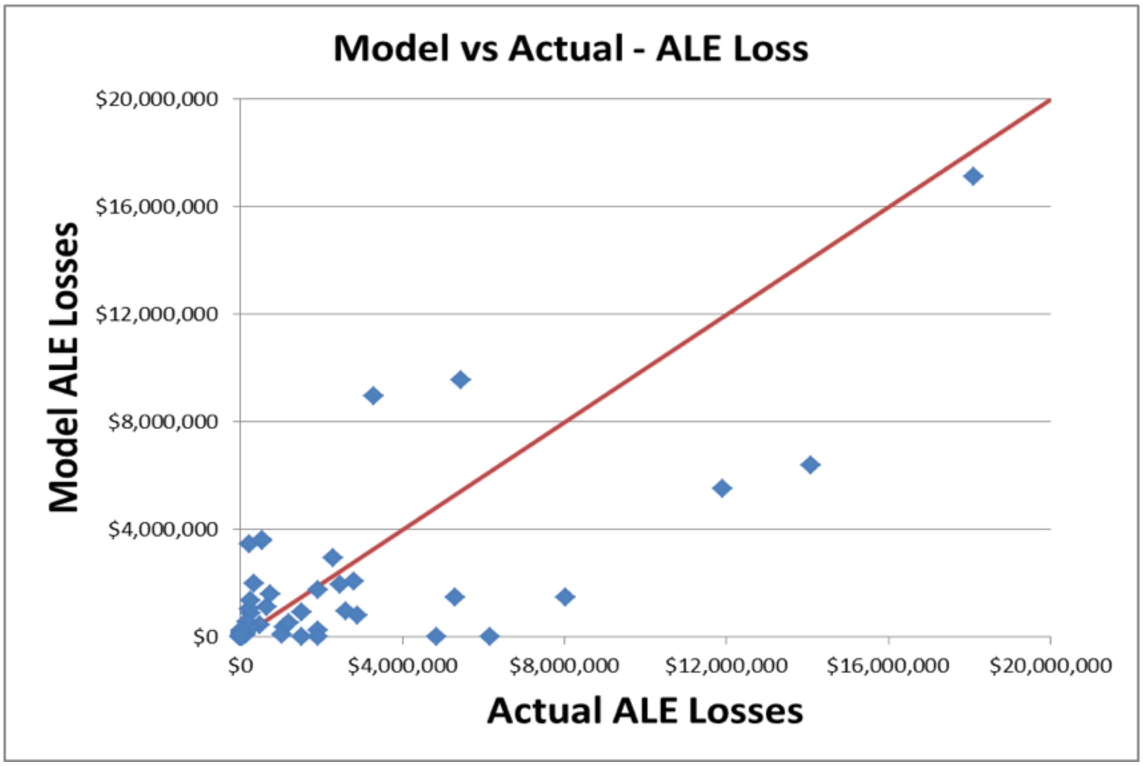


Figure 61. Model vs. Actual-ALE Loss

7. Describe how time element hurricane vulnerability functions take into consideration the damage (including damage due to storm surge, flood, and wind) to local and regional infrastructure.

Time element losses for Personal Residential and low-rise Commercial Residential buildings are based on empirical functions relating those losses to the interior damage to the structure. The model does not distinguish explicitly between direct and indirect losses to the structure, since the vulnerability functions do not explicitly consider the degree of flood or storm surge damage to the infrastructure. For Personal Residential losses there is potentially some influence of such damage injected through the validation process, since the functions are calibrated against claims data that include both types of losses. For low-rise Commercial Residential losses, however, there were no historical time element losses available for validation.

8. Describe the relationship between building structure and contents hurricane vulnerability functions.

The contents vulnerability is a function of the interior damage, which is a main contributor to the building vulnerability. Consequently, the relationship between contents vulnerability and structure vulnerability follows the relationship between overall building structure vulnerability and interior vulnerability.

9. Describe the relationship between building structure and time element hurricane vulnerability functions.

The time element vulnerability is a function of the interior damage, which is a main contributor to the building vulnerability. Consequently, the relationship between time element vulnerability and structure vulnerability follows the relationship between overall building structure vulnerability and interior vulnerability.

10. Describe the assumptions, data (including insurance claims data), methods, and processes used to develop contents and time element hurricane vulnerability functions when:

a. residential constructions types are unknown, or

b. one or more primary characteristics are unknown, or

c. one or more secondary characteristics are known, or

d. building input characteristics are conflicting.

The development of contents and time element hurricane vulnerability functions for unknown residential construction types, or when some of the primary characteristics are unknown, or one or more secondary characteristics are known, or building input characteristics are conflicting, follows the process described in disclosure 9 of standard V-1.

V-3 Hurricane Mitigation Measures and Secondary Characteristics

A. Modeling of hurricane mitigation measures to improve a building's hurricane wind resistance, the corresponding effects on hurricane vulnerability, and their associated uncertainties shall be theoretically sound and consistent with fundamental engineering principles. These measures shall include fixtures or construction techniques that affect the performance of the building and the damage to contents and shall consider:

- ***Roof strength***
- ***Roof covering performance***
- ***Roof-to-wall strength***
- ***Wall-to-floor-to-foundation strength***
- ***Opening protection***
- ***Window, door, and skylight strength.***

The modeling organization shall justify all hurricane mitigation measures considered by the hurricane model.

Modeling of mitigation measures to improve a building's hurricane wind resistance, the corresponding effects on hurricane vulnerability, and their associated uncertainties is theoretically sound and consistent with fundamental engineering principles. The effect of hurricane mitigation measures in hurricane vulnerability uncertainty is illustrated in Figure 62 through Figure 68. The following structures were modeled:

Reference case as defined by Commission
Mitigated case as defined by Commission
Reference plus one mitigation at a time

The hurricane mitigations include gable bracing, rated shingles, metal roof, stronger sheathing capacity, stronger roof-to-wall connections, stronger wall-to-sill connections, masonry reinforced walls, multiple opening protection options, and wind/missile resistant glass.

B. Application of hurricane mitigation measures that affect the performance of the building and the damage to contents shall be justified as to the impact on reducing damage whether done individually or in combination.

For the reference cases the interior damage is governed by the sheathing loss at low to moderate wind speeds. The application of mitigation measures is justified as shown in Figure 69 through Figure 72.

C. Treatment of individual and combined secondary characteristics that affect the performance of the building and the damage to contents shall be justified.

The application of individual and combined secondary characteristics is justified as shown in Figure 69 through Figure 72.

Disclosures

1. Describe any modifications to hurricane mitigation measures and secondary characteristics in the hurricane model since the previously-accepted hurricane model.

None to be reported.

2. Provide a completed Form V-2, Hurricane Mitigation Measures and Secondary Characteristics, Range of Changes in Damage. Provide a link to the location of the form here.

See Form V-2. Notice that there are no entries for the Wall-Foundation Strength rows for timber structures because the model does not have the capability to model wall-to-foundation anchors or straps for timber structures. The model does account for wall-to-sill plate connections, but not the sill plate-to-foundation connections. There are no field data to indicate that this is a significant failure mode. The connection to the foundation can be weak and is reflected in the wall-to-sill capacity (toe-nails, clips, straps).

3. Provide a description of the hurricane mitigation measures and secondary characteristics used by the hurricane model, whether or not they are listed in Form V-2, Hurricane Mitigation Measures and Secondary Characteristics, Range of Changes in Damage.

The hurricane mitigation measures and secondary characteristics include gable bracing, rated shingles, metal roof, stronger sheathing capacity, stronger roof-to-wall connections, stronger wall-to-sill connections, masonry reinforced walls, multiple opening protection options, and wind/missile resistant glass.

4. Describe how hurricane mitigation measures and secondary characteristics are implemented in the hurricane model. Identify any assumptions.

The various hurricane mitigation measures and secondary characteristics delineated in Forms V-2 and V-3 are implemented in the model by varying the capacity model parameters (mean and coefficient of variation) to reflect the strength of a given component. For example, the reference model roof covering is represented by a random value for each shingle, with the specific capacity values for a given Monte Carlo simulation randomly assigned on the basis of a specified probability density function, mean, and coefficient of variation assigned to shingles. If the strong roof cover mitigation option is chosen, a different mean reflecting higher capacity, is used to randomly assign capacities to the shingles. This same approach is used for every component for which a hurricane mitigation measure or secondary characteristic is modeled. One or any combination of hurricane mitigation measures and secondary characteristics may be selected prior to running the Monte Carlo simulation. The stronger resistances of the mitigated components are directly reflected in the randomly assigned capacities of those components. In the case of membrane, the mitigation is modeled through a reduction of the interior damage due to loss of roof cover and subsequent water penetration.

5. Describe how the effects of multiple hurricane mitigation measures and secondary characteristics are combined in the hurricane model and the process used to ensure that multiple hurricane mitigation measures and secondary characteristics are correctly combined.

Each hurricane mitigation measure and secondary characteristic (e.g., sheathing, roof cover, membrane, roof-to-wall connections) is modeled and accounted for independently, allowing any combination to be chosen. As reflected in the results in Figure 69 - Figure 72, it is assumed that the effect of mitigating one component can change the vulnerability but not the capacity of other components via the influence that mitigation has on loading or load sharing. It is also assumed that any given mitigation does not necessarily produce improved overall performance for all wind speeds. An example is the influence of the roof sheathing strength on the vulnerability of roof-to-wall connections, caused by the influence of intact strong roof sheathing on the uplift acting on weak roof-to-wall connections. Another example is the influence of opening vulnerability on the performance of other components (walls, sheathing, and roof-to-wall connections), as the change in internal pressure resulting from opening failure changes the loading on these other components.

In summary, hurricane mitigation measures and secondary characteristics may be selected individually or in combination, but the effects of a given mitigation on other components and on overall building vulnerability, should not be and are not isolated in the model.

6. Describe how building and contents damage are affected by performance of hurricane mitigation measures and secondary characteristics. Identify any assumptions.

Bracing the gable end, using rated shingles, using a membrane, or using a metal roof alone does not provide any benefit when all other components remain weak, as required by Form V-2. For example, regardless of the type of roof cover used, if the home loses its weak sheathing panels, there will be little benefit in mitigating the roof cover or gable end alone. Combining mitigation measures, however, does indeed reduce the vulnerability of the home, as demonstrated in the bottom section of Form V-2.

The hip roof has a greater impact in reducing the losses, especially in the case of frame structures. Because the base frame structure is inherently weaker, there is comparatively a higher gain with the hip timber structure than with the hip masonry structure. For example, a weak home with a hip roof is not vulnerable to gable end collapse.

Improving the roof sheathing capacity (8d nails) alone reduces the damage at wind speeds up to 100 mph and 120 mph sustained winds for wood and masonry structures, respectively, but at higher wind speeds the mitigation becomes counter-effective (Figure 69 and Figure 71). The behavior of the damage curve with mitigated sheathing after 100 (wood) and 120 (masonry) mph sustained winds is due to the still very weak roof-to-wall connections. Loss of sheathing reduces the uplift on the roof-to-wall connections. Thus, the stronger deck results in higher loads on the connections, which the connections are not prepared to absorb. This effect was recently experimentally identified through destructive testing of real structures with toe-nail connections and strong decking attachment (Shanmugam et al., 2009).

Clips and straps are very effective for frame structures, less so for masonry structures. The model emphasizes interior damage due to loss of sheathing, roof cover, or gable end, which are all independent of the roof-to-wall connection strength. If the strength of the plywood deck and roof cover is not increased, increasing the roof-to-wall connections alone will do little good at low to moderate wind speeds. At higher wind speeds, the integrity of the box system in the frame structure is improved by the stronger roof-to-wall connection, hence the more pronounced benefit for the frame structure than for masonry. The observed negative values in Form V-2 corresponding to the clip or straps mitigation are from round off of smaller values within the uncertainty scatter of the model and indicate zero change.

Clips and straps for wall-to-sill plate connections are very effective at high wind speeds for frame structures because they improve the integrity of the box system. Similarly, the reinforcing of the walls for masonry structures is more effective at high wind speeds when unreinforced walls become vulnerable.

Opening protections are effective, and more so at higher wind speeds. This follows logically, as the internal pressurization caused by an opening breach is critical to the failure of other components only at higher wind speeds.

A mitigated structure with a combination of individual hurricane mitigation measures and secondary characteristics (as per standards definition) shows improved performance over the base structure and each of the individual hurricane mitigation measures and secondary characteristics.

The nonzero damage between 40 and 60 mph sustained winds, the convergence of the base, and all mitigation cases in this wind speed range reflect the incorporation of non-exterior damage-related losses in the model. Water penetration through windows and doors is possible even without window or door breach (Salzano et al., 2010). This portion of the model is not dependent upon mitigations, thus the convergence of curves in Figure 69 through Figure 72 in that wind speed range.

7. Describe how hurricane mitigation measures and secondary characteristics affect the uncertainty of the vulnerability. Identify any assumptions.

Both the mean damage ratio and its associated uncertainty (expressed as standard deviation) differ between the reference and mitigated structures. Figure 62 through Figure 65 show the mean vulnerability curves together with the mean +/- one standard deviation for reference case and the mitigated case, for both masonry and timber.

To better contrast the reference and mitigated structure damage ratios, Figure 66 shows the percent change in the mean damage ratio from the reference to the mitigated structure for both masonry and timber. As expected, there is a reduction in mean damage in the mitigated structure relative to the reference structure. The magnitude of the reduction varies with wind speed, but the mitigated structure consistently has a lower damage ratio. Figure 67 shows the percent change of the standard deviation of the damage ratio from the reference to the mitigated structure for both masonry and timber. The percent change fluctuates negatively and positively over the range of wind speeds. At lower wind speeds it is expected that the standard deviation of the damage ratio of the mitigated structure should be lower. However, at higher wind speeds this expectation is not valid. The relative contribution of individual building components (some mitigated and others not) to the damage ratio change as a function of wind speed, and interact in a highly nonlinear manner. Figure 68 shows Figure 66 and Figure 67 in ratio to present the percent change in the coefficient of variation (COV), and reflects the reduced damage and reduced uncertainty of the mitigated structure at lower wind speeds.

Overall Figure 62 through Figure 68 demonstrate that the mitigated structure has a lower mean damage ratio over the full range of wind speeds, while the associated uncertainty is lower at low wind speeds and variable at higher wind speeds where significant physical damage to a combination of many mitigated and unmitigated components accumulates.

8. Provide a completed Form V-4, Differences in Hurricane Mitigation Measures and Secondary Characteristics. Provide a link to the location of the form here.

See Form V-4. Notice that there are no entries for the Wall-Foundation Strength rows for timber structures because the model does not have the capability to model wall-to-foundation anchors or straps for timber structures. The model does account for wall-to-sill plate connections, but not the sill plate-to-foundation connections. There are no field data to indicate that this is a significant failure mode. The connection to the foundation can be weak and is reflected in the wall-to-sill capacity (toe-nails, clips, straps).

9. Provide a completed Form V-5, Percentage Change in Hurricane Mitigation Measures and Secondary Characteristics, Mean Damage Ratios and Hurricane Loss Costs. Provide a link to the location of the form here.

See Form V-5. Notice that there are no entries for the Wall-Foundation Strength rows for timber structures because the model does not have the capability to model wall-to-foundation anchors or straps for timber structures. The model does account for wall-to-sill plate connections, but not the sill plate-to-foundation connections. There are no field data to indicate that this is a significant failure mode. The connection to the foundation can be weak and is reflected in the wall-to-sill capacity (toe-nails, clips, straps).

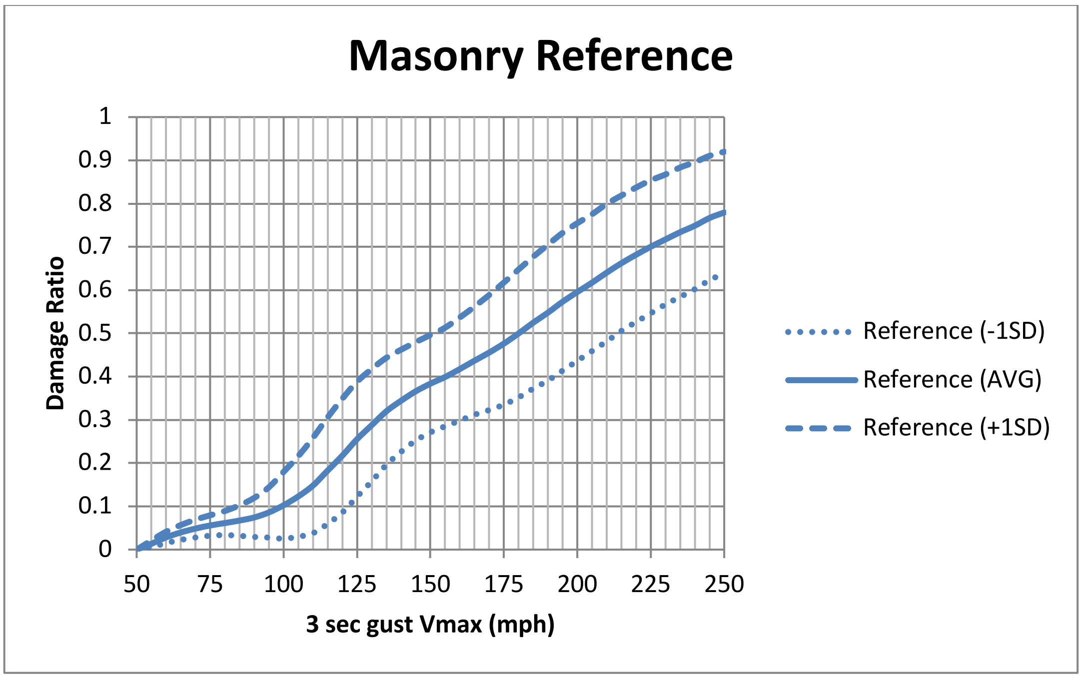


Figure 62. Masonry reference case vulnerability curves

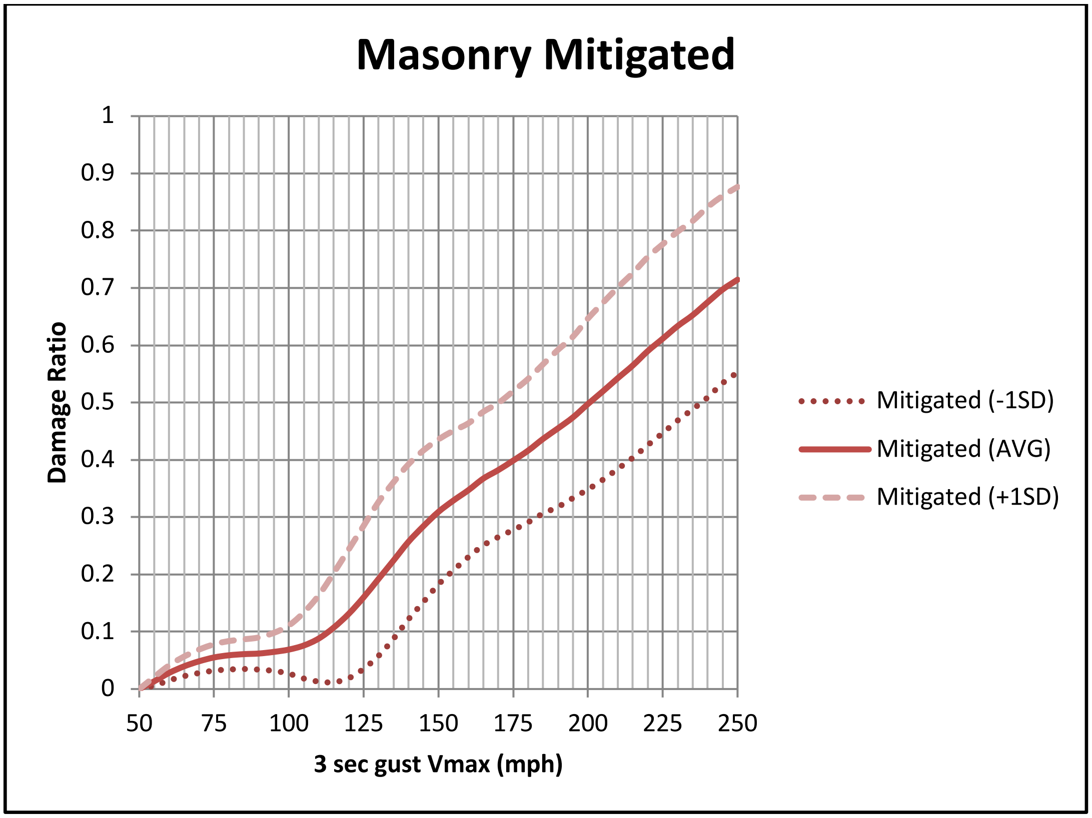


Figure 63. Masonry mitigated case vulnerability curves

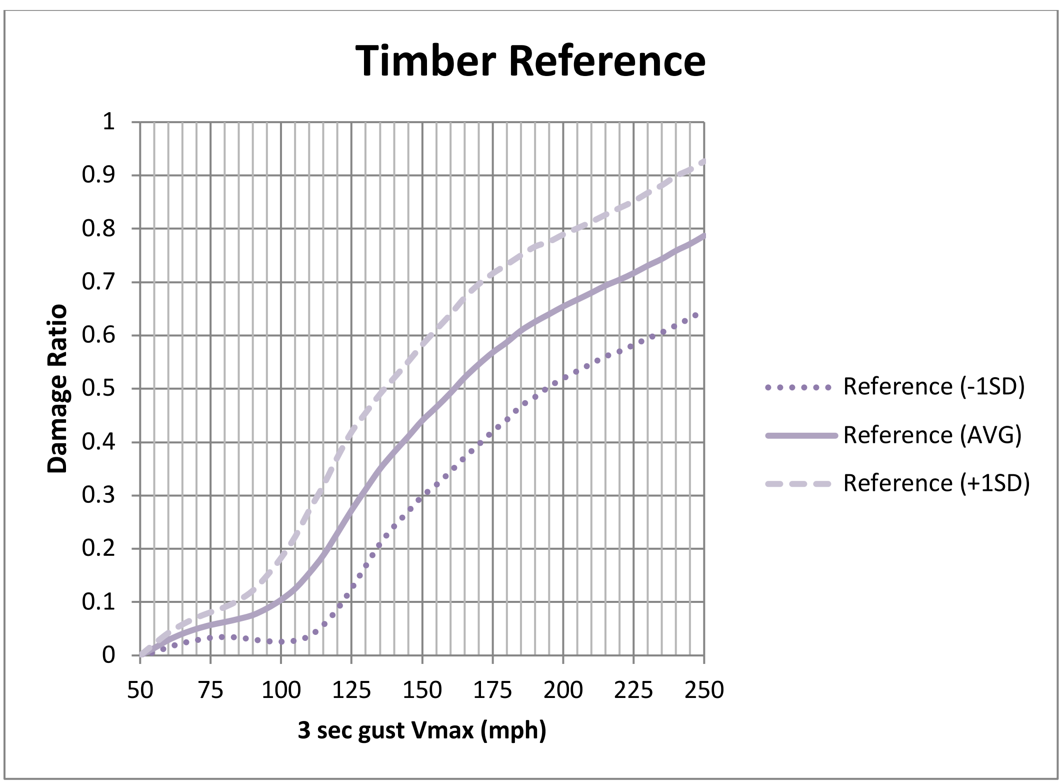


Figure 64. Timber reference case vulnerability curves

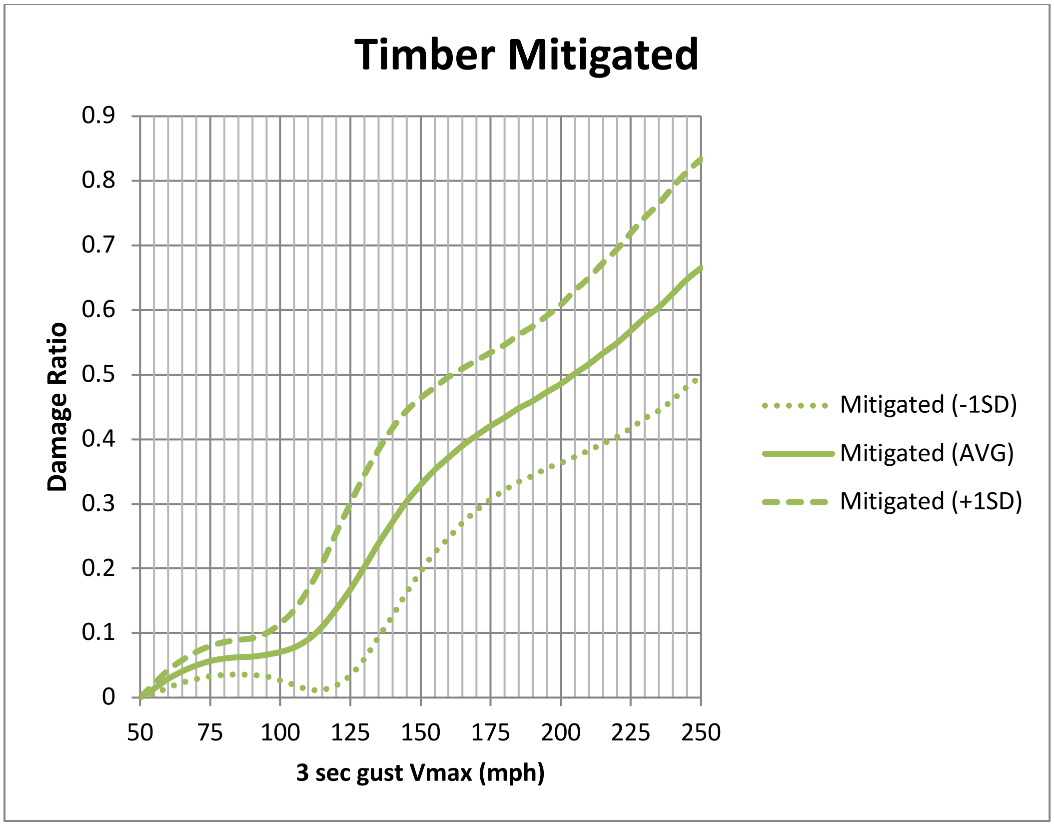


Figure 65. Timber mitigated case vulnerability curves

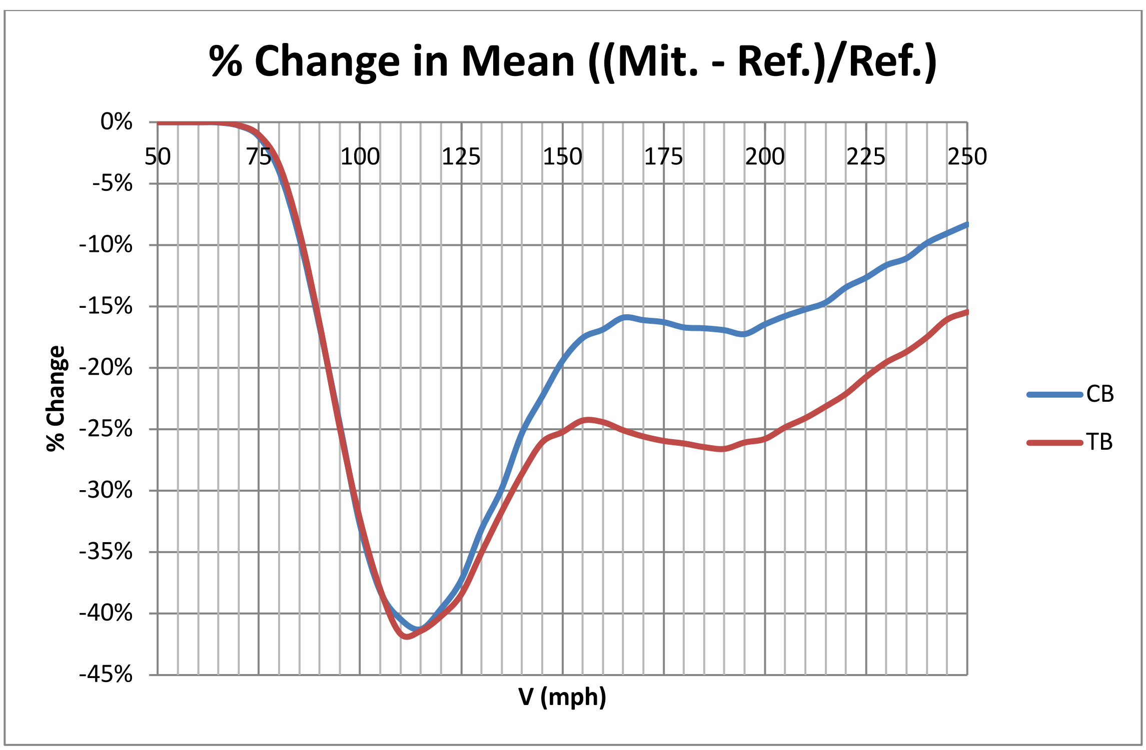


Figure 66. Percent change of mean damage ratio from reference to mitigated structure (blue: masonry, red: timber)

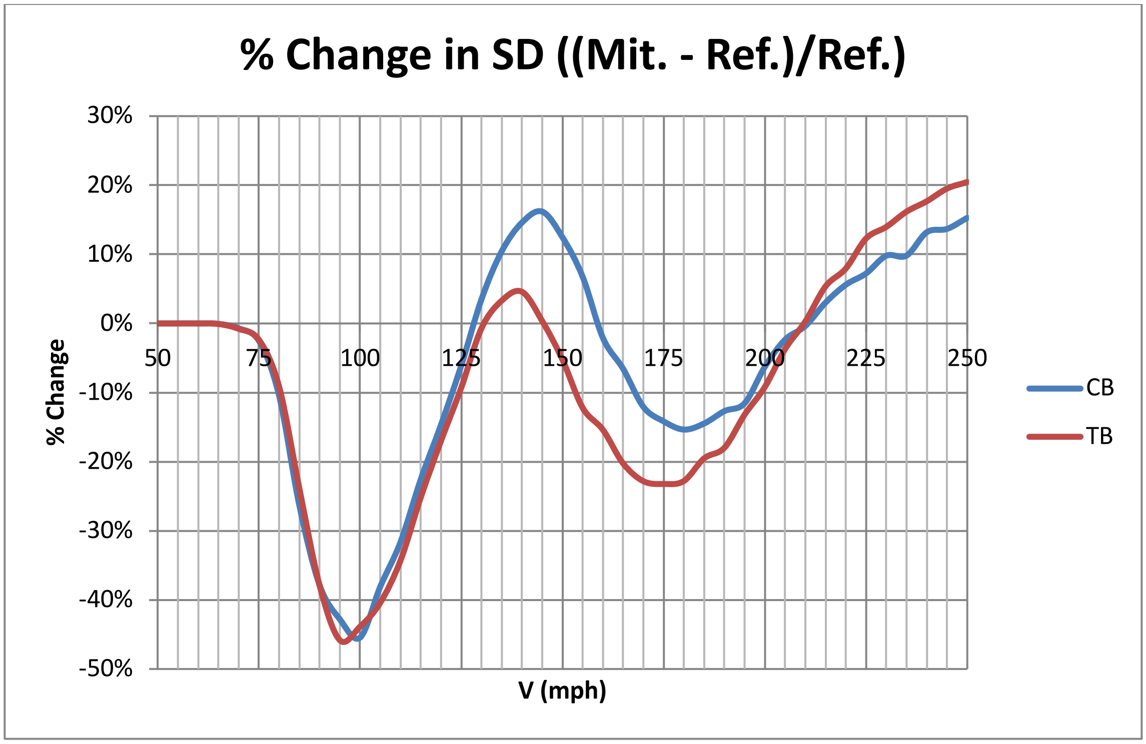


Figure 67. Percent change of standard deviation of the damage ratio from reference to mitigated structure (blue: masonry, red: timber)

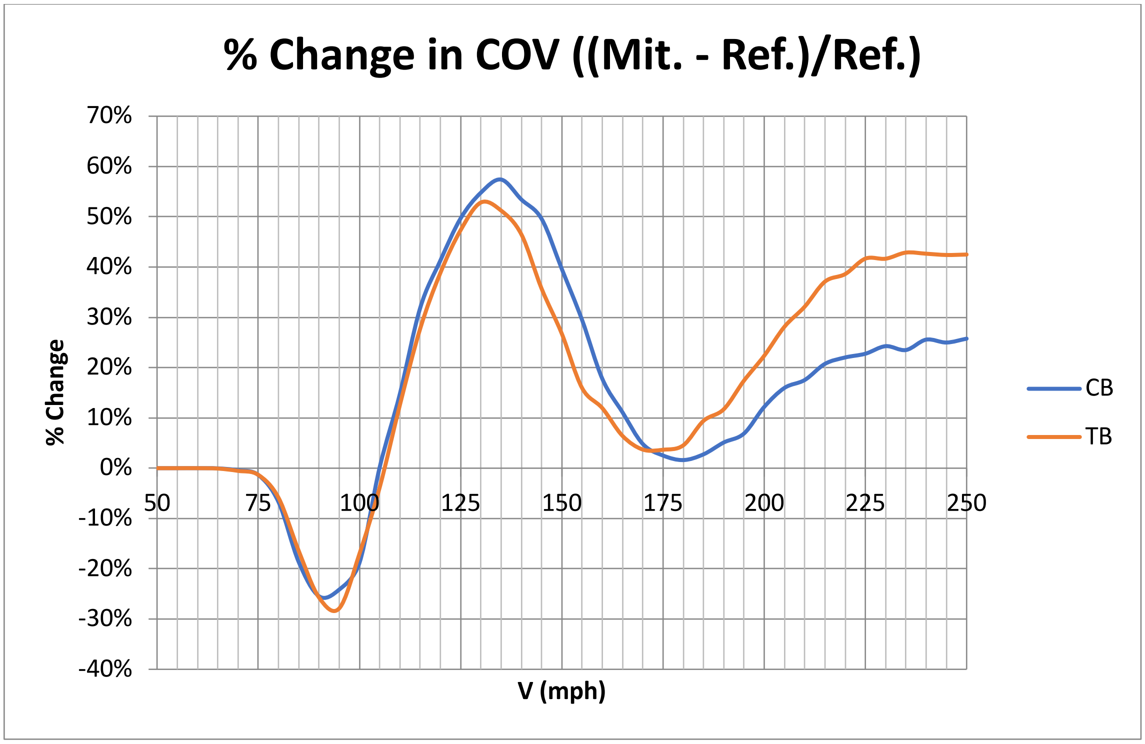


Figure 68. Relative change in coefficient of variation (COV) between mitigated and reference cases

Form V-1: One Hypothetical Event

A. Windspeeds for 96 ZIP Codes and sample personal and commercial residential exposure data are provided in the file named "FormV1Input17.xls." The windspeeds and ZIP Codes represent a hypothetical hurricane track. Model the sample personal and commercial residential exposure data provided in the file against these windspeeds at the specified ZIP Codes and provide the damage ratios summarized by windspeed (mph) and construction type.

The wind speeds provided are one-minute sustained 10-meter wind speeds. The sample personal and commercial residential exposure data provided consist of four structures (one of each construction type: wood frame, masonry, manufactured home, and concrete) individually placed at the population centroid of each of the ZIP Codes provided. Each ZIP Code is subjected to a specific wind speed.

For completing Part A, Estimated Damage for each individual wind speed range is the sum of ground up hurricane loss to all structures in the ZIP Codes subjected to that individual wind speed range, excluding demand surge and storm surge. Subject Exposure is all exposures in the ZIP Codes subjected to that individual wind speed range.

For completing Part B, Estimated Damage is the sum of the ground up hurricane loss to all structures of a specific type (wood frame, masonry, manufactured home, or concrete) in all of the wind speed ranges, excluding demand surge and storm surge. Subject Exposure is all exposures of that specific type in all of the ZIP Codes.

One reference structure for each of the construction types shall be placed at the population center of the ZIP Codes. Do not include contents, appurtenant structures, or time element coverages.

<u>Reference Frame Structure:</u> *One story* *Unbraced gable end roof* *ASTM D3161 Class D or* *ASTM D7158 Class D shingles* *½" plywood deck* *6d nails, deck to roof members* *Toe nail truss to wall anchor* *Wood framed exterior walls* *5/8" diameter anchors at 48" centers for wall/floor/foundation connections* *No shutters* *Standard glass windows* *No door covers* *No skylight covers* *Constructed in 1995*	***<u>Reference Masonry Structure:</u>*** *One story* *Unbraced gable end roof* *ASTM D3161 Class D or* *ASTM D7158 Class D shingles* *½" plywood deck* *6d nails, deck to roof members* *Weak truss to wall connection* *Masonry exterior walls* *No vertical wall reinforcing* *No shutters* *Standard glass windows* *No door covers* *No skylight covers* *Constructed in 1995*
<u>Reference Manufactured Home Structure:</u> *Tie downs* *Single unit* *Manufactured in 1980*	***<u>Reference Concrete Structure:</u>*** *Twenty story* *Eight apartment units per story* *No shutters* *Standard glass windows* *Constructed in 1980*

B. Confirm that the structures used in completing the form are identical to those in the above table for the reference structures. If additional assumptions are necessary to complete this form (for example, regarding structural characteristics, duration, or surface roughness), provide the reasons why the assumptions were necessary as well as a detailed description of how they were included.

The modelers do confirm that the structures used in completing the form are identical to those in the table provided in the standard.

C. Provide a plot of the Estimated Damage/Subject Exposure (y-axis) versus Windspeed (x-axis) Part A data.

See Appendix X.

D. Include Form V-1, One Hypothetical Event, in a submission appendix.

See Appendix X.

Form V-2: Hurricane Mitigation Measures and Secondary Characteristics, Range of Changes in Damage

A. Provide the change in the zero deductible personal residential reference building damage rate ratio (not hurricane loss cost) for each individual hurricane mitigation measure and secondary characteristic listed in Form V-2, Hurricane Mitigation Measures and Secondary Characteristics, Range of Changes in Damage, as well as for the combination of the four hurricane mitigation measures and secondary characteristics provided for the Mitigated Frame Building and the Mitigated Masonry Building below.

See Appendix Y.

B. If additional assumptions are necessary to complete this form (for example, regarding duration or surface roughness), provide the rationale for the assumptions as well as a detailed description of how they are included.

Not applicable.

C. Provide this form in Excel format without truncation. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form V-2, Hurricane Mitigation Measures and Secondary Characteristics, Range of Changes in Damage, in a submission appendix.

Reference Frame Building:	***Reference Masonry Building:***
One story Unbraced gable end roof ASTM D3161 Class D or ASTM D7158 Class D shingles ½" plywood deck 6d nails, deck to roof members Toe nail truss to wall anchor Wood framed exterior walls 5/8" diameter anchors at 48" centers for wall/floor/foundation connections No shutters Standard glass windows No door covers No skylight covers Constructed in 1995	***One story Unbraced gable end roof ASTM D3161 Class D or ASTM D7158 Class D shingles ½" plywood deck 6d nails, deck to roof members Weak truss to wall connections Masonry exterior walls No vertical wall reinforcing No shutters Standard glass windows No door covers No skylight covers Constructed in 1995***
Mitigated Frame Building: ***ASTM D7158 Class H shingles 8d nails, deck to roof members Truss straps at roof Structural wood panel Shutters***	***Mitigated Masonry Building:*** ***ASTM D7158 Class H shingles 8d nails, deck to roof members Truss straps at roof Structural wood panel Shutters***

Place the reference building at the population centroid for ZIP Code 33921.

See Appendix Y.

Form V-3: Hurricane Mitigation Measures and Secondary Characteristics, Mean Damage Ratios and Hurricane Loss Costs (Trade Secret Item)

A. Provide the mean damage ratio (without including any insurance considerations) to the reference building for each individual hurricane mitigation measure and secondary characteristic listed in Form V-3, Hurricane Mitigation Measures and Secondary Characteristics, Mean Damage Ratios and Hurricane Loss Costs (Trade Secret Item), as well as the percent damage for the combination of the four hurricane mitigation measures and secondary characteristics provided for the Mitigated Frame Building and the Mitigated Masonry Building below.

See Form V-3 below. Notice that for the 60 mph column all the vulnerabilities coincide at 6%. This is because at these low wind speeds, no significant damage is activated to trigger any significant difference between the different cases.

B. Provide the zero deductible personal residential hurricane loss cost rounded to three decimal places, for the reference building and for each individual hurricane mitigation measure and secondary characteristic listed in Form V-3, Hurricane Mitigation Measures and Secondary Characteristics, Mean Damage Ratios and Hurricane Loss Costs (Trade Secret Item), as well as the hurricane loss cost for the combination of the four hurricane mitigation measures and secondary characteristics provided for the Mitigated Frame Building and the Mitigated Masonry Building below.

See Form V-3 below.

C. If additional assumptions are necessary to complete this form (for example, regarding duration or surface roughness), provide the rationale for the assumptions as well as a detailed description of how they are included.

Not applicable.

D. Provide a graphical representation of the hurricane vulnerability curves for the reference building and the fully mitigated building.

Reference Frame Structure:	**Reference Masonry Structure**:
One story Unbraced gable end roof ASTM D3161 Class D or ASTM D7158 Class D shingles ½" plywood deck 6d nails, deck to roof members Toe nail truss to wall anchor Wood framed exterior walls 5/8" diameter anchors at 48" centers for wall/floor/foundation connections No shutters Standard glass windows No door covers No skylight covers Constructed in 1995	One story Unbraced gable end roof ASTM D3161 Class D or ASTM D7158 Class D shingles ½" plywood deck 6d nails, deck to roof members Weak truss to wall connections Masonry exterior walls No vertical wall reinforcing No shutters Standard glass windows No door covers No skylight covers Constructed in 1995
Mitigated Frame Structure: ASTM D7158 Class H shingles 8d nails, deck to roof members Truss straps at roof Structural wood panel Shutters	**Mitigated Masonry Structure**: ASTM D7158 Class H shingles 8d nails, deck to roof members Truss straps at roof Structural wood panel Shutters

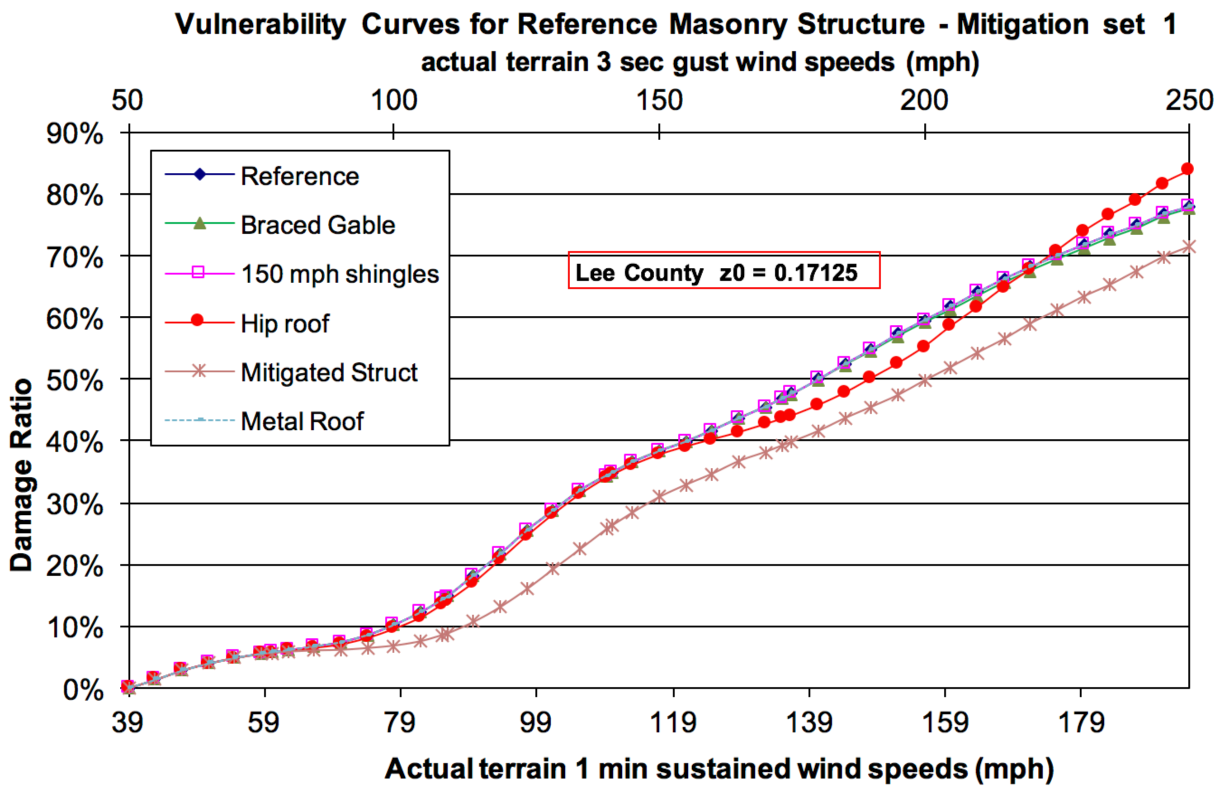
Place the reference building at the population centroid for ZIP Code.

See Figure 62 through Figure 65. Because there are too many vulnerability curves to plot in one figure, for the sake of clarity, the mitigations were divided in four sets for both masonry and frame structures. In each figure, there are two horizontal axes: the upper axis represents the actual terrain three-second gusty winds; the lower axis represents the actual terrain one-minute sustained winds. The conversion between three-second gust and one-minute sustained winds depends on the roughness of the terrain. Therefore, on each plot, the value of the roughness parameter for Lee County is indicated. Finally, please note that, as explained in the previous section, mitigating the roof shingles alone, or the metal roof alone, or the membrane alone without mitigating the roof deck (upgrading nail size and or spacing) or the roof-to-wall connections does not improve the overall vulnerability of the structure. Consequently, in Figure 62 through Figure 65, the curves for the base case and the rated shingle, metal roof, and membrane cases are superimposed on each other. This result is dependent on the base case weak sheathing connection and should not be interpreted to imply that reroofing is not an effective mitigation. Reroofing is only ineffective for the case of a very weak roof deck. The combination of re-nailing the decking and reroofing (now required practice) is an effective mitigation.

Form V-3: Mitigation Measures – Mean Damage Ratio (1 min)

INDIVIDUAL HURRICANE MITIGATION MEASURES AND SECONDARY CHARACTERISTICS			MEAN DAMAGE RATIO										HURRICANE LOSS COSTS	
			FRAME BUILDING					MASONRY BUILDING					FRAME BUILDING	MASONRY BUILDING
			WIND SPEED (MPH)*					WIND SPEED (MPH)*					ACROSS ALL WINDSPEEDS	
			60	85	110	135	160	60	85	110	135	160		
	REFERENCE BUILDING		6%	15%	39%	56%	67%	6%	14%	35%	47%	62%	$13.754	$13.313
ROOF STRENGTH	BRACED GABLE ENDS		6%	15%	39%	56%	66%	6%	14%	35%	47%	61%	$13.754	$13.313
	HIP ROOF		6%	14%	37%	50%	64%	6%	13%	34%	44%	59%	$13.221	$12.813
ROOF COVERING	METAL		6%	15%	39%	56%	67%	6%	14%	35%	47%	62%	$13.751	$13.310
	ASTM D7158 CLASS H SHINGLES		6%	15%	39%	56%	67%	6%	14%	35%	47%	62%	$13.751	$13.310
	MEMBRANE		6%	15%	39%	56%	67%	6%	14%	35%	47%	62%	$13.754	$13.313
	NAILING OF DECK 8d		6%	9%	38%	60%	67%	6%	9%	30%	48%	63%	$11.229	$10.689
ROOF-WALL STRENGTH	CLIPS		6%	15%	37%	48%	59%	6%	14%	35%	43%	54%	$13.711	$13.315
	STRAPS		6%	15%	37%	46%	51%	6%	14%	35%	43%	53%	$13.705	$13.315
WALL-FLOOR STRENGTH	TIES OR CLIPS		6%	15%	38%	54%	65%	-	-	-	-		$13.708	-
	STRAPS		6%	15%	37%	53%	64%	-	-	-	-		$13.696	-
WALL FOUNDATION STRENGTH	LARGER ANCHORS OR CLOSER SPACING		-	-	-	-	-	-	-	-	-	-	-	-
	STRAPS		-	-	-	-	-	-	-	-	-	-	-	-
	VERTICAL REINFORCING		-	-	-	-	-	6%	14%	35%	42%	48%	-	$13.298
OPENING PROTECTION	WINDOW SHUTTERS	STRUCT WOOD	6%	14%	36%	55%	67%	6%	14%	32%	46%	61%	$13.514	$13.084
		METAL	6%	14%	35%	54%	66%	6%	14%	31%	44%	61%	$13.368	$12.950
	DOOR AND SKYLIGHT COVERS		6%	15%	38%	56%	66%	6%	14%	35%	46%	61%	$13.723	$13.286
WINDOW DOOR, SKYLIGHT STRENGTH		IMPACT RATED	6%	14%	34%	50%	63%	6%	14%	30%	41%	58%	$13.341	$12.924
	ENTRY DOORS	MEETS WINDBORNE DEBRIS REQUIREMENTS	6%	15%	39%	56%	66%	6%	14%	35%	46%	61%	$13.745	$13.305
	GARAGE DOORS	MEETS WINDBORNE DEBRIS REQUIREMENTS	6%	12%	37%	56%	67%	6%	12%	33%	47%	62%	$12.724	$12.311
	SLIDING GLASS DOORS	MEETS WINDBORNE DEBRIS REQUIREMENTS	6%	15%	38%	55%	66%	6%	14%	35%	46%	61%	$13.714	$13.278

HURRICANE MITIGATION MEASURES AND SECONDARY CHARACTERISTICS IN COMBINATION	MEAN DAMAGE RATIO											
	FRAME BUILDING					MASONRY BUILDING					FRAME BUILDING	MASONRY BUILDING
	WIND SPEED (MPH)					WIND SPEED (MPH)					ACROSS ALL WINDSPEEDS	
	60	85	110	135	160	60	85	110	135	160		
MITIGATED BUILDING	6%	9%	28%	42%	50%	6%	9%	26%	39%	52%	$10.813	$10.511



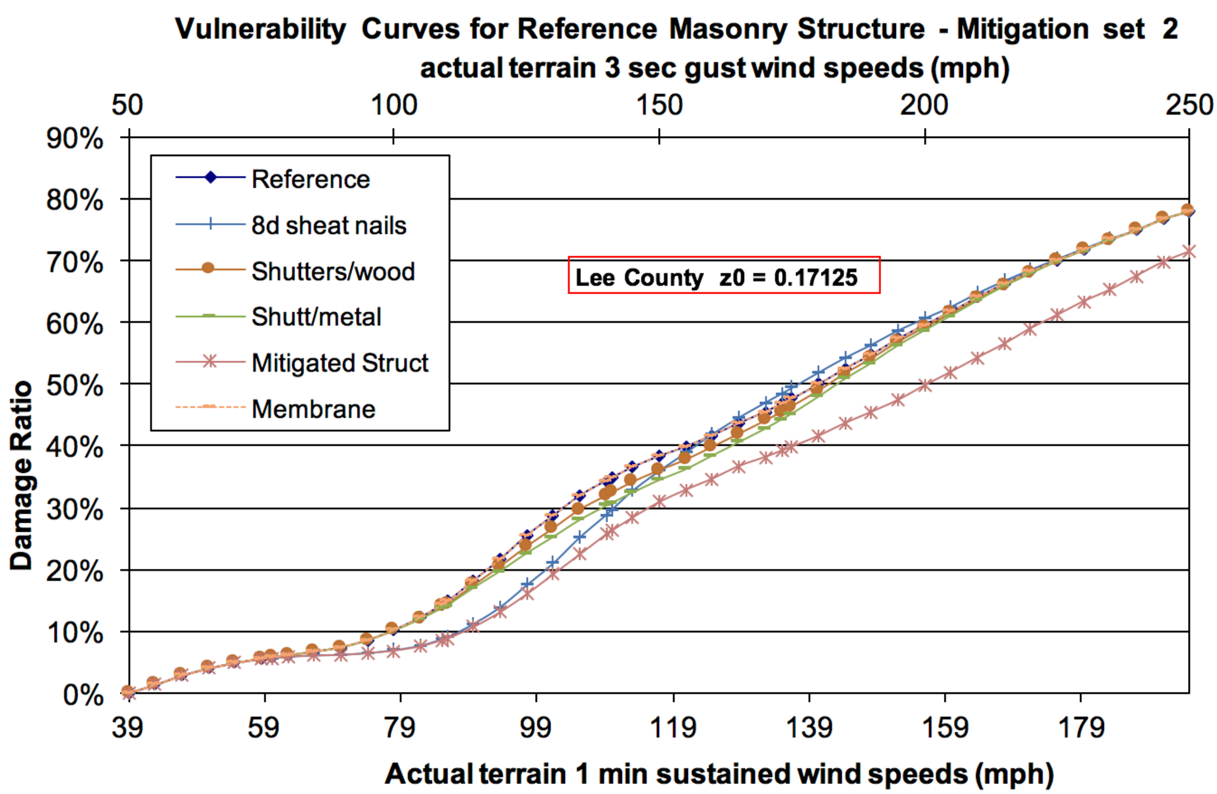
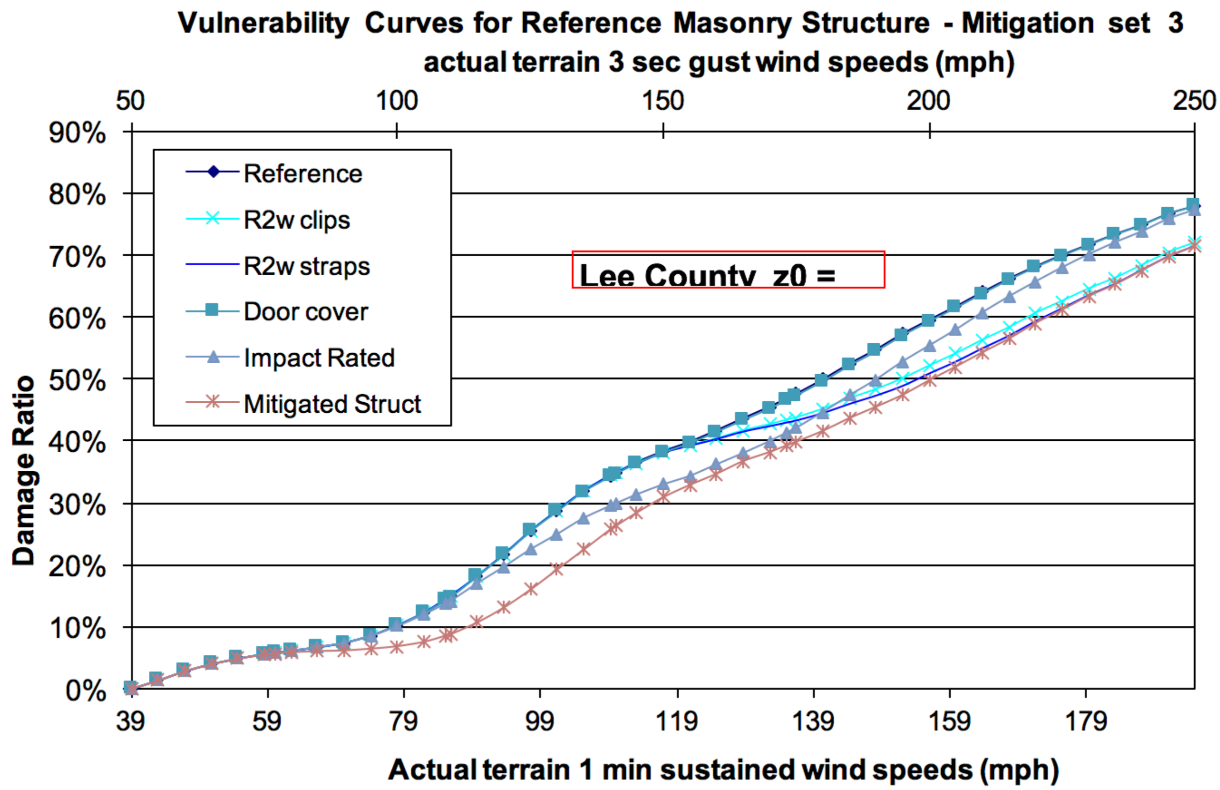


Figure 69. Mitigation measures for masonry homes.



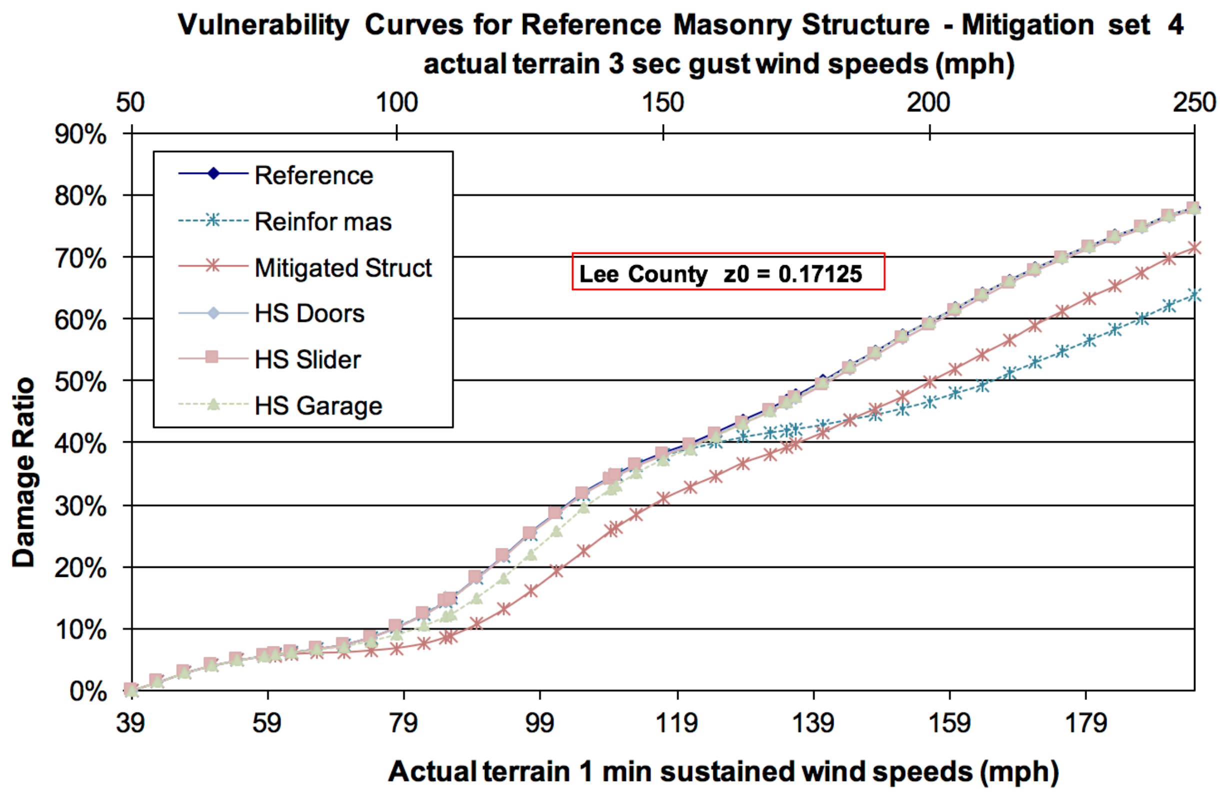
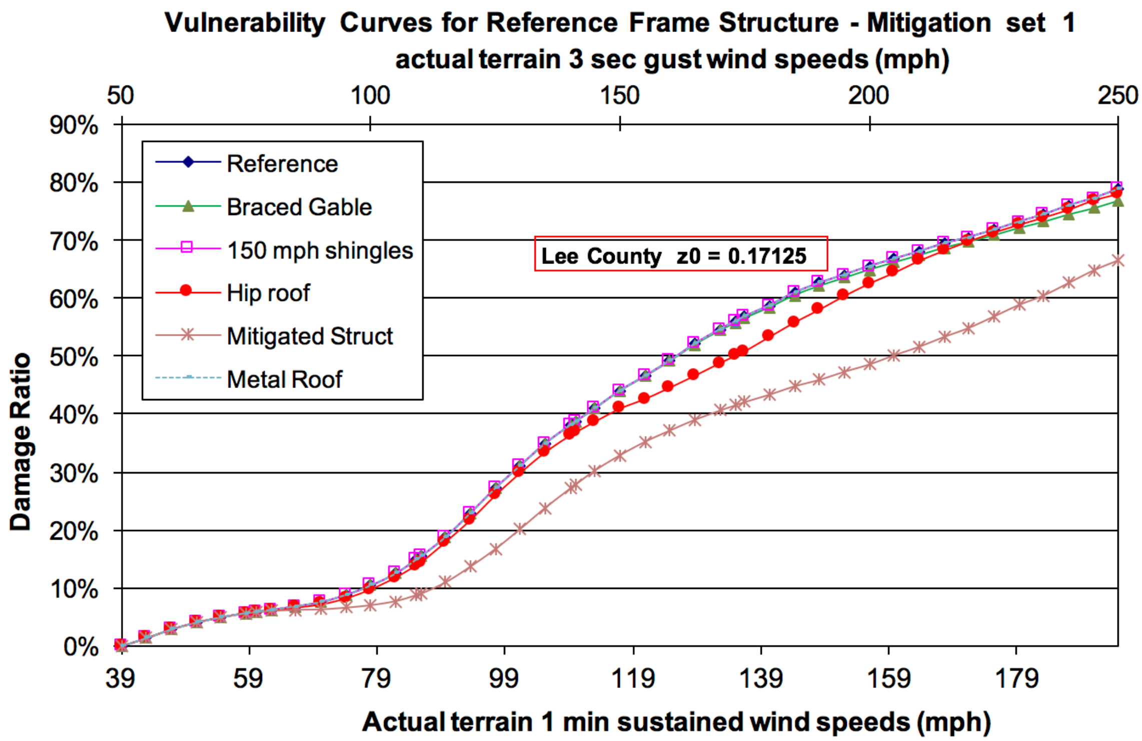


Figure 70. Mitigation measures for masonry homes.



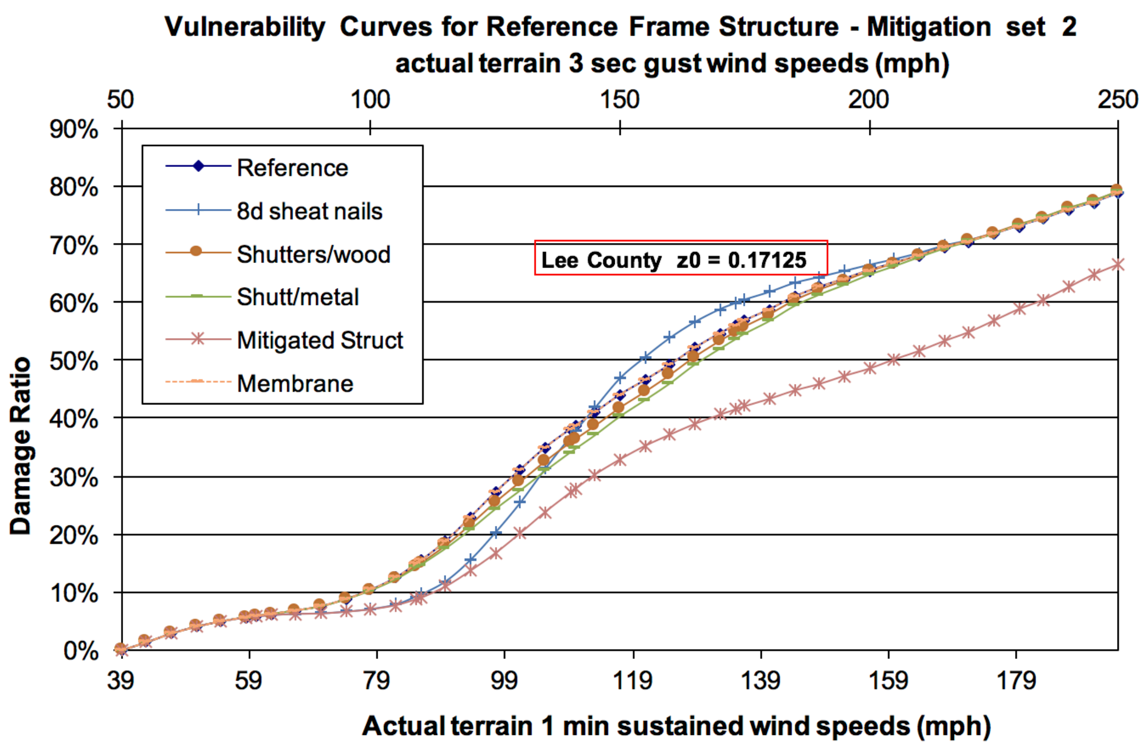
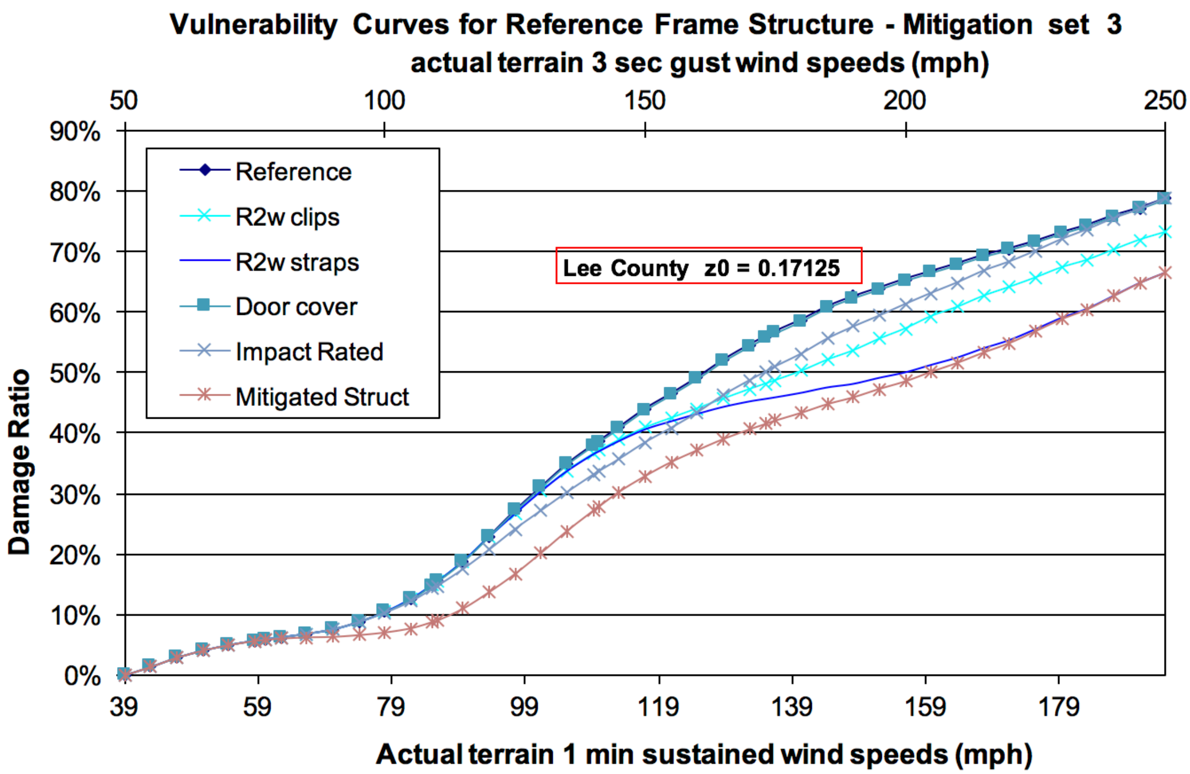


Figure 71. Mitigation measures for frame homes.



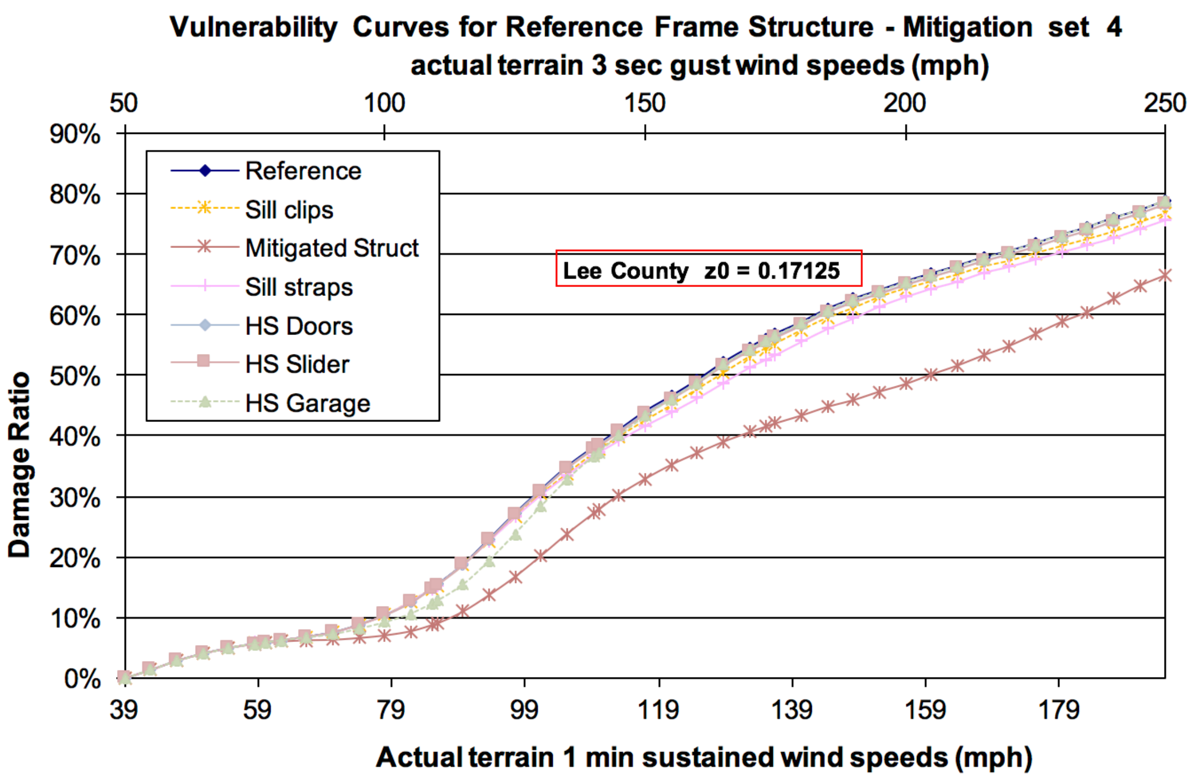


Figure 72. Mitigation measures for frame homes.

Form V-4: Differences in Hurricane Mitigation Measures and Secondary Characteristics

A. Provide the differences between the values reported in Form V-2, Hurricane Mitigation Measures and Secondary Characteristics, Range of Changes in Damage, relative to the equivalent data compiled from the previously-accepted hurricane model.

See Appendix Z.

B. Provide a list and describe any assumptions made to complete this form.

The list and assumptions governing this form are the same than the ones described in disclosures 3 and 4 of Standard V-3.

C. Provide a summary description of the differences.

Form V-4 shows no differences. The two modifications to the V-2 standard that would potentially result in differences are the change to reference structure shingles (Class F or G changed to Class D), and the change to the mitigated structure opening protection (plywood changed to structural wood panel).

Regarding shingles: The model distinguishes between shingle classes at three levels. The first level is unrated shingles, representing pre-ASTM compliance requirements. The second level is rated shingles, and represents Classes D, F and G, which have a very small difference in expected performance, and no field data to document actual performance differences. The third level is Class H, which is a significantly improved shingle with respect to wind resistance, and required for HVHZ. Thus, the shingle capacity for the reference structure was not altered between the current and previous submissions (both are modeled as level two). This is justified when considering V-2 results. In the previous submission, mitigating the Class F or G reference shingles to Class H in isolation made no difference. This is a result of the weak roof sheathing attachment for the reference case. Stronger shingles are not effective if the sheathing they are fastened to fails. Implementing a minor shingle capacity reduction in the reference structure to reflect a change from Class F or G to Class D would produce the same result (no benefit from Class H mitigation), as Class F, G and D shingles are all less vulnerable than the weak roof decking.

Regarding opening protection: Structural wood panels (SWP) are simply plywood or OSB of sufficient thickness to resist windborne debris impact, and fastened to the opening frame in a manner that adequately resists panel failure due to overpressure. The model assumes that plywood protection of sufficient thickness is applied in a manner to resist overpressure failure (plywood and SWP are treated as the same), thus no modifications were made in response to this change in the V-2 standard.

D. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form V-4, Differences in Hurricane Mitigation Measures and Secondary Characteristics, in a submission appendix.

Form V-5: Differences in Hurricane Mitigation Measures and Secondary Characteristics, Mean Damage Ratios and Hurricane Loss Costs (Trade Secret Item)

A. Provide the differences between the values reported in Form V-3, Hurricane Mitigation Measures and Secondary Characteristics, Mean Damage Ratios and Hurricane Loss Costs (Trade Secret Item), relative to the equivalent data compiled from the previously-accepted hurricane model.

See FormV5 below.

B Provide a list and describe any assumptions made to complete this form.

The list and assumptions governing this form are the same than the ones described in disclosures 3 and 4 of Standard V-3.

C. Provide a summary description of the differences.

Form V-5 shows no differences for the mean damage ratios. No changes were made to the reference or mitigated structure models relative to the previous submission. Please refer to the summary description of Form V-4 for justification.

The form shows minor differences for the loss cost ratios, of the order of 1.2% to 1.6%. Theses minor changes are due to changes in the hazard model.

Form V-5: Differences in Hurricane Mitigation Measures and Secondary Characteristics, Mean Damage Ratios and Hurricane Loss Costs

DIFFERENCES FROM FORM V-3 RELATIVE TO PREVIOUSLY-ACCEPTED HURRICANE MODEL

INDIVIDUAL HURRICANE MITIGATION MEASURES AND SECONDARY CHARACTERISTICS			MEAN DAMAGE RATIO										HURRICANE LOSS COSTS	
			FRAME BUILDING					MASONRY BUILDING					FRAME BUILDING	MASONRY BUILDING
			WINDSPEED (MPH)*					WINDSPEED (MPH)*					ACROSS ALL WINDSPEEDS*	
			60	85	110	135	160	60	85	110	135	160		
	REFERENCE BUILDING		0	0	0	0	0	0	0	0	0	0	$0.161	$0.163
ROOF CONFIGURATION	BRACED GABLE ENDS		0	0	0	0	0	0	0	0	0	0	$0.161	$0.163
	HIP ROOF		0	0	0	0	0	0	0	0	0	0	$0.162	$0.160
ROOF COVERING	METAL		0	0	0	0	0	0	0	0	0	0	$0.161	$0.163
	ASTM D7158 CLASS H SHINGLES		0	0	0	0	0	0	0	0	0	0	$0.161	$0.163
	MEMBRANE		0	0	0	0	0	0	0	0	0	0	$0.161	$0.163
	NAILING OF DECK	8d	0	0	0	0	0	0	0	0	0	0	$0.152	$0.160
ROOF-WALL STRENGTH	CLIPS		0	0	0	0	0	0	0	0	0	0	$0.165	$0.163
	STRAPS		0	0	0	0	0	0	0	0	0	0	$0.165	$0.163
WALL-FLOOR STRENGTH	TIES OR CLIPS		0	0	0	0	0	0	0	0	0	0	$0.166	
	STRAPS		0	0	0	0	0	0	0	0	0	0	$0.167	
WALL-FOUNDATION STRENGTH	LARGER ANCHORS OR CLOSER SPACING		–	–	–	–	–	—	—	—	—	—	-----	—
	STRAPS		-	-	-	-	-	—	—	—	—	—	-----	—
	VERTICAL REINFORCING		—	—	—	—	—	0	0	0	0	0	—	$0.164
OPENING PROTECTION	WINDOW SHUTTERS	STRUCTURAL WOOD PANEL	0	0	0	0	0	0	0	0	0	0	$0.166	$0.167
		METAL	0	0	0	0	0	0	0	0	0	0	$0.169	$0.170
	DOOR AND SKYLIGHT COVERS		0	0	0	0	0	0	0	0	0	0	$0.162	$0.163
WINDOW, DOOR, SKYLIGHT STRENGTH	WINDOWS	IMPACT RATED	0	0	0	0	0	0	0	0	0	0	$0.171	$0.172
	ENTRY DOORS	MEETS WIND-BORNE DEBRIS REQUIREMENTS	0	0	0	0	0	0	0	0	0	0	$0.162	$0.163
	GARAGE DOORS	MEETS WIND-BORNE DEBRIS REQUIREMENTS	0	0	0	0	0	0	0	0	0	0	$0.159	$0.162
	SLIDING GLASS DOORS	MEETS WIND-BORNE DEBRIS REQUIREMENTS	0	0	0	0	0	0	0	0	0	0	$0.162	$0.163

PERCENTAGE CHANGE FROM FORM V-3 RELATIVE TO PREVIOUSLY-ACCEPTED HURRICANE MODEL

HURRICANE MITIGATION MEASURES AND SECONDARY CHARACTERISTICS IN COMBINATION	MEAN DAMAGE RATIO										HURRICANE LOSS COSTS	
	FRAME BUILDING					MASONRY BUILDING					FRAME BUILDING	MASONRY BUILDING
	WINDSPEED (MPH)*					WINDSPEED (MPH)*					ACROSS ALL WINDSPEEDS*	
	60	85	110	135	160	60	85	110	135	160		
MITIGATED BUILDING	0	0	0	0	0	0	0	0	0	0	$0.169	$0.165

*Windspeeds are one-minute sustained 10-meter.

ACTUARIAL STANDARDS

A-1 Hurricane Modeling Input Data and Output Reports

A. Adjustments, edits, inclusions, or deletions to insurance company or other input data used by the modeling organization shall be based upon generally accepted actuarial, underwriting, and statistical procedures.

All modifications to the input data are consistent with generally accepted actuarial, underwriting and statistical procedures.

B. All modifications, adjustments, assumptions, inputs and input file identification, and defaults necessary to use the hurricane model shall be actuarially sound and shall be included with the hurricane model output report. Treatment of missing values for user inputs required to run the hurricane model shall be actuarially sound and described with the hurricane model output report.

The hurricane model output report identifies and summarizes the input file that was used. Any changes to the original input file, including the treatment of missing values are included in the output report as well.

Disclosures

1. Identify insurance-to-value assumptions and describe the methods and assumptions used to determine the property value and associated hurricane losses. Provide a sample calculation for determining the property value.

The model assumes that the insured value is the value of the property except in rare cases when the insurance company provides a separate property value that is higher than the insured value.

Sample calculation of property value:

Insured values as reported on the input file:

Structure	\$300,000
Appurtenant Structures	\$30,000
Contents	\$150,000
Time Element	\$15,000

Property values as calculated by the model:

Structure = Structure Insured Value =	\$300,000
Appurtenant Structures = Appurtenant Structures Insured Value =	\$30,000
Contents = Contents Insured Value =	\$150,000

Time Element = Time Element Insured Value = $15,000.

2. Identify depreciation assumptions and describe the methods and assumptions used to reduce insured hurricane losses on account of depreciation. Provide a sample calculation for determining the amount of depreciation and the actual cash value (ACV) hurricane losses.

For both replacement cost and ACV policies, the value of structures and contents is generally assumed to equal the insured limit. In the rare case where data on property value are available from the insurance company and that value exceeds the limit, the value provided is used to estimate the ground-up damages.

Depreciation is considered in the model, but not explicitly. The damage ratios were calibrated to insured losses that contained a mix of replacement cost and ACV policies, but primarily replacement cost. Consequently, there is an implicit allowance for depreciation (of an unknown degree) built into the modeled losses.

Sample calculation of depreciation and ACV loss:

Modeled Loss = $2,000

Depreciation = $0

ACV Loss = Modeled Loss - $0 Depreciation = $2,000.

3. Describe the methods used to distinguish among policy form types (e.g., homeowners, dwelling property, manufactured homes, tenants, condo unit owners).

The input record provided by the company includes a “policy form” code. If there is any ambiguity, the company is contacted for clarification.

4. Provide a copy of the input form(s) used by the hurricane model with the hurricane model options available for selection by the user for the Florida hurricane model under review. Describe the process followed by the user to generate the hurricane model output produced from the input form. Include the hurricane model name and version identification on the input form. All items included in the input form submitted to the Commission should be clearly labeled and defined.

Florida Public Hurricane Loss Model: Version 7.0
Input Data File Format Specifications
Personal Residential Policies

Input files containing personal residential policies to be processed through version 7.0 of the Florida Public Hurricane Loss Model should adhere to the format specifications contained in this document.

Observe the following when preparing the input file:
(a) Provide one policy per line in a comma-separated values file (.csv).
(b) Do not use comma within the fields' values (e.g., as thousand separators or within addresses).
(c) Include the name of each column in the first line of the file.
(d) For fields that require a code, enter the code that more closely represents the data value.
(e) Only include policies with wind coverage.

Each policy should contain a total of 31 attributes. Attributes 1-18 are the minimum required attributes. Attributes 19-31 are required secondary modifiers. Please always provide all 31 attributes.

1. Policy Id — A unique identifier for this policy in the data file. An alphanumeric text.

2. ZIP Code — The ZIP Code where this building is located. A 5-digit number.

3. Year Built — The year in which the property was built. A 4-digit number or UNKNOWN.

4. Construction Type — The construction type of the building. Encode the data to one of the following:

Value	Code
Frame	1
Masonry	2
Manufactured	3
Other	4
Unknown	5

5. Property Value — The dollar amount value of the building. If not known, enter UNKNOWN.

6. Structure Coverage — The structure coverage amount in dollars. Enter 0 if none.

7. App. Coverage — The appurtenant structure coverage amount in dollars. Enter 0 if none.

8. Content Coverage — The content coverage amount in dollars. Enter 0 if none.

9. ALE Coverage — The additional living expense coverage amount in dollars. Enter 0 if none.

10. Deductible — The deductible amount for perils other than hurricane in dollars (convert percentages to dollar amounts).

11.Hurricane Deductible — The hurricane deductible amount in dollars (convert percentages to dollar amounts)

12. Nature of Coverage

The settlement option on the structure. Encode the data to one of the following:

Value	Code
Replacement Cost	R
Actual Cash Value	A

13. County

The name of the county where the building is located.

14. Address

The street address or geographic coordinates of the building. If providing coordinates, please enter as longitude; latitude.

15. City

The name of the city where the building is located.

16. Form

Policy Form (HO-1, HO-2, HO-3, HO-5, HO-8, HO-4, HO-6, DP-1, DP-2, DP-3, etc.)

17. Program Code

Use one uppercase letter to represent each company program.

18. Territory Code

Use the territory codes reflected in your rate manual.

19. Year Retrofitted

The 4-digit year when the property was retrofitted (brought up to code).
If only the year of roof replacement is known, enter the 4-digit year when the roof was replaced followed by R (i.e. if the roof was replaced in 1999, enter 1999R).
If not retrofitted enter NA. If not known enter UNKNOWN.

20. Number of Stories

Number of stories in the building (e.g., 1, 2, 3, etc.) or UNKNOWN.

21. Location of Unit

The story in which the unit is located (e.g., 1, 2, 3, etc.) or UNKNOWN.
Only applicable to HO-4 and HO-6 policies. Enter "NA" for all other policy types.

22. Sliders

Indicates whether the unit has sliders. Encode the data to one of the following:

Value	Code
No Sliders	0
Sliders	1
Unknown	2
Not HO-4 / HO-6	NA

23. Area of Property

The total number of square feet for all floors of the insured property or UNKNOWN.

24. Roof Shape

Encode the data to one of the following:

Value	Code
Unbraced Gable	1
Braced Gable	2
Gable (Unknown bracing)	3
Hip	4
Other	5
Unknown	6

25. Roof Cover

Encode the data to one of the following:

Value	Code
Unrated Shingles	1
Rated Shingles (Current FBC)	2
Shingles (Unknown rating)	3
Tiles	4
Metal	5
Other FBC Compliant	6
Other Non-FBC Compliant	7
Unknown	8

26. Roof Membrane

Encode the data to one of the following:

Value	Code
Regular Underlayment	1
Secondary Water Resistance	2
Other*	3
Unknown	4

*Example of other include foam joints

27.Roof-to-Wall Connection

Encode the data to one of the following:

Value	Code
Toe Nails	1
Clips	2
Straps	3
Other	4
Unknown	5

28. Deck Attachment

Encode the data to one of the following:

Value	Code
Planks	1
Sheathing with 6d@6/12”	2
Sheathing with 8d@6/12”	3
Sheathing with 8d@6/6”	4
Other*	5
Unknown	6

* Example of other include reinforced concrete deck attachment

29. Garage Door

Encode the data to one of the following:

Value	Code
No garage door	0
Unbraced	1
Braced	2
Unknown	3

30. Opening Protection

If at least one glazed opening is not protected, enter as no protection.
If there is more than one type of opening protection, use the most predominant type code.
If the only known information is that the policy qualifies for a Basic or Hurricane windstorm loss reduction credit, use code 2.

Value	Code
No Protection	0
Plywood	1
Metal	2
Impact Resistant Glass	3
Other*	4
Unknown	5

*Example of other includes fabric.

31. Law and Ordinance

Whether the policy includes Law and Ordinance coverage.

Value	Code
Does not include coverage	0
Includes coverage	1
Coverage does not apply.	NA

Example data file with two policies:

PolicyID,ZIPCode,YearBuilt,ConstructionType,StructureCoverage,AppCoverage,ContentCoverage,ALECoverage,Deductible,HurricaneDeductible,NatureOfCoverage,County,Address,City,Form,ProgramCode,TerritoryCode,YearRetrofitted,NumberOfStories,LocationOfUnit,Sliders,AreaOfBuilding,RoofShape,RoofCover,RoofMembrane,RoofToWallConnection,DeckAttachment,GarageDoor,OpeningProtection,LawOrdinance
ABC100,33143,1981,2,50000,0,20000,8000,1000,1000,R,Miami-Dade,123 Main Street,Miami,HO-6,A,35,NA,1,UNKNOWN,2,1245,6,7,3,5,5,3,5 NA
ABC210,34109,1995,2,115000,0,20000,10000,2500,2500,R,Collier,-81.345593;26.017147,Naples,HO-6,A,35,NA,1,UNKNOWN,2,UNKNOWN,6,7,3,5,5,3,5,1

Florida Public Hurricane Loss Model: Version 7.0
Input Data File Format Specifications

Commercial Residential Policies

Input files containing commercial residential policies to be processed through version 7.0 of the Florida Public Hurricane Loss Model should adhere to the format specifications contained in this document.

Observe the following when preparing the input file:
(a) Provide one policy per line in a comma-separated values file (.csv). For a policy with multiple locations, each of the locations must be recorded in a separate line.
(b) Do not use comma within the fields' values (e.g., as thousand separators or within addresses).
(c) Include the name of each column in the first line of the file.
(d) For fields that require a code, enter the code that more closely represents the data value.
(e) Only include policies with wind coverage.

Each policy should contain a total of 40 attributes.

1. Policy Id A unique identifier for this policy in the data file. An alphanumeric text.

2. Location Id A unique identifier for the location of the covered building. An alphanumeric text.

3. Building Id A unique identifier for the building. An alphanumeric text.

4. Residency Type Encode the data to one of the following:

Value	Code
Apartment Building	1
Condominium	2
Unknown	3

5. ZIP Code The ZIP Code where this building is located. A 5-digit number.

6. Year Built The year in which the property was built. A 4-digit number or UNKNOWN.

7. Construction Type The construction type of the building. Please encode the data to one of the following:

Value	Code
Frame	1
Masonry	2
Manufactured	3
First story masonry and upper story timber	4
Other	5
Unknown	6

8. Property Value The dollar amount value of the building. If not known, enter UNKNOWN.

9. Structure Coverage	The structure coverage amount in dollars. Enter 0 if none.
10. App. Coverage	The appurtenant structure coverage amount in dollars. Enter 0 if none.
11. Content Coverage	The content coverage amount in dollars. Enter 0 if none.
12.Time Element Coverage	The time element coverage amount in dollars. Enter 0 if none.
13. Deductible	The deductible amount in dollars for perils other than hurricane (convert percentages to dollar amounts).
14. Hurricane Deductible	The hurricane deductible amount in dollars (convert percentages to dollar amounts)
15. Hurricane Deductible Type	The type of hurricane deductible. Please encode the data to one of the following:

Value	Code
Per calendar year	1
Per occurrence	2

16. Coinsurance	Coinsurance percentage (e.g., for 80% enter 80). Enter 0 if none.
17. Nature of Coverage	The settlement option on the structure. Encode the data to one of the following:

Value	Code
Replacement Cost	R
Actual Cash Value	A

18. County	The name of the county where the building is located.
19. Address	The street address or geographic coordinates of the building. If providing coordinates, enter as longitude; latitude.
20. City	The name of the city where the building is located.
21. Form	Policy Form. If company offers different base forms of coverage, enter company code; otherwise, enter 0.
22. Program Code	Use one uppercase letter to represent each company program.
23. Territory Code	Use the territory codes reflected in your rate manual.
24. Year Retrofitted	The 4-digit year when the property was retrofitted (brought up to code). If only the year of roof replacement is known, enter the 4-digit year when the roof was replaced followed by R (i.e. if the roof was replaced in 1999, enter 1999R). If not retrofitted enter NA. If not known enter UNKNOWN.
25. Number of Stories	Number of stories in the building (e.g., 1, 2, 3, etc.) or UNKNOWN.
26. Total Units	The number of units in the building (e.g., 1, 2, 3, etc.) or UNKNOWN.
27. Units per Story	The number of units per story (e.g., 1, 2, 3, etc.) or UNKNOWN.
28. Sliders	Indicates whether the unit has sliders. Encode the data to one of the following:

Value	Code
No Sliders	0
Sliders	1
Unknown	2

29. Area of Property	The total number of square feet for all floors of the insured property or UNKNOWN.

30 Roof Shape

Encode the data to one of the following:

Value	Code
Unbraced Gable	1
Braced Gable	2
Gable (Unknown bracing)	3
Hip	4
Flat	5
Other	6
Unknown	7

31. Roof Cover

Encode the data to one of the following:

Value	Code
Unrated Shingles	1
Rated Shingles (Current FBC)	2
Shingles (Unknown rating)	3
Tiles	4
Metal	5
Other FBC Compliant	6
Other Non-FBC Compliant	7
Unknown	8

32. Roof Membrane

Encode the data to one of the following:

Value	Code
Regular Underlayment	1
Secondary Water Resistance	2
Other	3
Unknown	4

33. Soffit

Encode the data to one of the following:

Value	Code
None	0
Vinyl	1
Aluminum	2
Plywood	3
Other	4
Unknown	5

34. Roof-to-Wall Connection

Encode the data to one of the following:

Value	Code
Toe Nails	1
Clips	2
Straps	3
Other	4
Unknown	5

35. Deck Attachment

Encode the data to one of the following:

Value	Code
Planks	1
Sheathing with 6d@6/12”	2
Sheathing with 8d@6/12”	3
Sheathing with 8d@6/6”	4
Other	5
Unknown	6

36. Appurtenant Structure Type

Encode the data to one of the following:

Value	Code
None	1
Pool	2
Detached Garage	3
Club House	4
Administration Building	5
Other	6
Unknown	7

37. Opening Protection

If at least one glazed opening is not protected, enter as no protection.
If there is more than one type of opening protection, use the most predominant type code.
If the only known information is that the policy qualifies for a Basic or Hurricane windstorm loss reduction credit, use code 2.

Value	Code
No Protection	0
Plywood	1
Metal	2
Impact Resistant Glass	3
Other	4
Unknown	5

38. Building Layout

Encode the data to one of the following:

Value	Code
Open (Access to units through external balcony)	1
Closed (Access to units through the interior)	2
Unknown	3

39.Coinsurance Enforcement

Whether the company enforces coinsurance clause at time of claim.
Encode the data to one of the following:

Value	Code
Yes	1
No	2

40. Frequency Update

Encode the data to one of the following:

Value	Code
At each renewal	1
At every other renewal	2
Less frequently or no routine update	3

Example data file with two policies:

```
PolicyID,LocationID,BuildingID,ResidencyType,ZIPCode,YearBuilt,ConstructionType,PropertyValue,Structure
Coverage,AppCoverage,ContentCoverage,TimeElementCoverage,Deductible,HurricaneDeductible,HurricaneDed
uctibleType,Coinsurance,NatureOfCoverage,County,Address,City,Form,ProgramCode,TerritoryCode,YearRetrof
itted,NumberOfStories,TotalUnits,UnitsPerStory,Sliders,AreaOfProperty,RoofShape,RoofCover,RoofMembrane,
Soffit,RoofToWallConnection,DeckAttachment,AppurtenantStructureType,OpeningProtection,BuildingLayout,C
oinsuranceEnforcement,FrequencyOfLimitUpdate
ABC100,1,1,1,33143,1981,2,10500000,10000000,250000,20000,0,500000,500000,2,0,R,Miami-Dade,123 Main
Street,Miami,0,A,35, NA,8,40,5,1,21346,5,6,3,4,4,5,3,3,1,2,3
ABC100,2,1,1,34109,1981,2,8500000,8000000,250000,20000,0,450000,450000,2,0,R,Collier,-
81.345593;26.017147,Naples,0,A,42,NA,6,30,5,1,19464,5,6,3,4,4,5,3,3,1,2,3
```


5. Disclose, in a hurricane model output report, the specific inputs required to use the hurricane model and the options of the hurricane model selected for use in a residential property insurance rate filing. Include the hurricane model name and version identification on the hurricane model output report. All items included in the hurricane model output report submitted to the Commission should be clearly labeled and defined.

A hurricane model output report follows.

Output Report for OIR Data Processing

Florida Public Hurricane Loss Model: Release 7.0

OIR Data Processing Results: <Company Name: OIR Filing Number>

Report Content:
- Original Number of the policies in data set
- Process steps to formalize the data set
- Numbers of policies which are excluded due to certain reason, e.g. invalid ZIP Codes, invalid format, etc.
- Numbers of: Construction Types, Territory Codes, Policy Forms, Program Codes, etc.

- Coverage limits for building, appurtenant structure, content, additional living expense
- Distribution of deductibles
- Number of records that change values for different types of roof shape, roof cover, roof membrane, roof to wall connection, nailing of deck, garage door, opening protection, due to missing or illogical values
-Number of records for a county whose name is changed due to inconsistencies with the zip codes

- Number of policies to generate the estimated losses
- Number of files in the report

The results are aggregated by different combinations of counties, ZIP Codes, policy forms, program codes, and territory codes as applicable.

In case if there are:
- more than 1 construction type
- more than 1 policy form
- more than 1 program code
- more than 1 territory code

There will be 40 files in the report for personal residential policies with names as below:

<CompanyName>_PERSONAL_Loss_ConstType.xls
<CompanyName>_PERSONAL_Loss_County.xls
<CompanyName>_PERSONAL_Loss_PolicyForm.xls
<CompanyName>_PERSONAL_Loss_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_TerritoryCode.xls
<CompanyName>_PERSONAL_Loss_Zipcode.xls
<CompanyName>_PERSONAL_Loss_ConstType_PolicyForm.xls
<CompanyName>_PERSONAL_Loss_ConstType_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_ConstType_TerritoryCode.xls
<CompanyName>_PERSONAL_Loss_County_ConstType.xls
<CompanyName>_PERSONAL_Loss_County_PolicyForm.xls
<CompanyName>_PERSONAL_Loss_Zipcode_ConstType.xls

<CompanyName>_PERSONAL_Loss_County_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_County_TerritoryCode.xls
<CompanyName>_PERSONAL_Loss_Zipcode_PolicyForm.xls
<CompanyName>_PERSONAL_Loss_PolicyForm_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_PolicyForm_TerritoryCode.xls
<CompanyName>_PERSONAL_Loss_TerritoryCode_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_Zipcode_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_Zipcode_TerritoryCode.xls
<CompanyName>_PERSONAL_Loss_ConstType_PolicyForm_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_ConstType_PolicyForm_TerritoryCode.xls
<CompanyName>_PERSONAL_Loss_ConstType_TerritoryCode_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_County_ConstType_PolicyForm.xls
<CompanyName>_PERSONAL_Loss_County_ConstType_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_County_ConstType_TerritoryCode.xls
<CompanyName>_PERSONAL_Loss_County_PolicyForm_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_County_PolicyForm_TerritoryCode.xls
<CompanyName>_PERSONAL_Loss_County_TerritoryCode_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_Zipcode_ConstType_PolicyForm.xls
<CompanyName>_PERSONAL_Loss_Zipcode_ConstType_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_Zipcode_PolicyForm_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_ConstType_PolicyForm_TerritoryCode_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_County_ConstType_PolicyForm_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_County_ConstType_PolicyForm_TerritoryCode.xls
<CompanyName>_PERSONAL_Loss_County_ConstType_TerritoryCode_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_County_PolicyForm_TerritoryCode_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_Zipcode_ConstType_PolicyForm_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_PolicyForm_TerritoryCode_ProgramCode.xls
<CompanyName>_PERSONAL_Loss_County_ConstType_PolicyForm_TerritoryCode_ProgramCode.xls

There will be 9 files in the report for commercial residential policies with names as below:

< CompanyName>_COMMERCIAL_Loss_ConstType.xls
<CompanyName>_COMMERCIAL_Loss_County.xls
<CompanyName>_COMMERCIAL_Loss_TerritoryCode.xls
<CompanyName>_COMMERCIAL_Loss_Zipcode.xls
<CompanyName>_COMMERCIAL_Loss_ConstType_TerritoryCode.xls
<CompanyName>_COMMERCIAL_Loss_County_ConstType.xls
<CompanyName>_COMMERCIAL_Loss_Zipcode_ConstType.xls
<CompanyName>_COMMERCIAL_Loss_County_TerritoryCode.xls
<CompanyName>_COMMERCIAL_Loss_County_ConstType_TerritoryCode.xls

There will be 9 files in the report for combined personal and commercial residential policies with names as below:

< CompanyName>_Loss_ConstType.xls
<CompanyName>_Loss_County.xls
<CompanyName>_Loss_TerritoryCode.xls
<CompanyName>_Loss_Zipcode.xls
<CompanyName>_Loss_ConstType_TerritoryCode.xls
<CompanyName>_Loss_County_ConstType.xls
<CompanyName>_Loss_ZIPcode_ConstType.xls
<CompanyName>_Loss_County_TerritoryCode.xls
<CompanyName>_Loss_County_ConstType_TerritoryCode.xls

Table 29. Output report for OIR data processing.

6. Describe actions performed to ensure the validity of insurer or other input data used for hurricane model inputs or for validation/verification.

Each line of data submitted for input is screened to ensure the number of fields, their order and the basic structure of the data matches the input specifications. Any mismatch causes the screening process stop and the line in question is reported to the FPHLM user for resolution. The correction typically requires manual intervention by the user after communicating with the organization that provided the data.

After the initial screening a series of functions is run to further check each data attribute and prepare it for processing through the model. Those checks are outlined in the table below.

Data Attribute	Pre-processing Steps
Policy ID	Not used in processing. Included in Model Output.
Model ID	Numeric ID assigned by model.
Residency Type	Replace empty, NULL, and out-of-range values with the value Unknown. Replace numeric codes with corresponding description.
Zip Code	Replace empty and NULL values with the value Unknown. Remove the last five characters (dash and four digits) from ZIP 5+4 values. Exposures without a valid ZIP Code are not modeled.
Year Built	Replace empty and NULL values with the value Unknown. Set to Unknown values smaller than 1800 or larger than the current year. Impute Unknown values using county statistics.
Construction Type	Remove any character that is not a digit. Replace empty and NULL values with the value Unknown. Replace numeric codes with corresponding description. Replace out-of-range numeric codes with the value Other.
Structure, App. Structures, Contents, and TE Coverages	Remove any character that is not a digit or a dot. Replace with 0 any value that is not a correct representation of a real number. Exposures with 0 total coverage are not modeled.
Deductible	Remove any character that is not a digit, a dot, or a percent sign. Replace with 0 any value that is not a correct representation of a real number. Replace with the corresponding dollar value any value that is expressed as a percentage of the exposure (values between 0 and 1). Report zero and high (> 10%) deductible policies.
Nature of Coverage	Replace empty, N/A, and NULL values with the value Unknown.
County	Remove any character that is not a lowercase or uppercase letter, a dot, a whitespace, or a dash. Ensure that the first letter of every word in the county name is capitalizes and the rest are not. Replace empty, N/A, and NULL values with the value Unknown. Correct county name spelling. Ensure correct assignment based on ZIP Code.
Address	Remove any character that is not a lowercase or uppercase letter, a digit, a dot, or a whitespace. Replace empty, N/A, and NULL values with the value Unknown.
Longitude and Latitude	Remove any character that is not a digit, a dot, or a dash. Replace empty and NULL values with the value 0. Assign location of ZIP Code centroid if Unknown and ZIP Code information is available.

Data Attribute	Pre-processing Steps
	Exposures without a location are not modeled.
City	Remove any character that is not a lowercase or uppercase letter, a dot, or a dash. Replace empty, N/A, and NULL values with the value Unknown.
Form	Replace empty, N/A, and NULL values with the value Unknown.
Program	Unused during processing. Included in model output. Replace empty, N/A, and NULL values with the value Unknown.
Territory	Unused during processing. Included in model output. Replace empty, N/A, and NULL values with the value Unknown.
Year Retrofitted	Replace empty, N/A, and NULL values with the value Unknown.
Number of Stories	Replace with the value Unknown any value that is not an integer number between 1 and 99. Ensure Manufactured policies have one story. Ensure Frame buildings have at most three stories. Ensure non-unit PR policies have one or two stories. Ensure the number of stories is at least the location of unit for unit policies. Impute Unknown values using county statistics.
Location of Unit	Replace with the value Unknown any value that is not either an integer number between 1 and 99, Unknown, or NA.
Sliders	Replace empty, N/A, and NULL values with the value Unknown. Replace numeric codes with corresponding description. Replace Unknown values with default.
Units per Story	Remove any character that is not a digit. Replace empty and NULL values with the value Unknown.
Total Units	Remove any character that is not a digit. Replace empty and NULL values with the value Unknown. Ensure values agree with units per story and number of units when available. Impute Unknown values using county statistics.
Area of Property	Remove any character that is not a digit or a dot. Replace empty and NULL values with the value Unknown.
Roof Shape	Replace empty, N/A, NULL, and out-of-range values with the value Unknown. Replace numeric codes with corresponding description. Impute Unknown values using county statistics.
Roof Cover	Replace empty, N/A, NULL, and out-of-range values with the value Unknown. Replace numeric codes with corresponding description. Impute Unknown values using county statistics.
Roof Membrane	Replace empty, N/A, NULL, or out-of-range values with the value Unknown. Replace numeric codes with corresponding description.
Soffit	Replace empty, N/A, NULL, and out-of-range values with the value Unknown. Replace numeric codes with corresponding description.
Building Layout	Remove any character that is not a digit. Replace empty and NULL values with the value Unknown. Replace numeric codes with corresponding description
Roof-to-Wall Connection	Replace empty, N/A, NULL, and out-of-range values with the value Unknown. Replace numeric codes with corresponding description.
Deck Attachment	Replace empty, N/A, NULL, and out-of-range values with the value Unknown. Replace numeric codes with corresponding description.

Data Attribute	Pre-processing Steps
Garage Door	Replace empty, N/A, NULL, and out-of-range values with the value Unknown. Replace numeric codes with corresponding description.
Opening Protection	Replace empty, N/A, NULL, and out-of-range values with the value Unknown. Replace numeric codes with corresponding description. Impute Unknown values using county statistics.

Table 30. Input Data Pre-processing

7. Disclose if changing the order of the hurricane model input exposure data produces different hurricane model output or results.

If one or more attributes are known and unknown attributes are assigned based on survey statistics, changing the order of the input exposure data may produce a different model output. Whenever assignment of attributes is performed, reprocessing the same input exposure, even with no change in order, may produce a different output.

8. Disclose if removing and adding policies from the hurricane model input file affects the hurricane model output or results for the remaining policies.

If one or more attributes are known and unknown attributes are assigned based on survey statistics, adding policies to or removing policies from the input exposure data may produce a different model output. If the policies added or removed have known attributes and are not part of the block receiving assignments, those policies themselves will have no impact on results for the remaining policies. However, as noted above, whenever assignment is involved, reprocessing the same input exposure, even with no additions to or deletions from that exposure, may produce a different output.

A-2 Hurricane Events Resulting in Modeled Hurricane Losses

A. Modeled hurricane loss costs and hurricane probable maximum loss levels shall reflect all insured wind related damages from storms that reach hurricane strength and produce minimum damaging windspeeds or greater on land in Florida.

Modeled hurricane losses are produced for storms reaching hurricane strength and producing damaging windspeeds on land in Florida.

B. The modeling organization shall have a documented procedure for distinguishing wind-related hurricane losses from other peril losses.

The procedure for distinguishing wind-related hurricane losses from other peril losses is documented.

Disclosures

1. Describe how damage from hurricane model generated storms (landfalling and by-passing hurricanes) is excluded or included in the calculation of hurricane loss costs and hurricane probable maximum loss levels for Florida.

Damages are computed for all Florida land-falling and certain by-passing storms in the stochastic set that attain hurricane level wind speeds. The following by-passing hurricanes are included:

-Non-landfalling hurricanes with point of closest approach in region A, B, C, D, E or F and open terrain winds greater than 30 mph in at least one Florida ZIP Code.

-Landfalling hurricanes in regions E or F with open terrain winds greater than 30 mph in at least one Florida ZIP Code.

2. Describe how damage resulting from concurrent or preceding flood or hurricane storm surge is treated in the calculation of hurricane loss costs and hurricane probable maximum loss levels for Florida.

Damage from concurrent or preceding flood or storm surge is not considered in the calculation of hurricane loss costs and hurricane probable maximum loss. The hurricane model assumes that wind is the only cause of loss from each hurricane.

A-3 Hurricane Coverages

A. The methods used in the calculation of building hurricane loss costs shall be actuarially sound.

The model's calculation of building loss costs is actuarially sound.

B. The methods used in the calculation of appurtenant structure hurricane loss costs shall be actuarially sound.

The model's calculation of appurtenant structure loss costs is actuarially sound.

C. The methods used in the calculation of contents hurricane loss costs shall be actuarially sound.

The model's calculation of contents loss costs is actuarially sound.

D. The methods used in the calculation of time element hurricane loss costs shall be actuarially sound.

The model's calculation of time element loss costs is actuarially sound.

Disclosures

1. Describe the methods used in the hurricane model to calculate hurricane loss costs for building coverage associated with personal and commercial residential properties.

Personal Residential Buildings

The model includes a set of vulnerability matrices for personal residential buildings. The matrices specify the probability of damage of a given magnitude at various wind speeds. For each building in the policy portfolio the applicable matrix for that building is used to determine the expected percent damage at a given wind speed. This determination is made storm by storm for every storm in the stochastic set. The resulting damages, adjusted for policy limits, deductibles and demand surge, are aggregated across all storms to calculate the loss cost per $1,000 of exposure.

A provision for Law and Ordinance coverage can be included or excluded from the loss cost for each policy. To exclude Law and Ordinance for a policy a reduction factor is applied to the modeled structure loss for each storm in the stochastic set. The factor depends on the characteristics of the exposure (such as construction type and year-built) and on the wind speed of the storm in question at that policy's location.

Commercial Residential Buildings

For low-rise commercial residential buildings (three stories or fewer) the model includes a set of vulnerability curves. The curves specify the expected damage rate by wind speed.

For mid-/high-rise commercial residential buildings (over three stories), the model estimates exterior damage to the building by aggregating expected damage per story and interior damage as a function of the volume of water intrusion resulting from breached openings on each story.

Similar to the approach applied to personal residential buildings, expected damages for commercial residential buildings are determined for each storm, adjusted for policy provisions and demand surge, and aggregated to calculate the loss cost per $1,000 of exposure.

2. Describe the methods used in the hurricane model to calculate hurricane loss costs for appurtenant structure coverage associated with personal and commercial residential properties.

Expected damages for both personal residential and commercial residential appurtenant structures are determined by policy for each storm in the stochastic set, adjusted for policy provisions and demand surge, and aggregated across all storms to calculate the loss cost per $1,000 of exposure. Expected damages are determined as follows:

Personal Residential Appurtenant Structures

Since the appurtenant structures damage is not derived from the building damage, only one vulnerability matrix is applied for appurtenant structures. The typical insurance portfolio gives no indication of the type of appurtenant structure covered under a particular policy. Therefore, a distribution of the three types (slightly vulnerable, moderately vulnerable, and highly vulnerable) was assumed in developing this matrix, and the result was then validated against claim data.

Commercial Residential Appurtenant Structures

For commercial residential exposures, appurtenant structures might include a clubhouse or administration building. These are modeled like additional buildings. For other structures such as pools, the appurtenant structures vulnerability matrix developed for residential buildings is applied.

3. Describe the methods used in the hurricane model to calculate hurricane loss costs for contents coverage associated with personal and commercial residential properties.

Expected damages for both personal residential and commercial residential contents coverage are determined for each storm in the stochastic set, adjusted for policy provisions and demand surge, and aggregated across all storms to calculate the loss cost per $1,000 of exposure. Expected damages are determined as follows:

Personal Residential Contents

Contents losses are a function of the internal damage. The model applies empirical functions that are based on engineering judgment and were validated against claim data for Hurricanes Andrew, Charley, and Frances. Figure 73 shows masonry claims data from Hurricane Andrew, the cubic polynomial trend fit, and the model curve for the High Velocity Hurricane Zone (HVHZ), which consists of Miami-Dade and Broward counties. Notice that in this case the fit between model and data is reasonable where the density of data is higher. A resulting set of vulnerability matrices are applied to determine expected percent contents damage for a given wind speed.

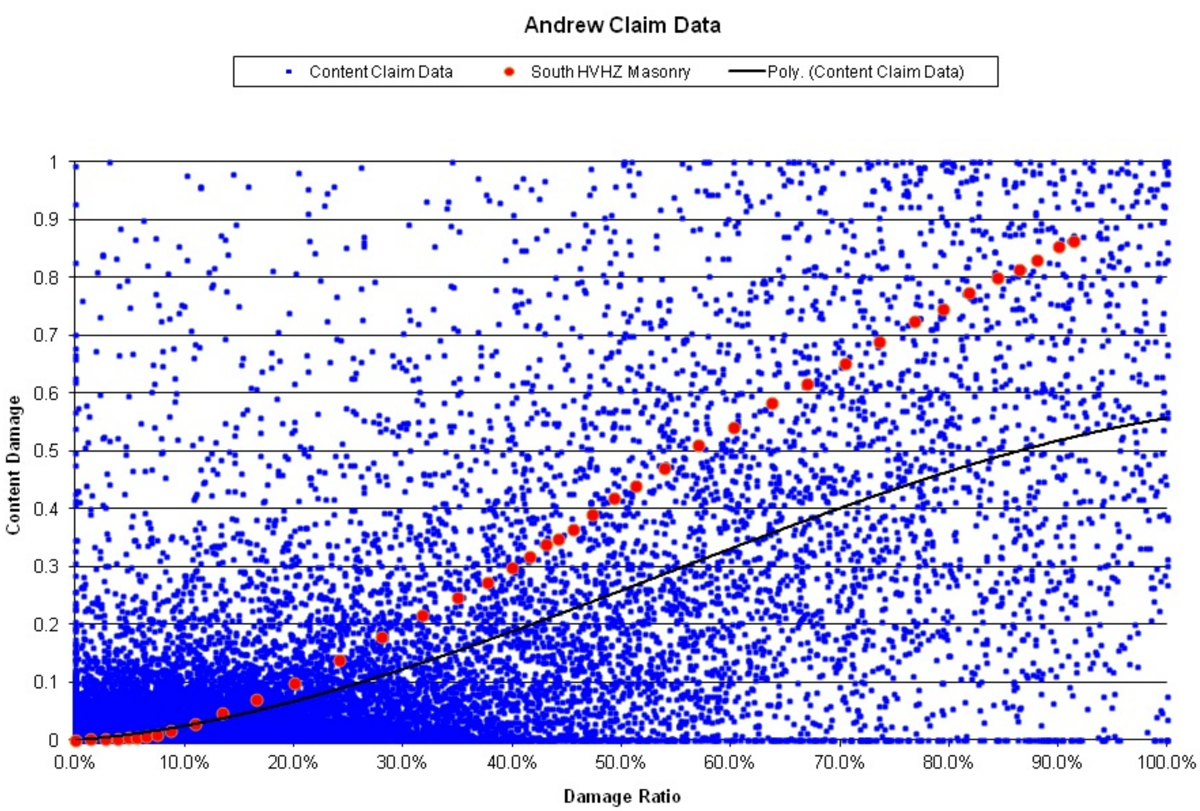


Figure 73. Modeled vs. actual relationship between structure and content damage ratios for Hurricane Andrew.

Commercial Residential Contents

Contents damage in low-rise buildings (three stories or fewer) is modeled as a proportion of interior damage. The resulting set of vulnerability curves vary by subregion and number of stories and specify expected percent damage by wind speed.

Contents damage in mid-/high-rise buildings (over three stories) is also determined as a proportion of total estimated interior damage to the building. The interior damage is estimated by determining the expected number of openings (windows, doors, sliding-glass doors) per story to be breached, and the resulting volume of water intrusion in each story.

The assumptions underlying contents damage development are based on engineering judgment.

4. Describe the methods used in the hurricane model to calculate hurricane loss costs for time element coverage associated with personal and commercial residential properties.

Expected damages for both personal residential and commercial residential time element coverage are determined for each storm in the stochastic set, adjusted for policy provisions and demand surge, and aggregated across all storms to calculate the loss cost per $1,000 of exposure. Expected damages are determined as follows:

Personal Residential Time Element

Personal residential time element damages are based on an empirical function relating those damages to the interior damage to the structure. The model does not distinguish explicitly between direct and indirect loss to the structure, but the function is calibrated against claim data that include both types of losses. Vulnerability matrices are applied to determine the expected percent loss for a given wind speed.

Commercial Residential Time Element

The time element damages associated with low-rise buildings (three stories or fewer) are modeled using functions that relate those damages to interior damage to the building. The resulting set of vulnerability curves specify expected percent damage by wind speed.

Time element damages in mid-/high-rise buildings (over three stories) are not modeled.

A-4 Modeled Hurricane Loss Cost and Hurricane Probable Maximum Loss Level Considerations

A. Hurricane loss cost projections and hurricane probable maximum loss levels shall not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin.

The model does not include expenses, risk load, investment income, premium reserves, taxes, assessments or profit margin in the calculation of loss costs and probable maximum loss levels.

B. Hurricane loss cost projections and hurricane probable maximum loss levels shall not make a prospective provision for economic inflation.

The model does not make a prospective provision for economic inflation in the calculation of loss costs and probable maximum loss levels.

C. Hurricane loss cost projections and hurricane probable maximum loss levels shall not include any explicit provision for direct hurricane storm surge losses.

The model does not include any explicit provision for direct hurricane storm surge losses in the calculation of loss costs and probable maximum loss levels.

D. Hurricane loss cost projections and hurricane probable maximum loss levels shall be capable of being calculated from exposures at a geocode (latitude-longitude) level of resolution.

The model allows for loss cost and probable maximum loss calculations at the geocode level of resolution.

E. Demand surge shall be included in the hurricane model's calculation of hurricane loss costs and hurricane probable maximum loss levels using relevant data and actuarially sound methods and assumptions.

Demand surge is included in the model's calculation of loss costs and probable maximum loss levels. Demand surge is based on and analysis of Marshall & Swift/Boeckh construction cost indices before and after hurricanes occurring between 1992 and 2007. The methods and assumptions underlying the demand surge factors are actuarially sound.

Disclosures

1. Describe the method(s) used to estimate annual hurricane loss costs and hurricane probable maximum loss levels. Identify any source documents used and any relevant research results.

To estimate annual loss costs and probable maximum loss levels, losses are estimated for individual policies in the portfolio for each hurricane in a stochastic set of storms. Losses are estimated separately for structure, appurtenant structure, contents, and time element coverage.

The meteorological component of the model generates the stochastic set of hurricanes and derives an expected three-second gust wind speed, by latitude and longitude, for each hurricane in that set of storms.

The engineering component of the model consists of a set of vulnerability matrices for personal residential exposures and a set of vulnerability curves for low-rise commercial residential exposures. The matrices specify the probability of damage of a given magnitude at various wind speeds. The curves specify the expected damage rate by wind speed. For mid-rise and high-rise commercial residential exposures, the model estimates exterior damage by aggregating expected damage per story and interior damage as a function of the volume of water intrusion resulting from breached openings on each story.

The estimated damages are reduced by applicable deductibles and increased to allow for the impact of demand surge on claim costs.

The modeled insured losses can then be summed across all properties in a ZIP Code or across all ZIP Codes in a county to obtain expected aggregate loss. The losses can also be aggregated by policy form, construction type, rating territories, etc.

Finally, modeled losses are divided by the number of years in the simulation and by the total amount of insurance to estimate annual loss costs.

To estimate Probable maximum loss on an "annual aggregate" basis modeled losses for storms occurring in the same year of the simulation are summed to produce annual storm losses. Probable maximum loss levels are calculated from the ordered set of annual losses as described in Standard A-6, Disclosure # 8.

To estimate Probable maximum loss on an "annual occurrence" basis the ordered set consists of the largest loss in each year of the simulation.

The following sources were used in the research:

Hogg, R. V., & Klugman, S. (1984). Loss Distributions. New York: Wiley.
Klugman, S., Panjer, H., & Willmot, G. (1998). Loss Models: From Data to Decisions. New York: Wiley.

Wilkinson, M. E. (1982). Estimating Probable Maximum Loss with Order Statistics. Casualty Actuarial Society, LXIX, pp. 195-209.

2. Identify the highest level of resolution for which hurricane loss costs and hurricane probable maximum loss levels can be provided. Identify all possible resolutions available for the reported hurricane output ranges.

Losses are calculated at the policy/coverage level for each storm in the stochastic set.

Losses can be summarized across any policy characteristic provided in the exposures. Therefore, loss costs and probable maximum loss levels can be aggregated by characteristics such as policy form, coverage, construction, deductible, latitude-longitude, ZIP Code, county, rating territory, roof shape, or whatever is provided for input.

For the reported output ranges, the resolutions available are defined by the policy characteristics provided in the exposures, namely, policy form, ZIP Code, construction and deductible. ZIP Codes can be aggregated to the county, region, or statewide level.

3. Describe how the hurricane model incorporates demand surge in the calculation of hurricane loss costs and hurricane probable maximum loss levels.

Demand surge factors by coverage are calculated for each storm in the stochastic set and are applied to the estimated losses for that storm. For each storm, demand surge is assumed to be a function of coverage, region, and the storm's estimated statewide losses before consideration of demand surge.

General Form of the Demand Surge Functions

The functions applied to determine the demand surge for each storm are of the form

Structure: Surge Factor = c + p1 x ln (statewide storm losses) + p2,

where c is a constant,
p1 is a constant for all regions except Monroe County,
p2 varies by region, and
"statewide storm losses" are the estimated losses, before demand surge, for the storm under consideration.

Appurtenant Structures: Surge Factor = Structure Factor.

Contents: Surge Factor = [(Structure Factor – 1) x 30%] + 1.

Additional Living Expenses: Surge Factor = 1.5 x Structure Factor - .5.

Development of the Demand Surge Function for Structure

To estimate the impact of demand surge on the settlement cost of structural claims following a hurricane we used a quarterly construction cost index produced by Marshall & Swift/Boeckh. We considered the history of the index from first quarter 1992 through second quarter 2007. There is an index for each of 52 ZIP Codes in Florida representing 42 counties. We grouped the indices to produce a set of regional indices, weighting each ZIP Code index with population.

The approach to estimating structural demand surge was to examine the index for specific regions impacted by one or more hurricanes since 1992. From the history of the index, we projected what the index would have been in the period following the storm had no storm occurred. Any gap between the predicted and actual index was assumed to be due to demand surge. In total we examined ten storm–region combinations. From these ten observations of structural demand surge, we generalized to the functional relationship shown above.

Monroe County was treated as an exception. There were no storms of any severity striking Monroe during the period of our observations. We believe, though, that the location of and limited access to the Keys will result in an unusually high surge in reconstruction costs after a storm, particularly since the Overseas Highway could be damaged by storm surge or seriously blocked by debris. We have therefore judgmentally selected demand surge parameters for Monroe in excess of those indicated for the remainder of South Florida.

Development of the Contents Demand Surge Function

The approach to determining the contents demand surge function was to relate any surge in consumer prices in Southeast Florida following hurricanes Katrina and Wilma to the estimated structure demand surge following those storms. We used a sub-index of the Miami-Ft. Lauderdale Consumer Price Index for this purpose and compared the projected and actual indices after the storms. Since the surge in consumer prices was roughly 30% of the surge in construction costs, we selected that percentage as the relationship between structure and contents demand surge.

Development of Time Element (TE) Demand Surge Function

To estimate TE demand surge we first examined the relationship between structure losses and TE losses in the validation dataset. This dataset includes losses from three storms (Andrew, Charley, and Frances) and eleven insurance companies. We then compared the predicted increase in TE losses associated with various increases in structure losses. That generalized relationship is the TE demand surge function shown above.

TE demand surge is related to structure demand surge in the following sense: structure surge is caused by an inability of the local construction industry to meet the sudden demand for materials and labor following a storm. A high surge in construction costs suggests a more serious mismatch between the demand for repairs and the supply of materials and labor. This mismatch translates into longer delays in the completion of repairs and rebuilding, which in turn implies a higher surge in TE costs.

Because the model's TE surge is determined as a function of structure surge, Monroe County TE surge factors are higher than those for the remainder of South Florida. We believe this is reasonable because of the unusual delays in repair and rebuilding that are likely to occur following a major storm in the Keys, especially if there is damage to US 1 or to bridges connecting the islands.

Treatment of Demand Surge for Storms Impacting both the Florida Panhandle and Alabama

The Northwest region is segregated from the remainder of the North to allow for demand surge that is a function of combined Florida–Alabama losses from storms impacting both states. The Northwest region consists of all Panhandle counties west of Leon and Wakulla. The definition of this region was selected by considering which counties experienced losses from Hurricanes Ivan, Frederic, and Elena, i.e., from storms that impacted both states. Not all counties in the Northwest region experienced losses from these three specific storms, but losses in neighboring counties suggest that that they are nevertheless at risk for inclusion in a combined Florida–Alabama event.

Demand surge factors for the Northwest region are determined as an upward adjustment to the factors for the Northeast–North Central region. The purpose of this adjustment is to correct for an understatement of the model's demand surge that occurs when only the Florida losses from a combined Florida–Alabama event are used to determine the level of demand surge from a storm.

4. Provide citations to published papers, if any, or modeling-organization studies that were used to develop how the hurricane model estimates demand surge.

No published papers or modeling organization studies were used in the demand surge development.

5. Describe how economic inflation has been applied to past insurance experience to develop and validate hurricane loss costs and hurricane probable maximum loss levels.

No adjustments for economic inflation were applied to past insurance experience in the development or validation of loss costs and probable maximum loss levels.

A-5 Hurricane Policy Conditions

A. The methods used in the development of mathematical distributions to reflect the effects of deductibles and policy limits shall be actuarially sound.

The methods used by the model to reflect the impact of deductibles and policy limits are actuarially sound.

B. The relationship among the modeled deductible hurricane loss costs shall be reasonable.

The model produces deductible loss costs with reasonable relationships among the various deductibles.

C. Deductible hurricane loss costs shall be calculated in accordance with s. 627.701(5)(a), F.S.

The model calculates deductible loss costs in compliance with this statute as described in Disclosure #4 below.

Disclosures

1. Describe the methods used in the hurricane model to treat deductibles (both flat and percentage), policy limits, and insurance-to-value criteria when projecting hurricane loss costs and hurricane probable maximum loss levels. Discuss data or documentation used to validate the method used by the hurricane model.

In practice insurance companies often allocate deductibles to structure, content, AP, and ALE on a pro-rata loss basis. Thus, if for example, structure and content damages before deductible are \$20,000 and \$6,000 respectively, and the deductible is \$3,000, then (20,000/26,000)(3,000) = \$2,308 is allocated to structure and (6,000/26,000)(3,000) = \$692 is allocated to contents. This means that the various damages have to be considered and deductibles applied simultaneously. The deductibles must be allocated among the different losses and the truncation applied to each loss separately on a pro-rata basis.

For the pro-rata deductible method to work optimally, the functional relationships between structure damage and others should be estimated, and for each interval or class of structural damage, the corresponding mean and variance of the C, AP, and ALE damages should be specified. The conditional probabilities for C, AP, and ALE will then be the same as those for structural damage. An independent content matrix is somewhat problematic and may create biases in estimates of net of deductible losses. For structures we are likely to have damage ratio ranges or intervals of 0 to 2%, 2% to 4%, 4% to 6%, etc. For each interval (and its midpoint), ideally we may want to use the mean and variance of the corresponding damage ratios for contents, AP, and ALE. In practice, since the damage matrix for different types of losses are not directly related, we need to use the mean of the content, or AP, or ALE damage vector conditional on windspeeds since the windspeed is the only common frame of reference to the various types of damages.

$$\text{Expected Structure Loss} = E(L_s) = \sum_{D_S}^{L+D_S} (DM_i - D_s)\, p_S(x_i w) + \sum LM_S\, p_S(x_i w)$$

$$\text{Expected Content Loss} = E(L_C) = \sum_{C_S}^{L+C_S} (f(X_i) - D_c)\, p_C(x_i w) + \sum LM_C\, p_C(x_i w)$$

$$\text{Expected Appurtenant Loss} = E(L_{AP}) = \sum (g(X_i) - D_{AP})\, p_S(x_i w) + \sum LM_{AP}\, p_S(x_i w)$$

$$\text{Expected ALE Loss} = E(L_{ALE}) = \sum (h(X_i) - D_{ALE})\, p_S(x_i w) + \sum LM_{ALE}\, p_S(x_i w)$$

$$\text{Expected Loss} = E(L) = E(L_S) + E(L_C) + E(L_{AP}) + E(L_{ALE})$$

where each of the losses net of deductible is $\geqslant 0$ and where the deductibles DS, DC, DAP, DALE are applied on a pro-rata basis to the respective damages as follows:

$D_S = [DM_S / (DM_S + C + AP + ALE)] * D$
$D_C = [C / (DM_S + C + AP + ALE)] * D$
$D_{AP} = [AP / (DM_S + C + AP + ALE)] * D$
$D_{ALE} = [ALE / (DM_S + C + AP + ALE)] * D$

For this method to work, ideally, the joint probabilities of the losses must be estimated and used. In practice such joint probabilities are hard to estimate and validate. Thus, the engineering component should ideally provide for each structural damage interval, and given a wind speed, the mean and variance of damage ratio for content, AP, and ALE. The model uses the mean C, AP, and ALE for the given wind speed to determine the allocation of deductible to the various coverages.

This method is based on Hogg and Klugman (1984). Modeled losses net of deductible were validated against insurance company losses for Hurricanes Andrew, Charley, and Frances.

Personal Residential

In the damage matrices, each wind speed interval is associated with a distribution of possible damage ratios. Each damage ratio is multiplied by insured value to determine dollar damages, the deductible is deducted, and net of deductible loss is estimated.

Commercial Residential

The deductible is deducted from expected loss for each building.

Personal and Commercial Residential

The deductible is allocated to coverage by first calculating expected losses for each coverage, assuming zero deductible, and then allocating the deductible to coverage based on those losses.

Percentage deductibles are converted into dollar amounts.

Both the replacement cost and property value are assumed to equal the coverage limit unless the property value is provided as an input.

2. Describe whether, and if so how, the hurricane model treats policy exclusions and loss settlement provisions.

The model does not adjust losses for policy exclusions or loss settlement provisions.

3. Complete the following table using the method implemented in the hurricane model.

Building Value	Policy Limit	Deductible	Damage Ratio	Ground Up Hurricane Loss	Insurance Hurricane Loss
$100,000	$90,000	$500	2%	$2,000	$1,500
$100,000	$90,000	$500	50%	$50,000	$49,500
$100,000	$90,000	$500	92%	$92,000	$89,500
$100,000	$90,000	$500	100%	$100,000	$89,500
$100,000	$100,000	$500	92%	$92,000	$91,500

4. Describe how the hurricane model treats annual deductibles.

If there are multiple Hurricanes in a year in the stochastic set, the wind deductibles are applied to the first hurricane, and any remaining amount is then applied to the second hurricane. If none of the wind deductible remains, then the general peril deductible is applied. This is the case for both personal and commercial residential policies.

A-6 Hurricane Loss Outputs and Logical Relationships to Risk

A. The methods, data, and assumptions used in the estimation of hurricane probable maximum loss levels shall be actuarially sound.

The probable maximum loss levels estimated by the model are actuarially sound.

B. Hurricane loss costs shall not exhibit an illogical relation to risk, nor shall hurricane loss costs exhibit a significant change when the underlying risk does not change significantly.

Loss costs produced by the model exhibit a logical relation to risk and do not change significantly when the underlying risk is unchanged.

C. Hurricane loss costs produced by the hurricane model shall be positive and non-zero for all valid Florida ZIP Codes.

The model's loss costs are positive and non-zero for all valid Florida ZIP Codes.

D. Hurricane loss costs cannot increase as the quality of construction type, materials and workmanship increases, all other factors held constant.

The model produces loss costs that do not increase as the quality of construction increases, all other factors held constant.

E. Hurricane loss costs cannot increase as the presence of fixtures or construction techniques designed for hazard mitigation increases, all other factors held constant.

The model's loss costs do not increase in the presence of hazard mitigation features, all other factors held constant.

F. Hurricane loss costs cannot increase as the wind resistant design provisions increase, all other factors held constant.

The model's loss costs do not increase in the presence of wind resistant design provisions, all other factors held constant.

G. Hurricane loss costs cannot increase as building code enforcement increases, all other factors held constant.

The model produces loss costs that do not increase as building code enforcement increases, all other factors held constant.

H. Hurricane loss costs shall decrease as deductibles increase, all other factors held constant.

The model's loss costs decrease as deductibles increase, all other factors held constant.

I. The relationship of hurricane loss costs for individual coverages, (e.g., building, appurtenant structure, contents, and time element) shall be consistent with the coverages provided.

The relationships between modeled loss costs by coverage are consistent with the coverage provided.

J. Hurricane output ranges shall be logical for the type of risk being modeled and apparent deviations shall be justified.

Output ranges are logical by risk type. Apparent deviations are justified in Disclosure #17 below.

K. All other factors held constant, hurricane output ranges produced by the hurricane model shall in general reflect lower hurricane loss costs for:

1. masonry construction versus frame construction,

All other factors held constant, the output ranges reflect lower loss costs for masonry versus frame construction.

2. personal residential risk exposure versus manufactured home risk exposure,

All other factors held constant, the output ranges reflect lower loss costs for site-built versus manufactured home exposures.

3. inland counties versus coastal counties, and

All other factors held constant, the output ranges reflect lower loss costs for inland versus coastal counties.

4. northern counties versus southern counties, and

All other factors held constant, the output ranges reflect lower loss costs for northern versus southern counties.

5. newer construction versus older construction.

All other factors held constant, the output ranges reflect lower loss costs for newer construction versus older construction.

L. For hurricane loss cost and hurricane probable maximum loss level estimates derived from and validated with historical insured hurricane losses, the assumptions in the derivations concerning (1) construction characteristics, (2) policy provisions, (3) coinsurance, and (4) contractual provisions shall be appropriate based on the type of risk being modeled.

In the derivation of loss costs and probable maximum loss levels the model's assumptions concerning construction characteristics, policy provisions, coinsurance and contractual provisions are appropriate based on the type of risk modeled.

Disclosures

1. Provide a completed Form A-1, Zero Deductible Personal Residential Hurricane Loss Costs by ZIP Code. Provide a link to the location of the form here.

See Form A-1.

2. Provide a completed Form A-2A, Base Hurricane Storm Set Statewide Hurricane Losses (2012 FHCF Exposure Data). Provide a link to the location of the form here.

See Form A-2A***.***

3. Provide a completed Form A-2B, Base Hurricane Storm Set Statewide Hurricane Losses (2017 FHCF Exposure Data). Provide a link to the location of the form here.

See Form A-2B.

4. Provide a completed Form A-3A, 2004 Hurricane Season Losses (2012 FHCF Exposure Data). Provide a link to the location of the form here.

See Form A-3A.

5. Provide a completed Form A-3B, 2004 Hurricane Season Losses (2017 FHCF Exposure Data). Provide a link to the location of the form here.

See Form A-3B.

6. Provide a completed Form A-4A, Hurricane Output Ranges (2012 FHCF Exposure Data). Provide a link to the location of the form here.

See Form A-4A.

7. Provide a completed Form A-4B, Hurricane Output Ranges (2017 FHCF Exposure Data). Provide a link to the location of the form here.

See Form A-4AB.

8. Provide a completed Form A-5, Percentage Change in Hurricane Output Ranges (2012 FHCF Exposure Data). Provide a link to the location of the form here.

See Form A-5.

9. Provide a completed Form A-7, Percentage Change in Logical Relationship to Hurricane Risk. Provide a link to the location of the form here.

See Form A-7.

10. Provide a completed Form A-8A, Hurricane Probable Maximum Loss for Florida (2012 FHCF Exposure Data). Provide a link to the location of the form here.

See Form A-8A.

11. Provide a completed Form A-8B, Hurricane Probable Maximum Loss for Florida (2017 FHCF Exposure Data). Provide a link to the location of the form here.

See Form A-8B.

12. Describe how the hurricane model produces hurricane probable maximum loss levels.

Probable Maximum Loss on an Annual Aggregate Basis

Probable maximum loss is produced non-parametrically using order statistics of simulated annual losses.

The model produces N simulated annual losses, represented by $X_1, X_2, \ldots, X_N$. The data are ordered so that $X_{(1)} \leq X_{(2)} \leq \ldots \leq X_{(N)}$.

For a return period of Y years, let p = 1-1/Y. The corresponding PML for the return period Y is the pth quantile of the ordered losses.

Let k = (N)*p. If k is an integer, then the estimate of the PML is the kth order statistic, $X_{(k)}$, of the simulated losses. If k is not an integer, then let k* = the smallest integer greater than k, and the estimate of the pth quantile is given by $X_{(k^*)}$.

Probable Maximum Loss on an Annual Occurrence Basis

Probable maximum loss on an annual occurrence basis is determined similarly to probable maximum loss on an annual aggregate basis. The set of N losses, $X_1, X_2, \ldots, X_N$, consists of the largest event loss in each simulated year, ordered from smallest to largest.

13. Provide citations to published papers, if any, or modeling-organization studies that were used to estimate hurricane probable maximum loss levels.

Wilkinson, M. E. (1982). Estimating Probable Maximum Loss with Order Statistics. *Casualty Actuarial Society*, *LXIX*, pp. 195-209.

14. Describe how the hurricane probable maximum loss levels produced by the hurricane model include the effects of personal and commercial residential insurance coverage.

The model can produce probable maximum loss levels separately for personal and commercial residential exposures or on a combined basis. To produce the probable maximum loss on a combined basis, modeled losses for both personal and commercial exposures are aggregated for each storm in the simulation before the years are ordered. Because modeled losses are used as the basis for the probable maximum loss level, the effects of policy limits, deductibles, etc. are reflected in the probable maximum loss estimates.

15. Explain any differences between the values provided on Form A-8A, Hurricane Probable Maximum Loss for Florida (2012 FHCF Exposure Data), and those provided on Form S-2A, Examples of Hurricane Loss Exceedance Estimates (2012 FHCF Exposure Data).

The values on Form A-8A and Form S-2A are the same.

16. Explain any differences between the values provided on Form A-8B, Hurricane Probable Maximum Loss for Florida (2017 FHCF Exposure Data), and those provided on Form S-2B, Examples of Hurricane Loss Exceedance Estimates (2017 FHCF Exposure Data).

The values on Form A-8B and Form S-2B are the same.

17. Provide an explanation for all anomalies in the hurricane loss costs that are not consistent with the requirements of this standard.

Forms A-4A and A-4B: In Forms A-4A and A-4B the county weighted average loss cost for masonry sometimes exceeds frame because the masonry weights are greater in ZIP Codes with higher loss costs.

Form A-6: There are anomalies in the Building Code and Building Strength tests in Form A-6. The anomalies are the result of the following model assumptions:

- The model assumes no difference in structure strength between the 1998, 2004 and 2007 Building Codes in the HVHZ.
- The model assumes no difference in structure strength between 1974 and 1992 Mobile Homes and does not vary damages based on tie-downs.
- The model assumes no difference in structure strength between the 1980 and 1998 Building Codes as they apply to Commercial Residential construction, except in the HVHZ where metal shutters were required after 1994.

18. Provide an explanation of the differences in hurricane output ranges between the previously-accepted hurricane model and the current hurricane model based on the 2012 FHCF Exposure Data.

As described in Standard G-1, there were minor updates to the model. The statewide impacts for $0 deductible loss costs were:

- +2.34% due to updated HURDAT2
- +0.002% due to updated Zip Code centroids

The impact of the updates was similar for both personal and commercial residential loss costs.

The changes due to the HURDAT update were larger in the eastern portion of the panhandle where loss costs for some counties increased by roughly 10%.

19. Identify the assumptions used to account for the effects of coinsurance on commercial residential hurricane loss costs.

The model assumes properties are insured to value and makes no adjustment to losses for coinsurance penalties.

Form A-1: Zero Deductible Personal Residential Hurricane Loss Costs by ZIP Code

A. Provide three maps, color-coded by ZIP Code (with a minimum of six value ranges), displaying zero deductible personal residential hurricane loss costs per $1,000 of exposure for frame owners, masonry owners, and manufactured homes.

B. Create exposure sets for these exhibits by modeling all of the buildings from Notional Set 3 described in the file "NotionalInput157.xlsx" geocoded to each ZIP Code centroid in the state, as provided in the hurricane model. Provide the predominant County name and the Federal Information Processing Standards (FIPS) code associated with each ZIP Code centroid. Refer to the Notional Hurricane Policy Specifications below for additional modeling information. Explain any assumptions, deviations, and differences from the prescribed exposure information.

C. Provide, in the format given in the file named "2017FormA1.xlsx" in both Excel and PDF format, the underlying hurricane loss cost data, rounded to three decimal places, used for A. above. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name.

Notional Hurricane Policy Specifications

Policy Type	Assumptions
Owners	**Coverage A = Building** • Replacement Cost included subject to Coverage A limit • Law and Ordinance not included **Coverage B = Appurtenant Structure** • Replacement Cost included subject to Coverage B limit • Law and Ordinance not included **Coverage C = Contents** • Replacement Cost included subject to Coverage C limit **Coverage D = Time Element** • Time limit = 12 months • Per diem = $150.00/day per policy, if used **Hurricane loss costs per $1,000 shall be related to the Coverage A limit**
Manufactured Homes	**Coverage A = Building** • Replacement Cost included subject to Coverage A limit **Coverage B = Appurtenant Structure** • Replacement Cost included subject to Coverage B limit **Coverage C = Contents** • Replacement Cost included subject to Coverage C limit

Coverage D = Time Element

- Time limit = 12 months
- Per diem = $150.00/day per policy, if used

Hurricane loss costs per $1,000 shall be related to the Coverage A limit

See Appendix B.

Form A-2A: Base Hurricane Storm Set Statewide Hurricane Losses (2012 FHCF Exposure Data)

A. Provide the total insured hurricane loss and the dollar contribution to the average annual hurricane loss assuming zero deductible policies for individual historical hurricanes using the Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data provided in the file named "hlpm2012c.exe." The list of hurricanes in this form shall include all Florida and by-passing hurricanes in the modeling organization Base Hurricane Storm Set, as defined in Standard M-1, Base Hurricane Storm Set.

The table below contains the minimum number of hurricanes from HURDAT2 to be included in the Base Hurricane Storm Set, based on the 117-year period 1900-2016. As defined, a by-passing hurricane (ByP) is a hurricane which does not make landfall, but produces minimum damaging windspeeds or greater on land in Florida. For the by-passing hurricanes included in the table only, the hurricane intensity entered is the maximum windspeed at closest approach to Florida as a hurricane, not the windspeed over Florida. Each hurricane has been assigned an ID number. As defined in Standard M-1, Base Hurricane Storm Set, the Base Hurricane Storm Set for the modeling organization may exclude hurricanes that had zero modeled impact, or it may include additional hurricanes when there is clear justification for the additions. For hurricanes in the table below resulting in zero hurricane loss, the table entry shall be left blank. Additional hurricanes included in the hurricane model's Base Hurricane Storm Set shall be added to the table below in order of year and assigned an intermediate ID number as the hurricane falls within the bounding ID numbers.

B. If additional assumptions are necessary to complete this form, provide the rationale for the assumptions as well as a detailed description of how they are included.

C. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form A-2A, Base Hurricane Storm Set Statewide Hurricane Losses (2012 FHCF Exposure Data), in a submission appendix.

Note: Total dollar contributions should agree with the total average annual zero deductible statewide hurricane loss costs provided in Form S-5, Average Annual Zero Deductible Statewide Hurricane Loss Costs – Historical versus Modeled, based on the 2012 FHCF Exposure Data.

See Appendix C.

Form A-2B: Base Hurricane Storm Set Statewide Hurricane Losses (2017 FHCF Exposure Data)

A. Provide the total insured hurricane loss and the dollar contribution to the average annual hurricane loss assuming zero deductible policies for individual historical hurricanes using the Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data found in the file named "hlpm2017c.exe." The list of hurricanes in this form shall include all Florida and by-passing hurricanes in the modeling organization Base Hurricane Storm Set, as defined in Standard M-1, Base Hurricane Storm Set.

The table below contains the minimum number of hurricanes from HURDAT2 to be included in the Base Hurricane Storm Set, based on the 117-year period 1900-2016. As defined, a by-passing hurricane (ByP) is a hurricane which does not make landfall, but produces minimum damaging windspeeds or greater on land in Florida. For the by-passing hurricanes included in the table only, the hurricane intensity entered is the maximum windspeed at closest approach to Florida as a hurricane, not the windspeed over Florida. Each hurricane has been assigned an ID number. As defined in Standard M-1, Base Hurricane Storm Set, the Base Hurricane Storm Set for the modeling organization may exclude hurricanes that had zero modeled impact, or it may include additional hurricanes when there is clear justification for the additions. For hurricanes in the table below resulting in zero hurricane loss, the table entry shall be left blank. Additional hurricanes included in the hurricane model Base Hurricane Storm Set shall be added to the table below in order of year and assigned an intermediate ID number as the hurricane falls within the bounding ID numbers.

B. If additional assumptions are necessary to complete this form, provide the rationale for the assumptions as well as a detailed description of how they are included.

C. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form A-2B, Base Hurricane Storm Set Statewide Hurricane Losses (2017 FHCF Exposure Data), in a submission appendix.

Note: Total dollar contributions should agree with the total average annual zero deductible statewide hurricane loss costs provided in Form S-5, Average Annual Zero Deductible Statewide Hurricane Loss Costs – Historical versus Modeled, based on the 2017 FHCF Exposure Data.

See Appendix D.

Form A-3A: 2004 Hurricane Season Losses (2012 FHCF Exposure Data)

A. Provide the percentage of residential zero deductible hurricane losses, rounded to four decimal places, and the monetary contribution from Hurricane Charley (2004), Hurricane Frances (2004), Hurricane Ivan (2004), and Hurricane Jeanne (2004) for each affected ZIP Code, individually and in total. Include all ZIP Codes where hurricane losses are equal to or greater than $500,000.

Use the 2012 Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data provided in the file named "hlpm2012c.exe."

Rather than using directly a specified published windfield, the winds underlying the hurricane loss cost calculations must be produced by the hurricane model being evaluated and should be the same hurricane parameters as used in completing Form A-2A, Base Hurricane Storm Set Statewide Hurricane Losses (2012 FHCF Exposure Data).

B. Provide maps color-coded by ZIP Code depicting the percentage of total residential hurricane losses from each hurricane, Hurricane Charley (2004), Hurricane Frances (2004), Hurricane Ivan (2004), and Hurricane Jeanne (2004), and for the cumulative hurricane losses using the following interval coding:

Red	***Over 5%***
Light Red	***2% to 5%***
Pink	***1% to 2%***
Light Pink	***0.5% to 1%***
Light Blue	***0.2% to 0.5%***
Medium Blue	***0.1% to 0.2%***
Blue	***Below 0.1%***

Plot the relevant storm track on each map.

C. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form A-3A, 2004 Hurricane Season Losses (2012 FHCF Exposure Data), in a submission appendix.

See Appendix E.

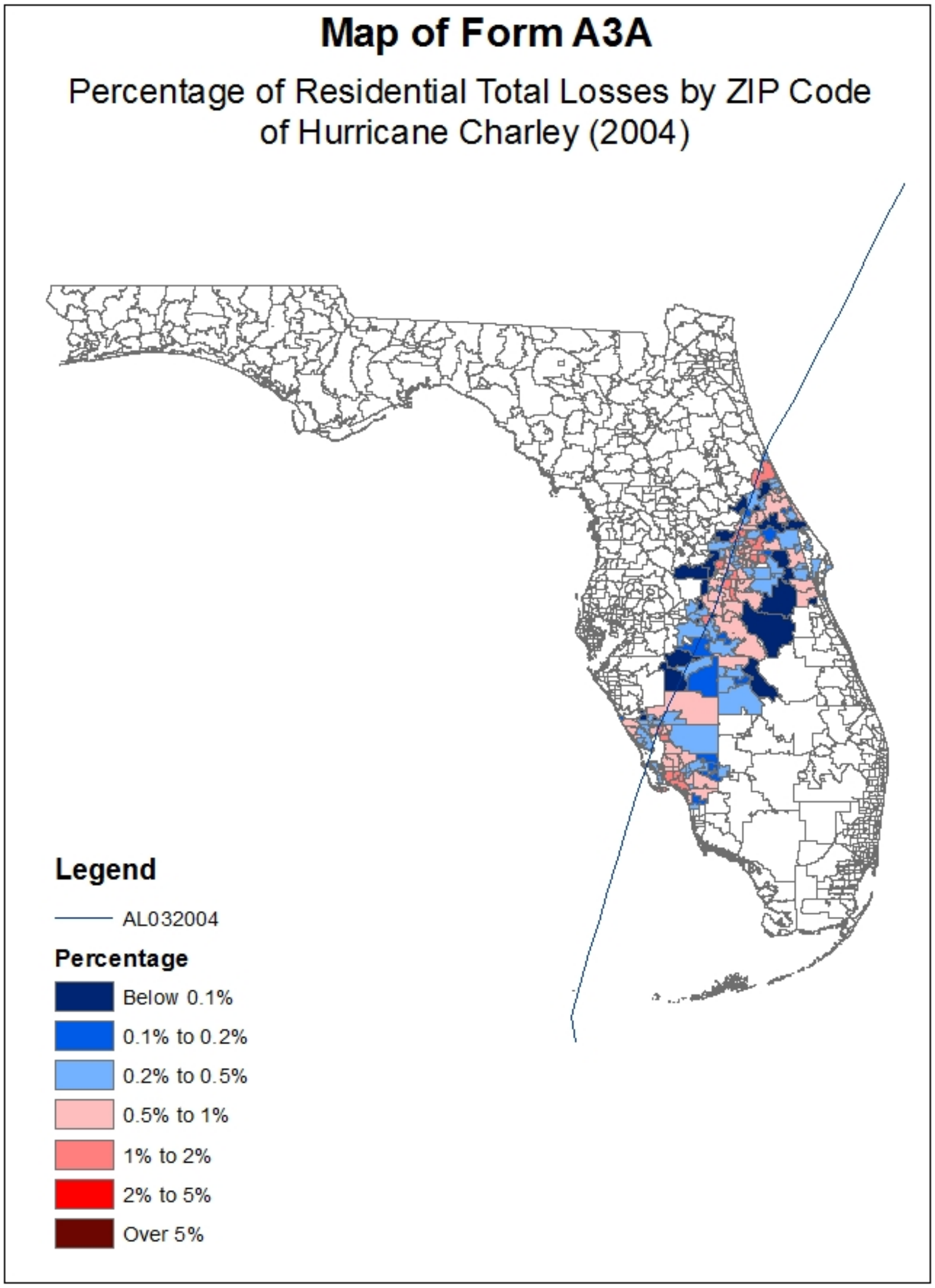


Figure 74. Percentage of residential total losses by ZIP code of Hurricane Charley (2004).

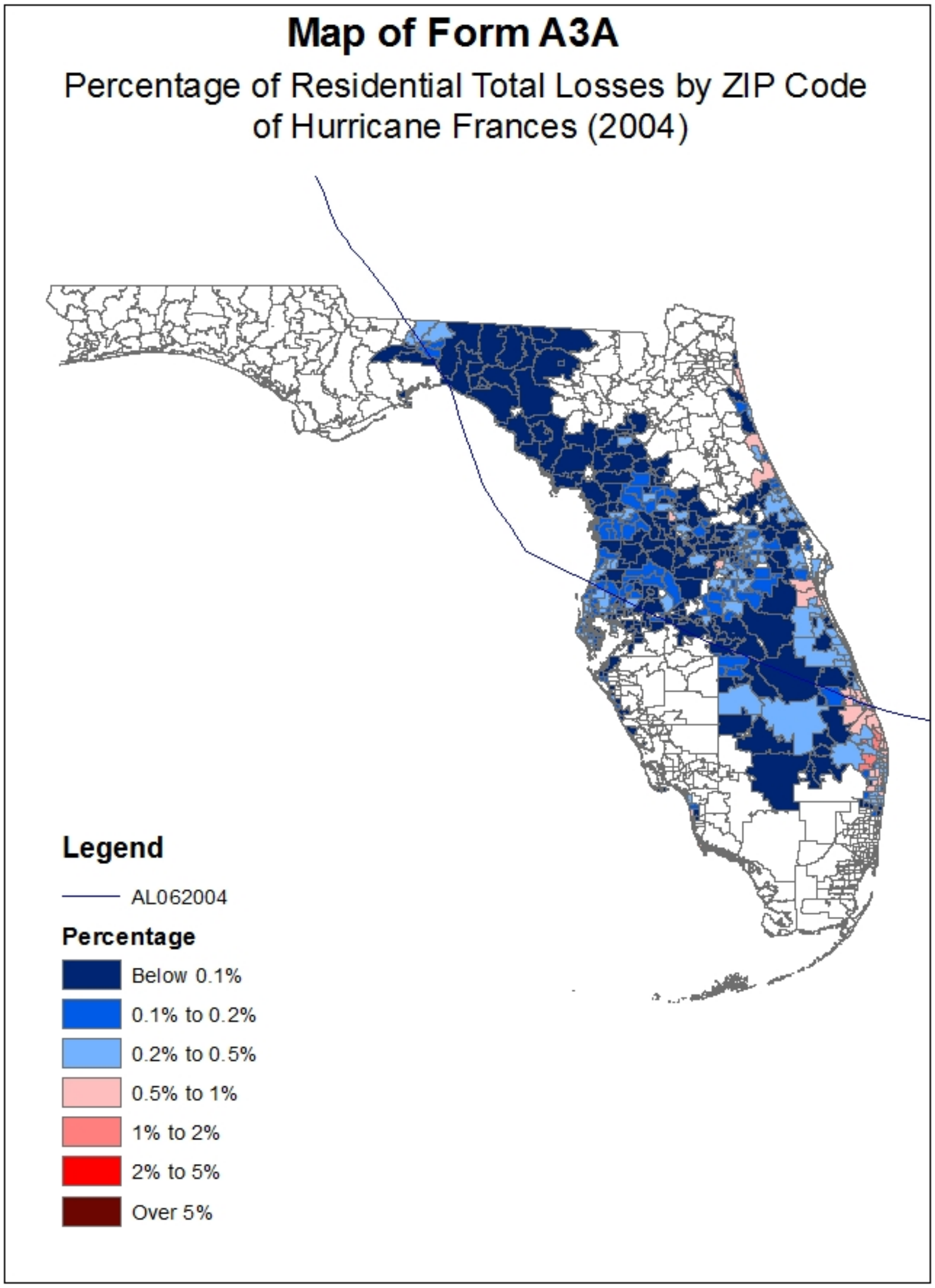


Figure 75. Percentage of residential total losses by ZIP code of Hurricane Frances (2004).

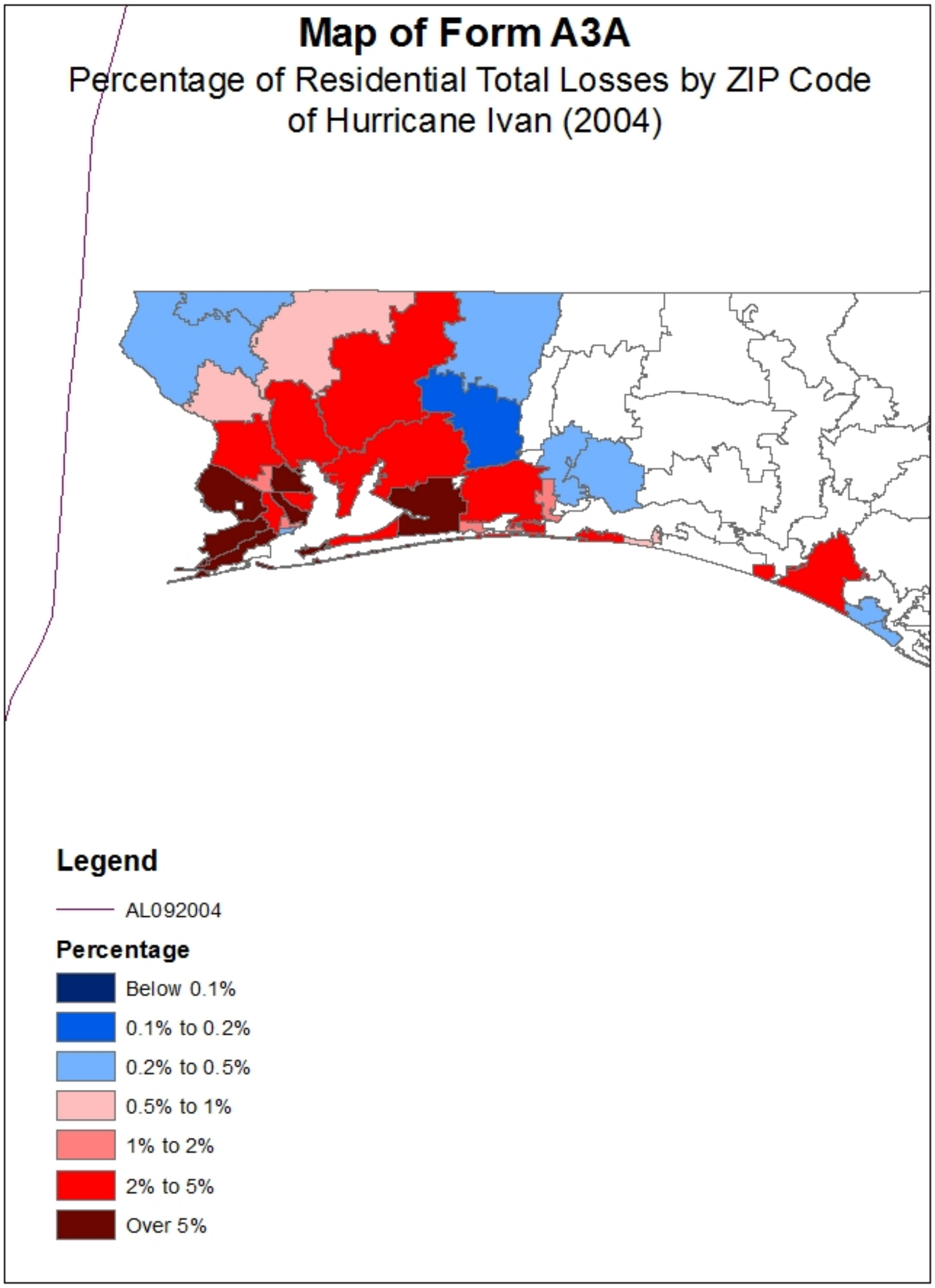


Figure 76. Percentage of residential total losses by ZIP code of Hurricane Ivan (2004)

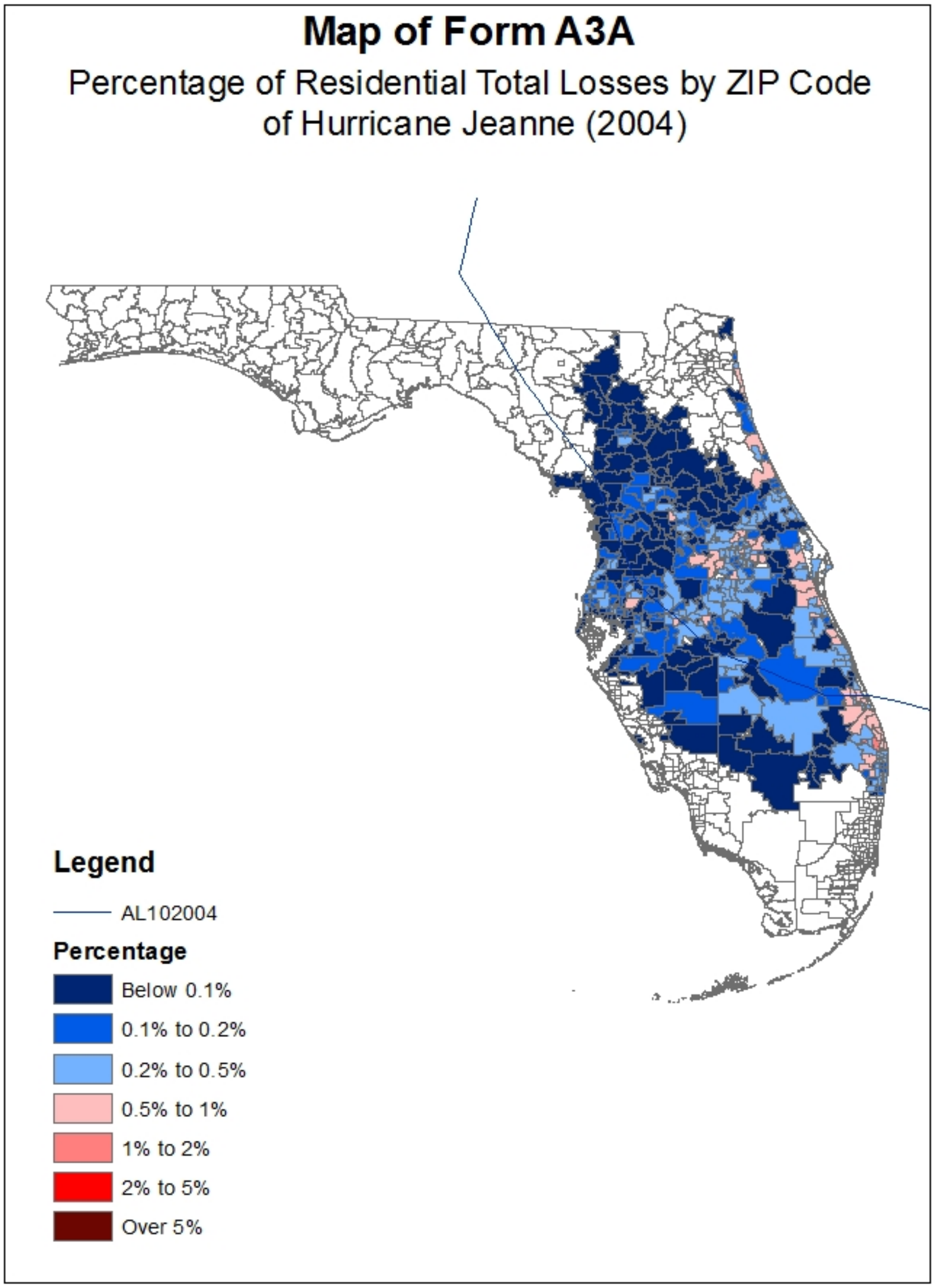


Figure 77. Percentage of residential total losses by ZIP code of Hurricane Jeanne (2004).

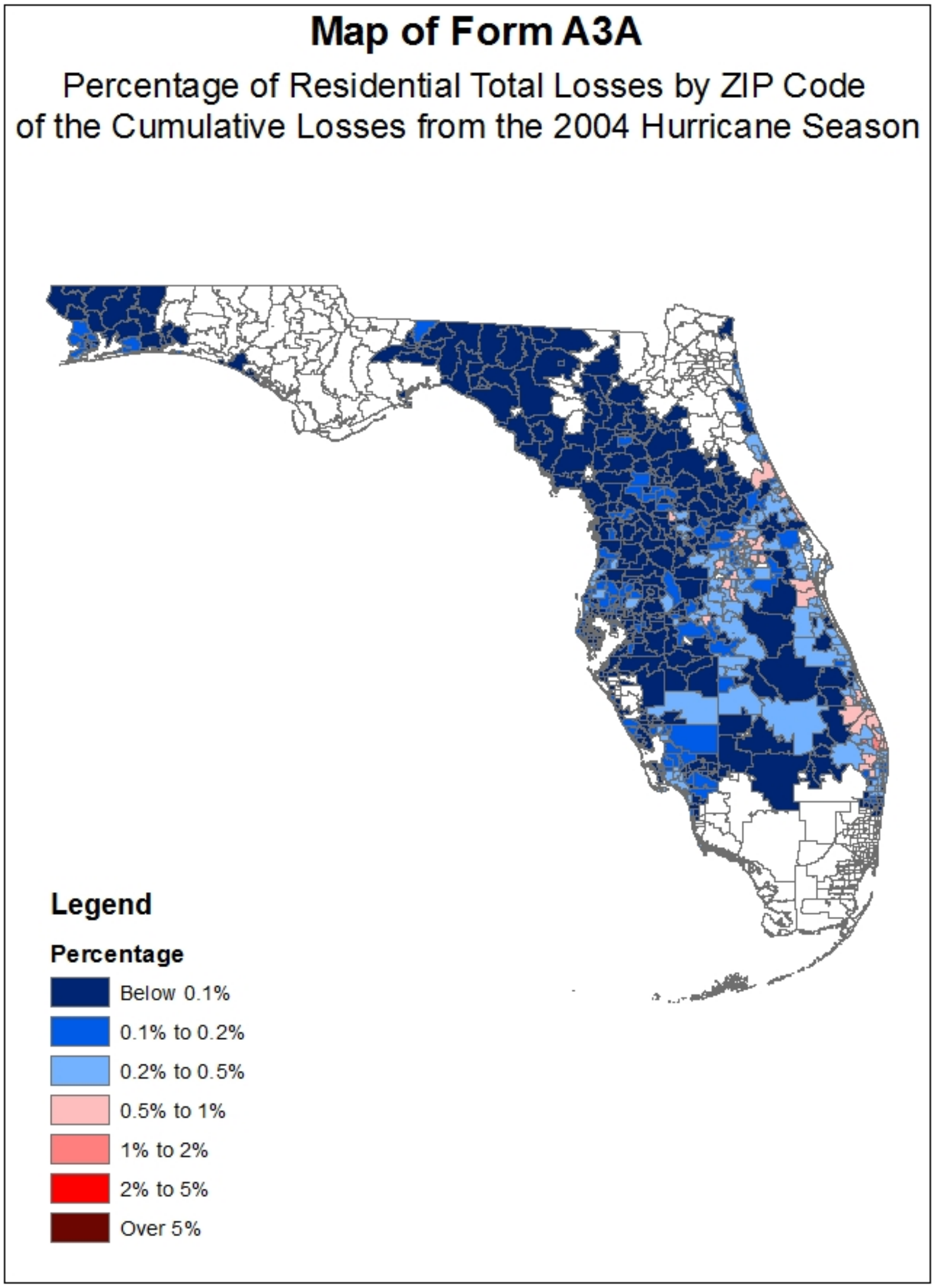


Figure 78. Percentage of residential total losses by ZIP code of the cumulative losses

Form A-3B: 2004 Hurricane Season Losses (2017 FHCF Exposure Data)

A. Provide the percentage of residential zero deductible hurricane losses, rounded to four decimal places, and the monetary contribution from Hurricane Charley (2004), Hurricane Frances (2004), Hurricane Ivan (2004), and Hurricane Jeanne (2004) for each affected ZIP Code, individually and in total. Include all ZIP Codes where hurricane losses are equal to or greater than $500,000.

Use the 2017 Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data provided in the file named "hlpm2017c.exe."

Rather than using directly a specified published windfield, the winds underlying the hurricane loss cost calculations must be produced by the hurricane model being evaluated and should be the same hurricane parameters as used in completing Form A-2B, Base Hurricane Storm Set Statewide Hurricane Losses (2017 FHCF Exposure Data).

B. Provide maps color-coded by ZIP Code depicting the percentage of total residential hurricane losses from each hurricane, Hurricane Charley (2004), Hurricane Frances (2004), Hurricane Ivan (2004), and Hurricane Jeanne (2004), and for the cumulative hurricane losses using the following interval coding:

Red	***Over 5%***
Light Red	***2% to 5%***
Pink	***1% to 2%***
Light Pink	***0.5% to 1%***
Light Blue	***0.2% to 0.5%***
Medium Blue	***0.1% to 0.2%***
Blue	***Below 0.1%***

Plot the relevant storm track on each map.

C. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form A-3B, 2004 Hurricane Season Losses (2017 FHCF Exposure Data), in a submission appendix.

See Appendix F.

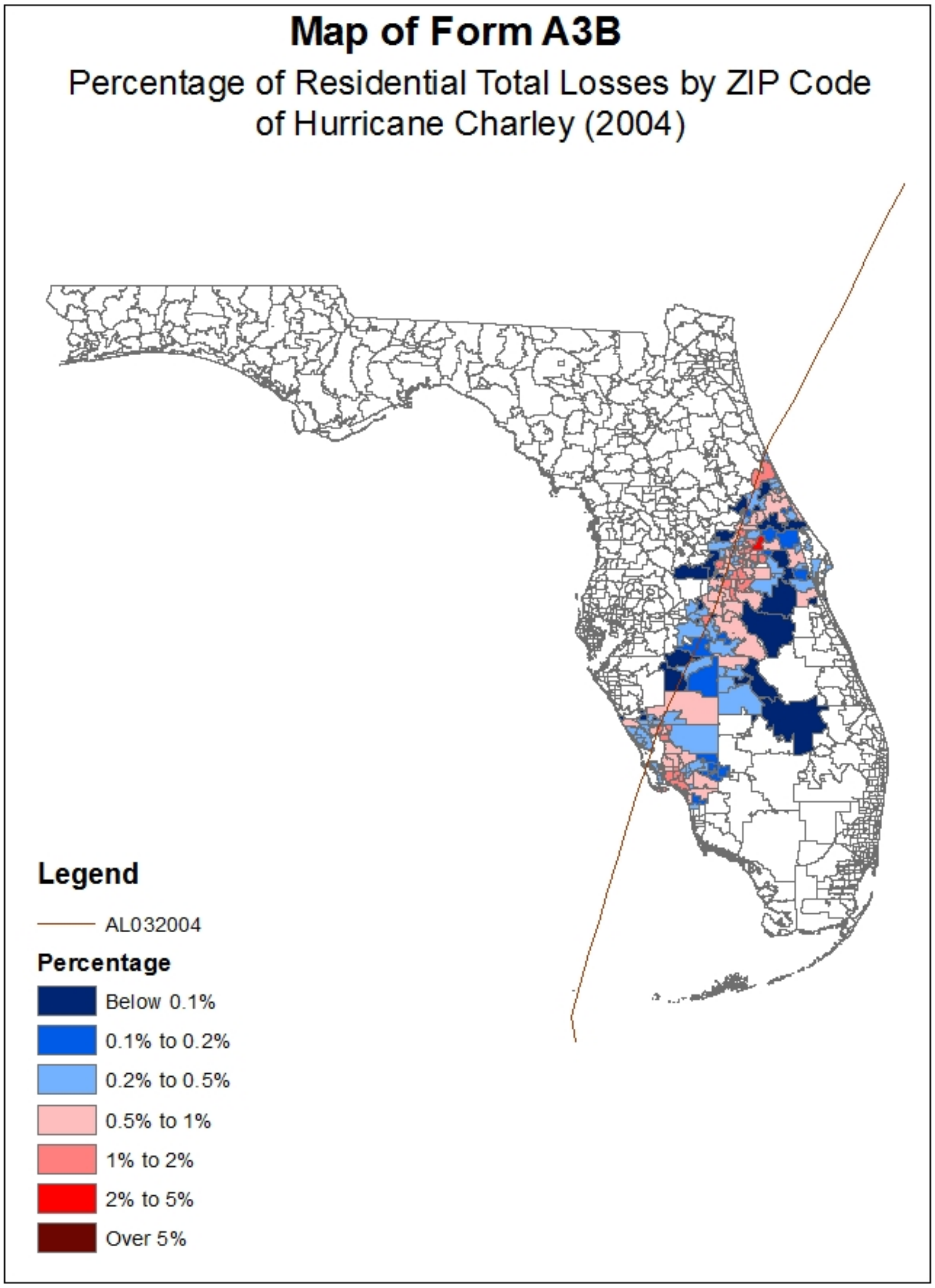


Figure 79. Percentage of residential total losses by ZIP code of Hurricane Charley (2004)

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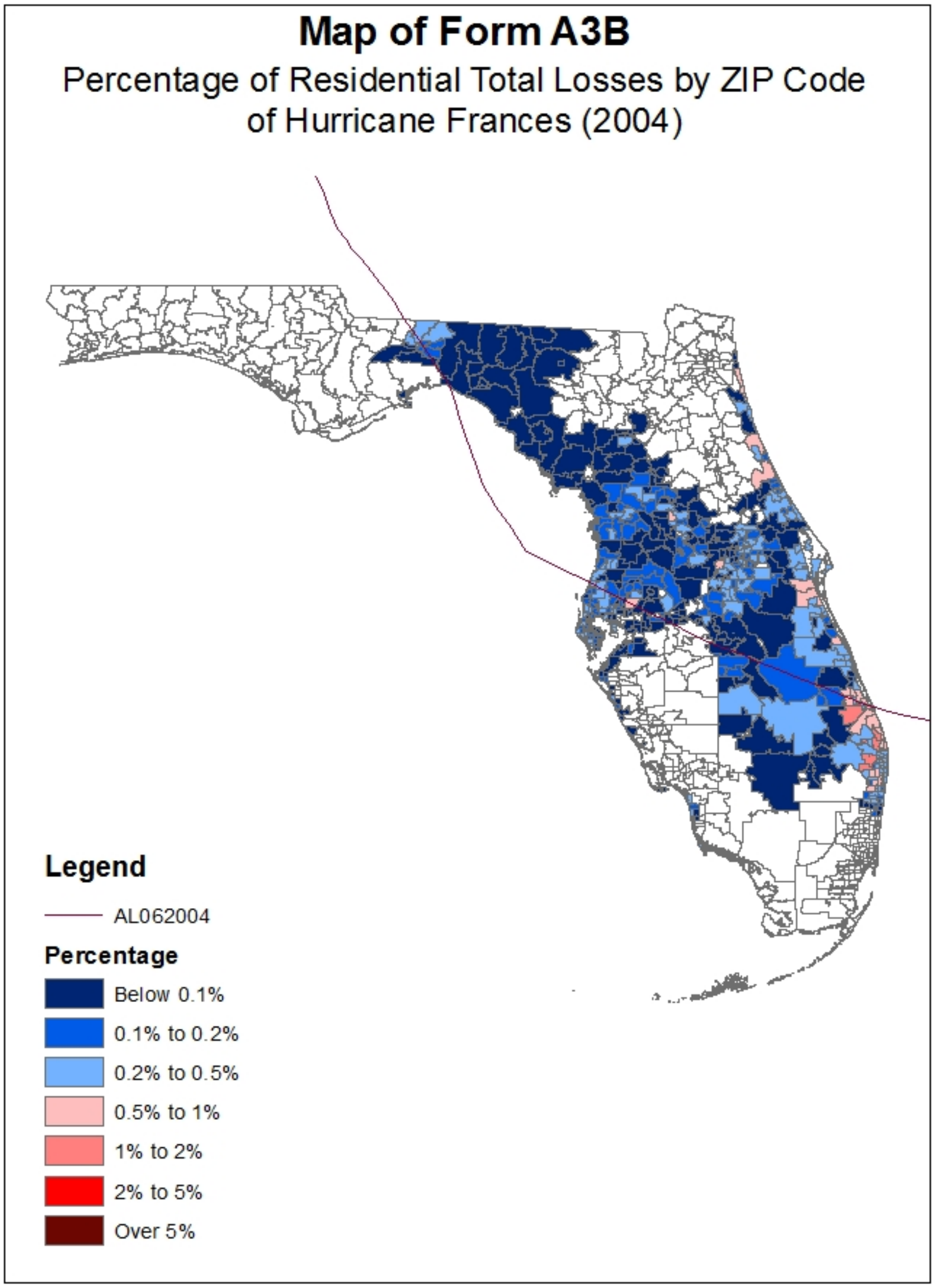

Figure 80. Percentage of residential total losses by ZIP code of Hurricane Frances (2004).

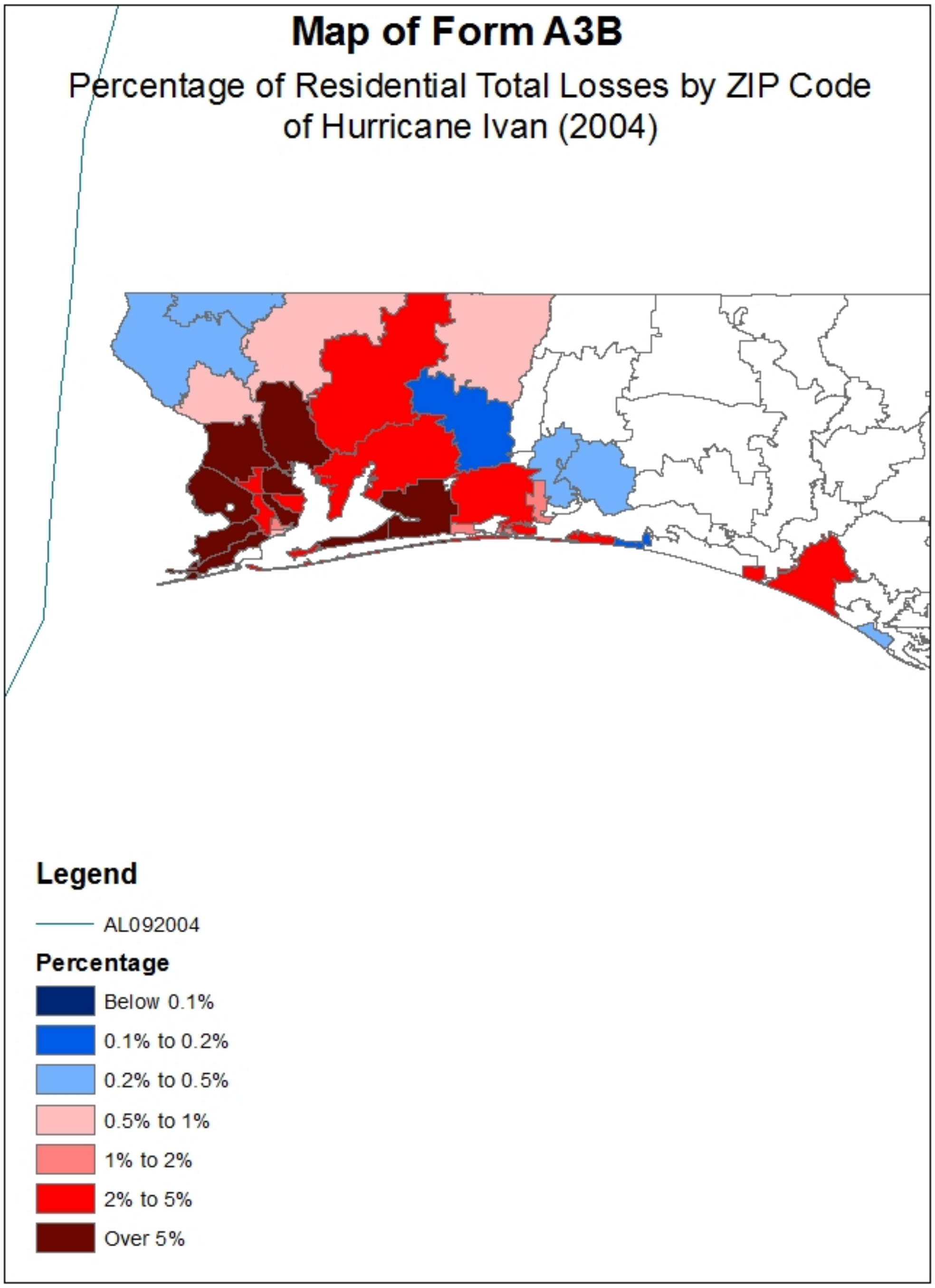

Figure 81. Percentage of residential total losses by ZIP code of Hurricane Ivan (2004).

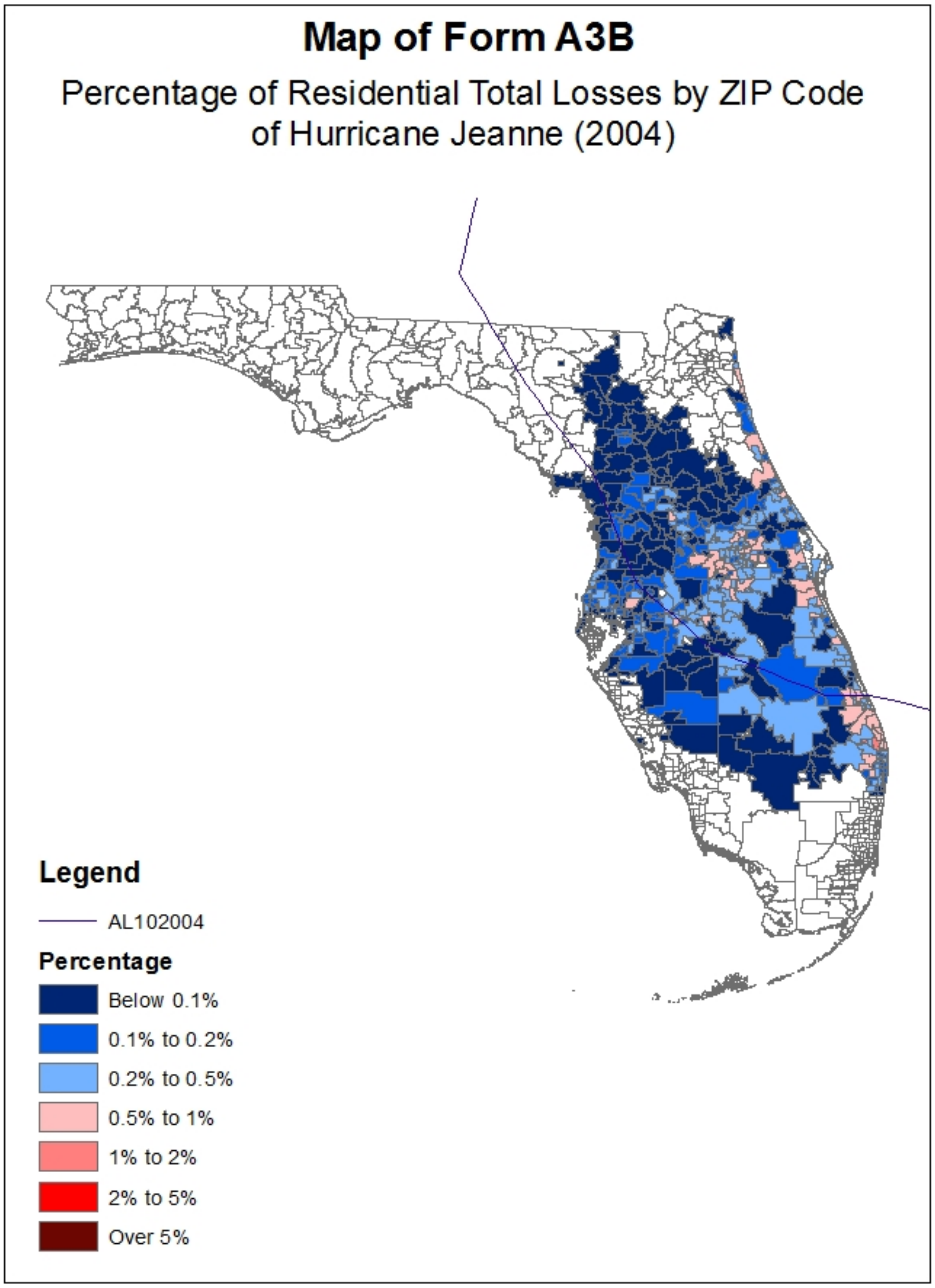

Figure 82. Percentage of residential total losses by ZIP code of Hurricane Jeanne (2004).

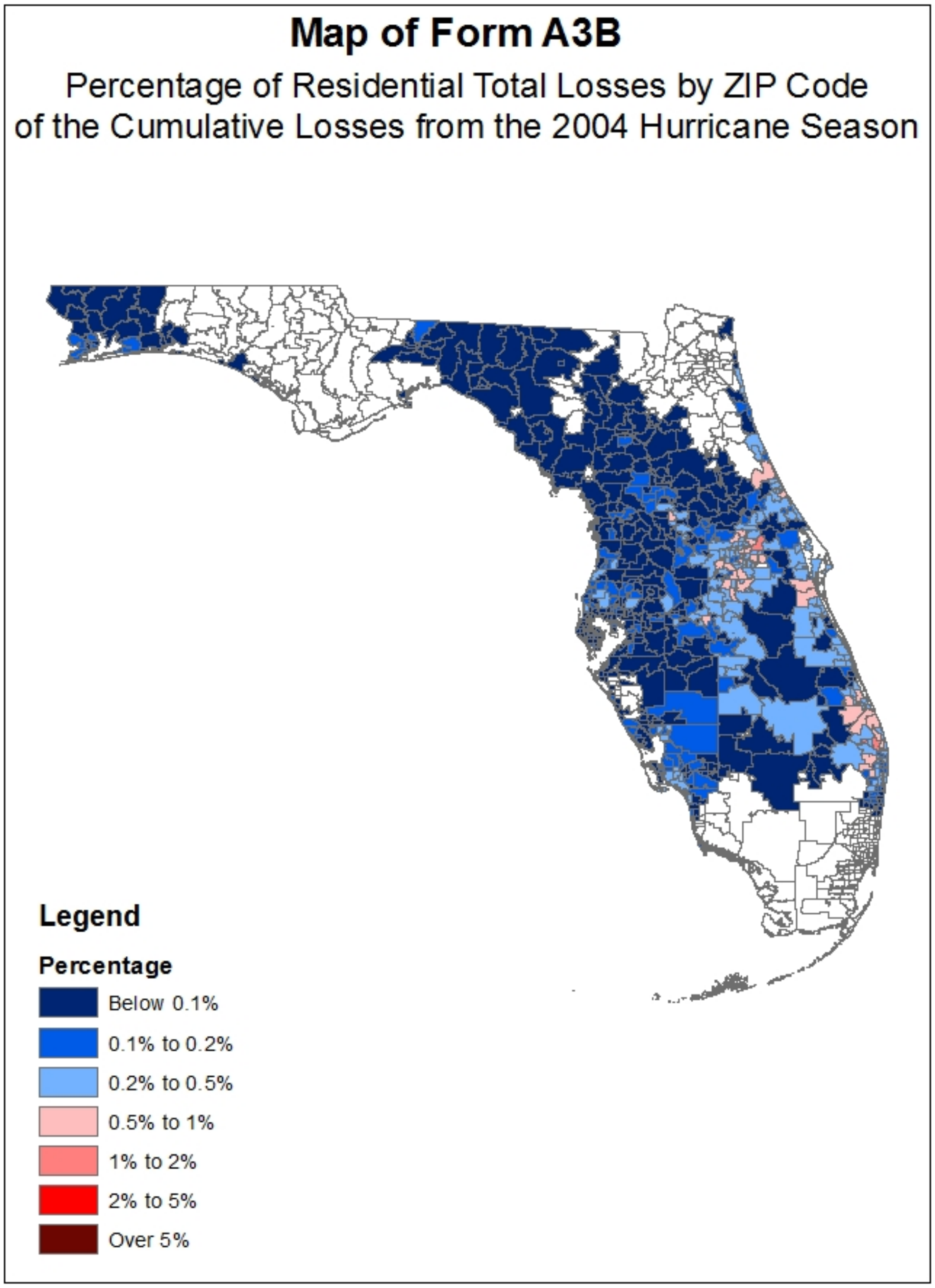

Figure 83. Percentage of residential total losses by ZIP code of the cumulative losses from the 2004 Hurricane Season.

Form A-4A: Hurricane Output Ranges (2012 FHCF Exposure Data)

A. Provide personal and commercial residential hurricane output ranges in the format shown in the file named "2017FormA4A.xlsx" by using an automated program or script. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form A-4A, Hurricane Output Ranges (2012 FHCF Exposure Data), in a submission appendix.

B. Provide hurricane loss costs, rounded to three decimal places, by county. Within each county, hurricane loss costs shall be shown separately per $1,000 of exposure for frame owners, masonry owners, frame renters, masonry renters, frame condo unit owners, masonry condo unit owners, manufactured homes, and commercial residential. For each of these categories using ZIP Code centroids, the hurricane output range shall show the highest hurricane loss cost, the lowest hurricane loss cost, and the weighted average hurricane loss cost. The aggregate residential exposure data for this form shall be developed from the information in the file named "hlpm2012c.exe," except for insured values and deductibles information. Insured values shall be based on the hurricane output range specifications given below. Deductible amounts of 0% and as specified in the hurricane output range specifications given below shall be assumed to be uniformly applied to all risks. When calculating the weighted average hurricane loss costs, weight the hurricane loss costs by the total insured value calculated above. Include the statewide range of hurricane loss costs (i.e., low, high, and weighted average).

C. If a modeling organization has hurricane loss costs for a ZIP Code for which there is no exposure, give the hurricane loss costs zero weight (i.e., assume the exposure in that ZIP Code is zero). Provide a list in the submission document of those ZIP Codes where this occurs.

None.

D. If a modeling organization does not have hurricane loss costs for a ZIP Code for which there is some exposure, do not assume such hurricane loss costs are zero, but use only the exposures for which there are hurricane loss costs in calculating the weighted average hurricane loss costs. Provide a list in the submission document of the ZIP Codes where this occurs.

ZIP Code 32653 has exposure but no losses.

E. NA shall be used in cells to signify no exposure.

F. All hurricane loss costs that are not consistent with the requirements of Standard A-6, Hurricane Loss Outputs and Logical Relationships to Risk, and have been explained in Disclosure A-6.17 shall be shaded.

G. Indicate if per diem is used in producing hurricane loss costs for Coverage D (Time Element) in the personal residential hurricane output ranges. If a per diem rate is used, a rate of $150.00 per day per policy shall be used.

See Appendix G.

Form A-4B: Hurricane Output Ranges (2017 FHCF Exposure Data)

A. Provide personal and commercial residential hurricane output ranges in the format shown in the file named "2017FormA4B.xlsx" by using an automated program or script. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form A-4B, Hurricane Output Ranges (2017 FHCF Exposure Data), in a submission appendix.

B. Provide hurricane loss costs, rounded to three decimal places, by county. Within each county, hurricane loss costs shall be shown separately per $1,000 of exposure for frame owners, masonry owners, frame renters, masonry renters, frame condo unit owners, masonry condo unit owners, manufactured homes, and commercial residential. For each of these categories using ZIP Code centroids, the hurricane output range shall show the highest hurricane loss cost, the lowest hurricane loss cost, and the weighted average hurricane loss cost. The aggregate residential exposure data for this form shall be developed from the information in the file named "hlpm2017c.exe," except for insured values and deductibles information. Insured values shall be based on the hurricane output range specifications given below. Deductible amounts of 0% and as specified in the hurricane output range specifications given below shall be assumed to be uniformly applied to all risks. When calculating the weighted average hurricane loss costs, weight the hurricane loss costs by the total insured value calculated above. Include the statewide range of hurricane loss costs (i.e., low, high, and weighted average).

C. If a modeling organization has hurricane loss costs for a ZIP Code for which there is no exposure, give the hurricane loss costs zero weight (i.e., assume the exposure in that ZIP Code is zero). Provide a list in the submission document of those ZIP Codes where this occurs.

None.

D. If a modeling organization does not have hurricane loss costs for a ZIP Code for which there is some exposure, do not assume such hurricane loss costs are zero, but use only the exposures for which there are hurricane loss costs in calculating the weighted average hurricane loss costs. Provide a list in the submission document of the ZIP Codes where this occurs.

None.

E. NA shall be used in cells to signify no exposure.

F. All hurricane loss costs that are not consistent with the requirements of Standard A-6, Hurricane Loss Outputs and Logical Relationships to Risk, and have been explained in Disclosure A-6.17 shall be shaded.

G. Indicate if per diem is used in producing hurricane loss costs for Coverage D (Time Element) in the personal residential hurricane output ranges. If a per diem rate is used, a rate of $150.00 per day per policy shall be used.

See Appendix H.

Form A-5: Percentage Change in Hurricane Output Ranges (2012 FHCF Exposure Data)

A. Provide summaries of the percentage change in average hurricane loss cost output range data compiled in Form A-4A, Hurricane Output Ranges (2012 FHCF Exposure Data), relative to the equivalent data compiled from the previously-accepted hurricane model in the format shown in the file named "2017FormA5.xlsx."

For the change in hurricane output range exhibit, provide the summary by:

- ***Statewide (overall percentage change),***
- ***By region, as defined in Figure 14 – North, Central and South,***
- ***By county, as defined in Figure 15 – Coastal and Inland.***

B. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include all tables in Form A-5, Percentage Change in Hurricane Output Ranges (2012 FHCF Exposure Data), in a submission appendix.

C. Provide color-coded maps by county reflecting the percentage changes in the average hurricane loss costs based on the 2012 FHCF Exposure Data with specified deductibles for frame owners, masonry owners, frame renters, masonry renters, frame condo unit owners, masonry condo unit owners, manufactured homes, and commercial residential from the hurricane output ranges from the previously-accepted hurricane model.

Counties with a negative percentage change (reduction in hurricane loss costs) shall be indicated with shades of blue, counties with a positive percentage change (increase in hurricane loss costs) shall be indicated with shades of red, and counties with no percentage change shall be white. The larger the percentage change in the county, the more intense the color-shade.

See Appendix I.

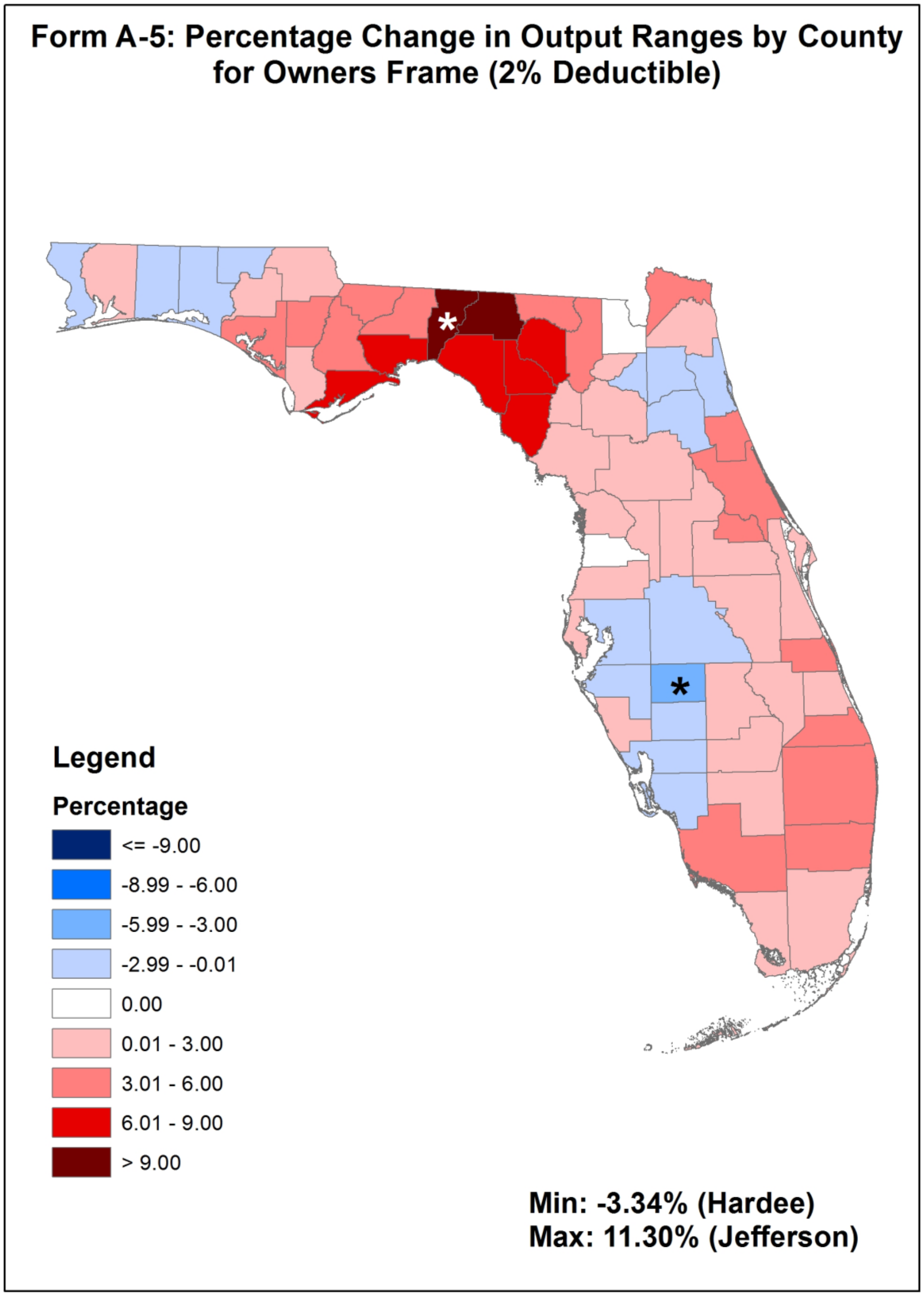

Figure 84. Percentage change in output ranges by county for owners frame (2% deductible).

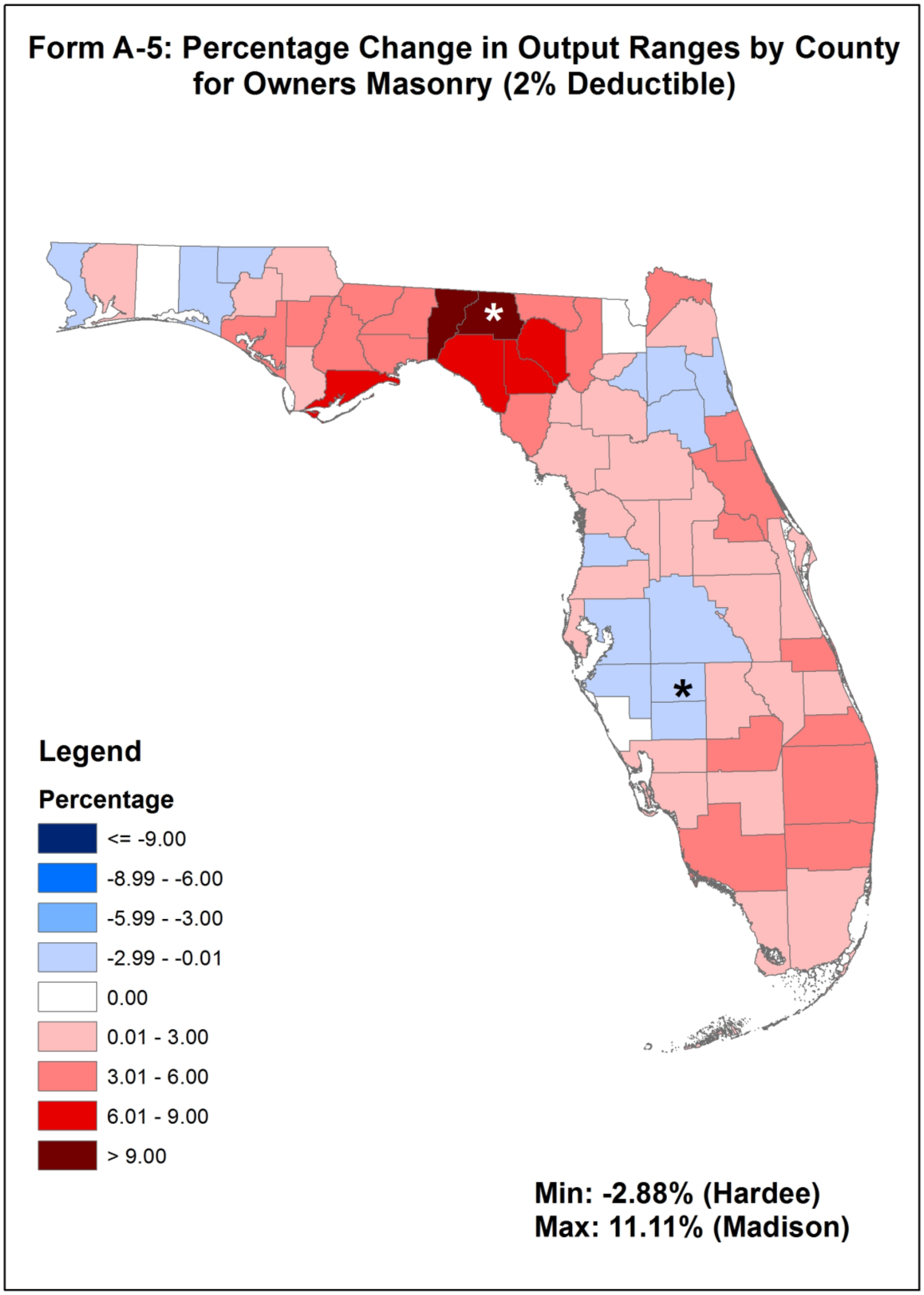

Figure 85. Percentage change in output ranges by county for owners masonry (2% deductible).

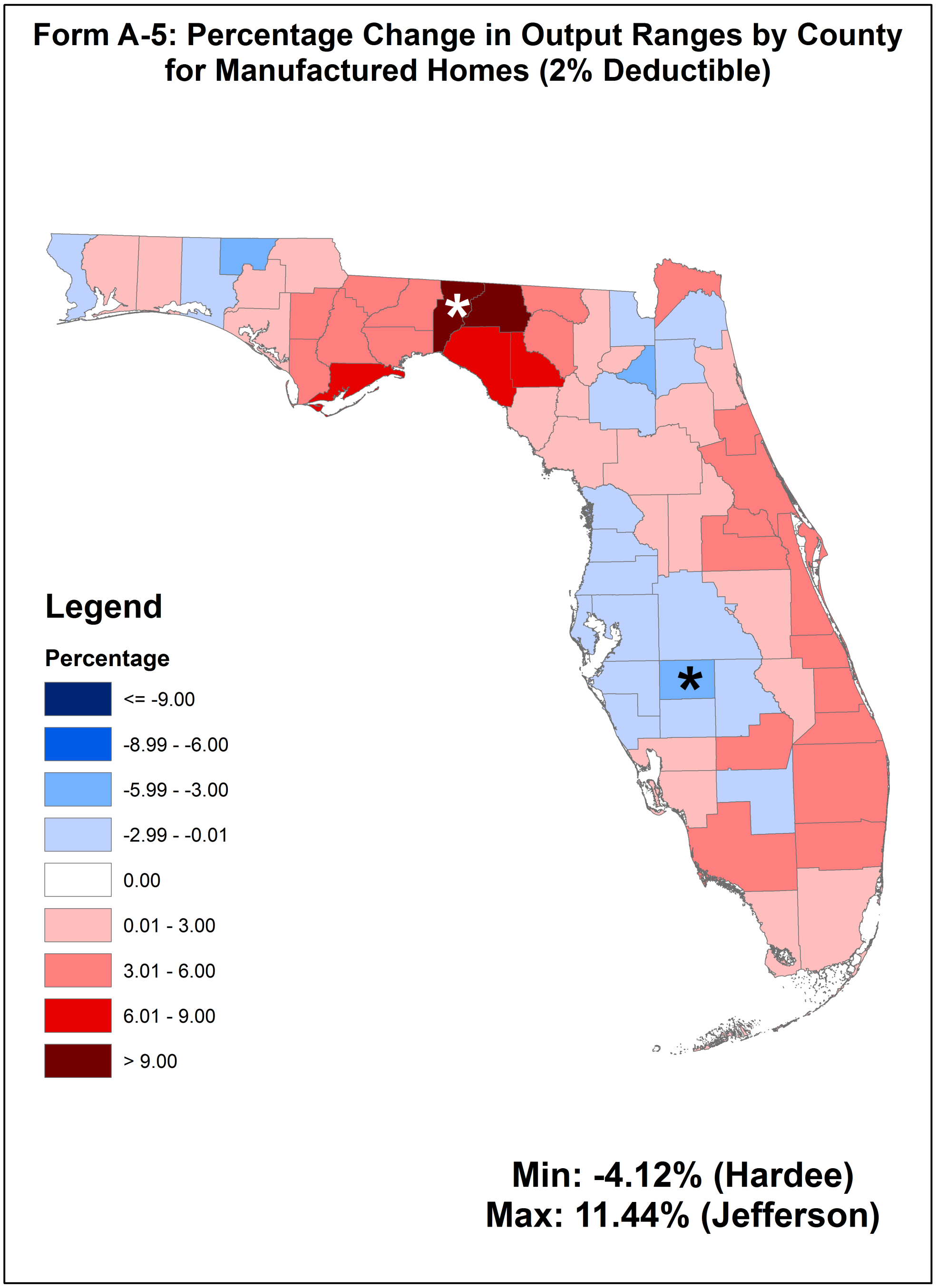

Figure 86. Percentage change in output ranges by county for mobile homes (2% deductible).

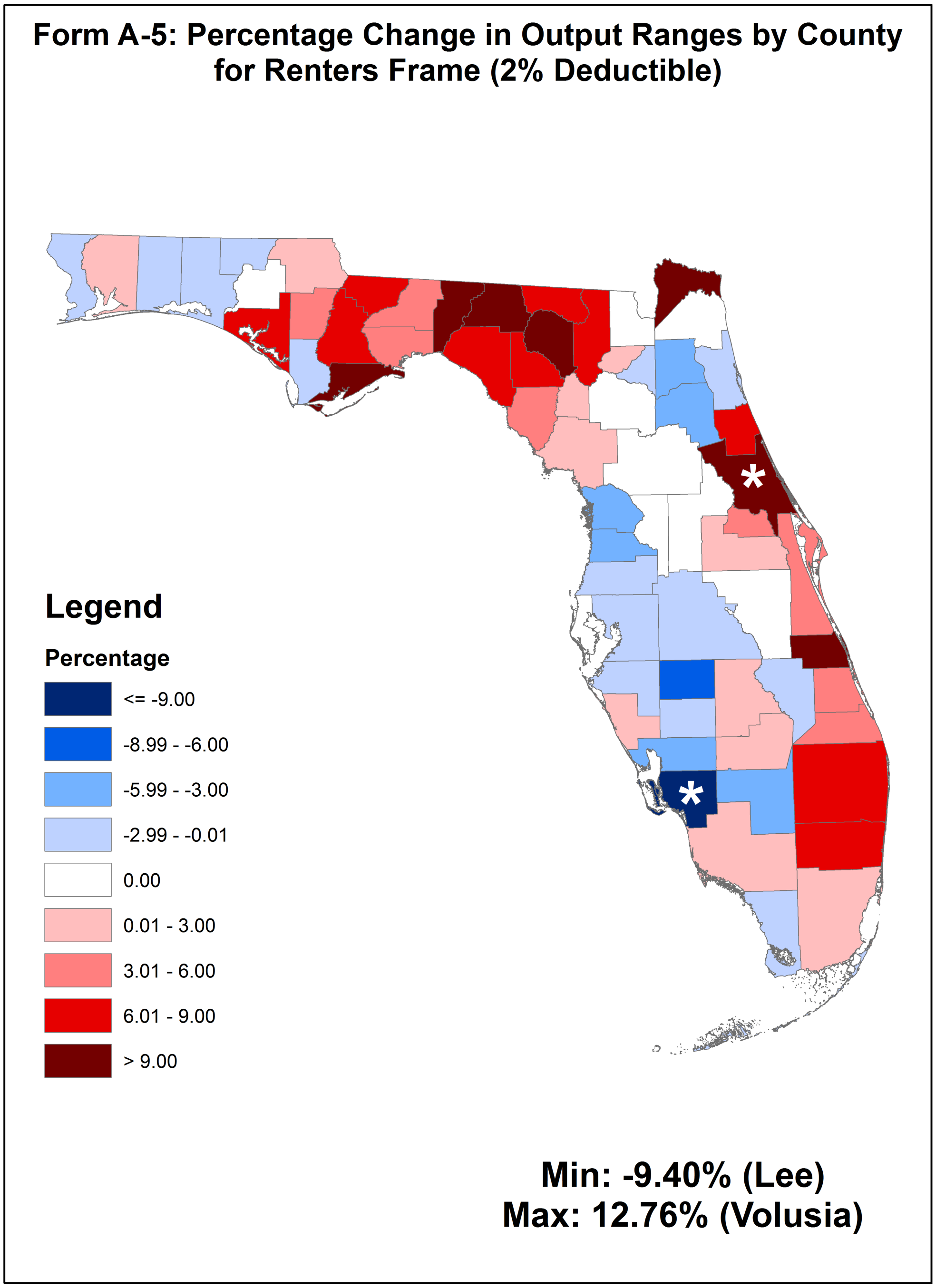

Figure 87. Percentage change in output ranges by county for renters frame (2% deductible).

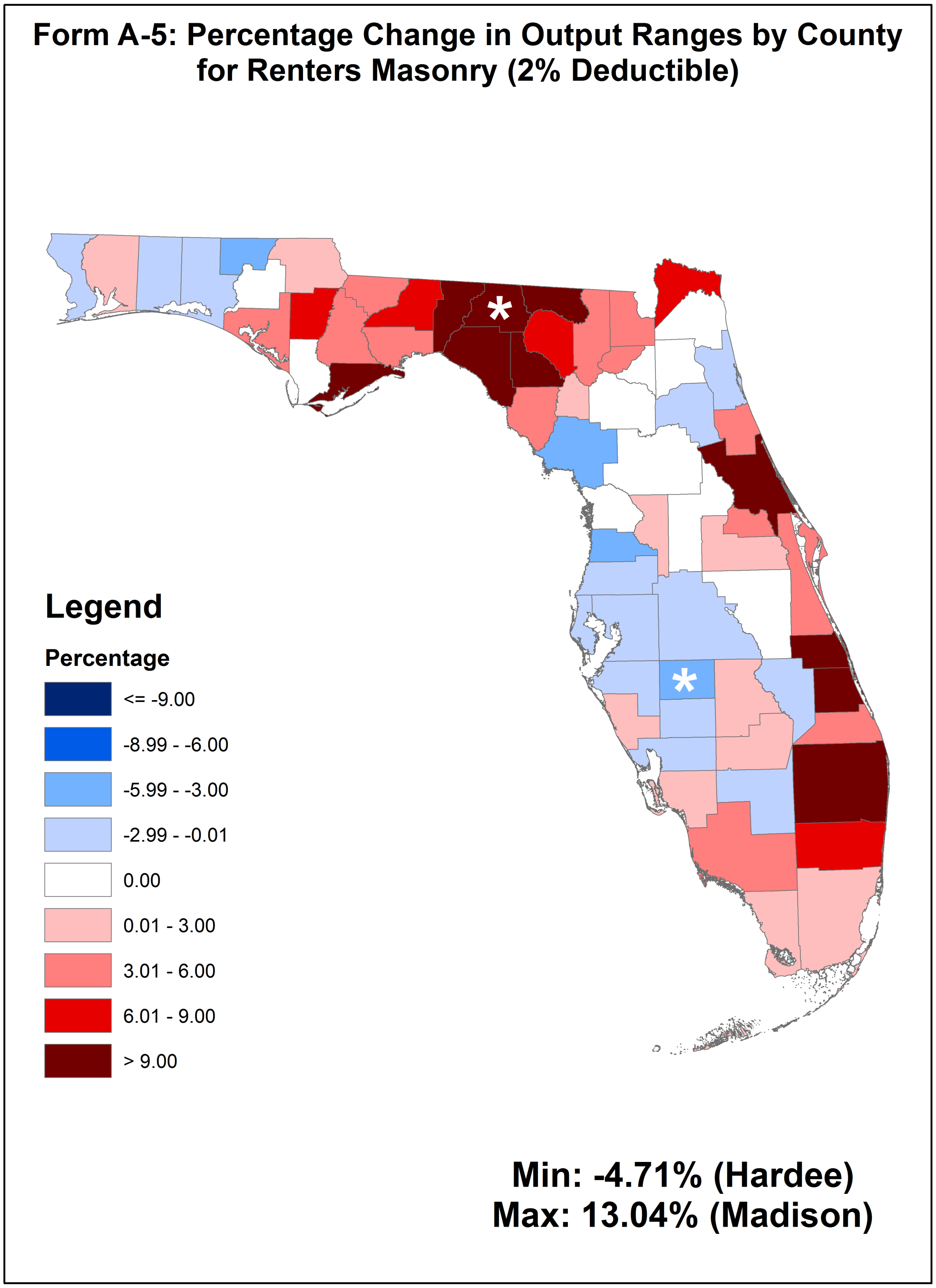

Figure 88. Percentage change in output ranges by county for renters masonry (2% deductible).

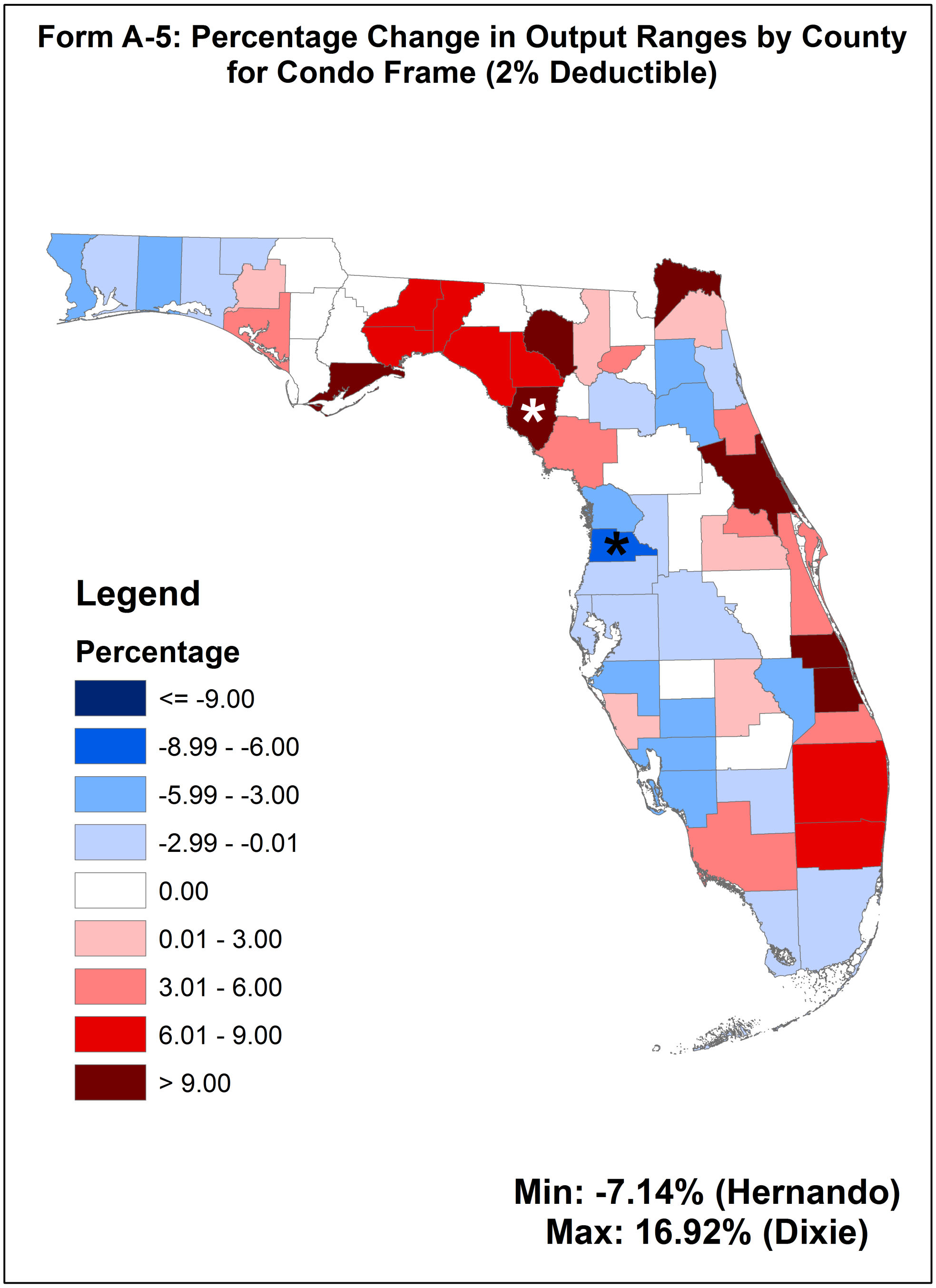

Figure 89. Percentage change in output ranges by county for condo frame (2% deductible).

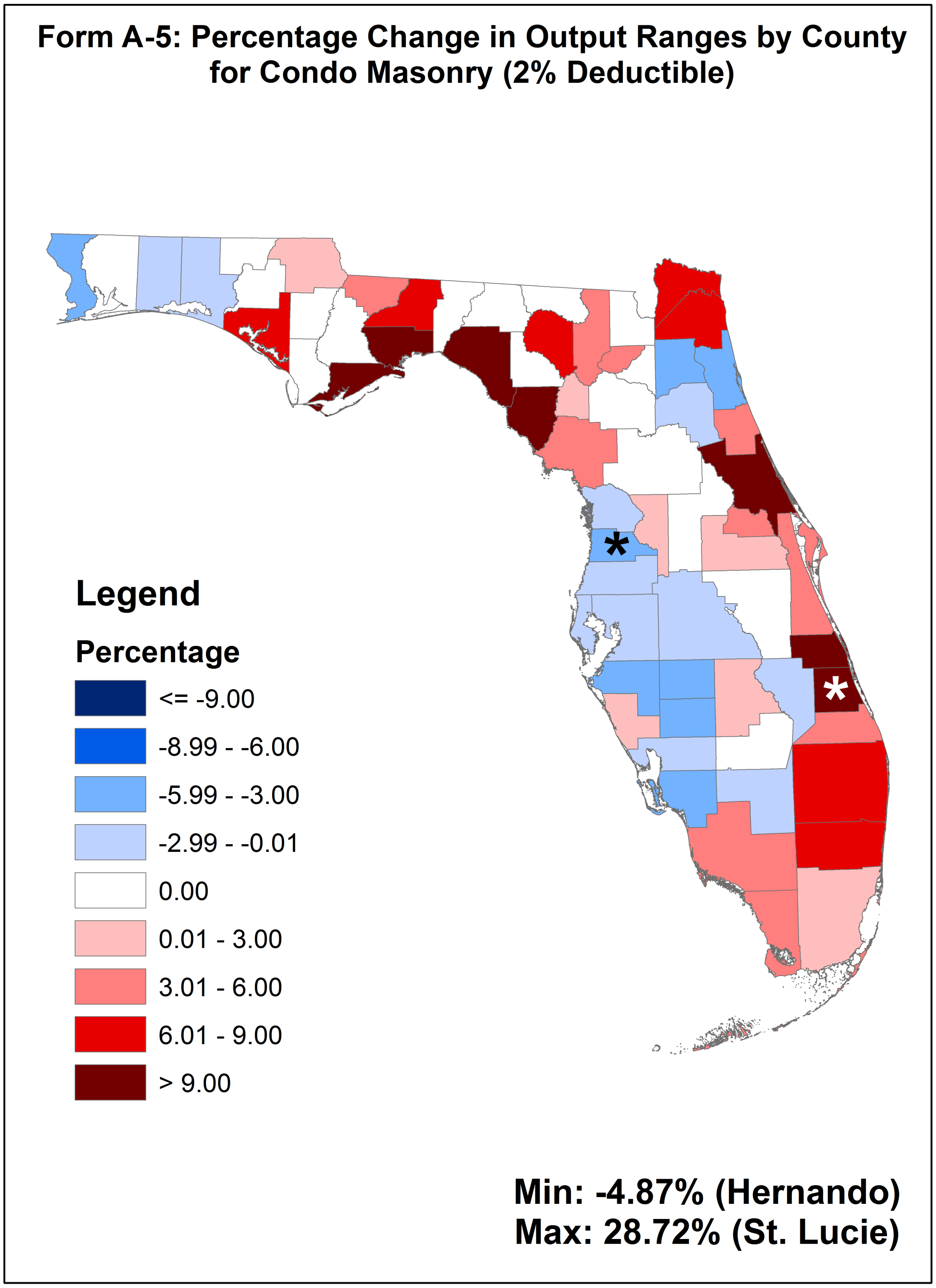

Figure 90. Percentage change in output ranges by county for condo masonry (2% deductible).

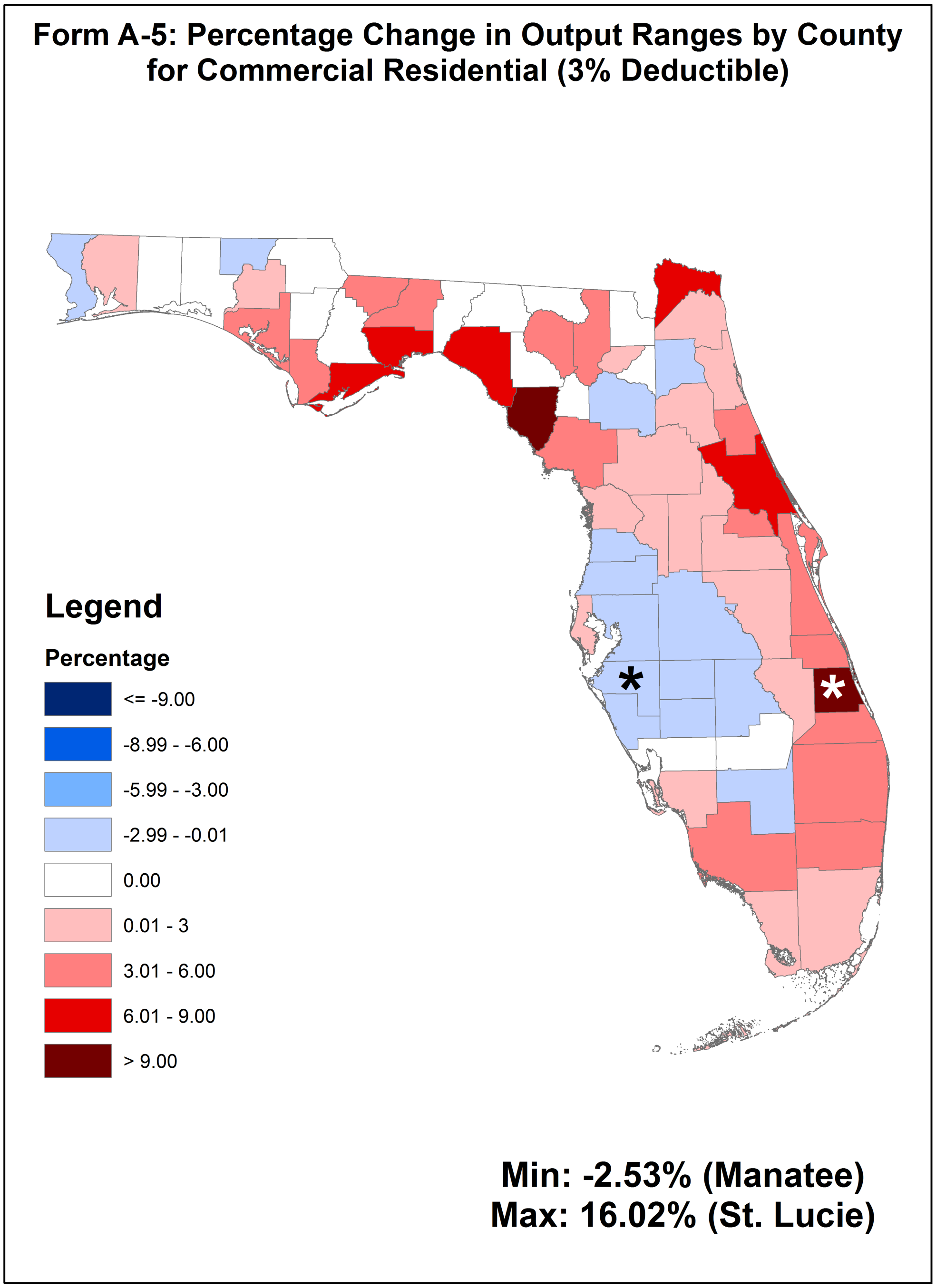

Figure 91. Percentage change in output ranges by county for commercial residential (3% deductible).

Form A-6: Logical Relationship to Hurricane Risk (Trade Secret Item)

A. Provide the logical relationship to hurricane risk exhibits in the format shown in the file named "2017FormA6.xlsx."

B. Create exposure sets for each exhibit by modeling all of the coverages from the appropriate Notional Set listed below at each of the locations in "Location Grid A" as described in the file "NotionalInput17.xlsx." Refer to the Notional Hurricane Policy Specifications below for additional modeling information.

C. Explain any assumptions, deviations, and differences from the prescribed exposure information. In particular, explain how the treatment of unknown is handled in each sensitivity.

Exhibit	Notional Set
Deductible Sensitivity	Set 1
Policy Form Sensitivity	Set 2
Policy Form/Construction Sensitivity	Set 3
Coverage Sensitivity	Set 4
Building Code/Enforcement (Year Built) Sensitivity	Set 5
Building Strength Sensitivity	Set 6
Condo Unit Floor Sensitivity	Set 7
Number of Stories Sensitivity	Set 8

D. Hurricane models shall treat points in "Location Grid A" as coordinates that would result from a geocoding process. Hurricane models shall treat points by simulating hurricane loss at exact location or by using the nearest modeled parcel/street/cell in the hurricane model.

Report results for each of the points in "Location Grid A" individually, unless specified.

Hurricane loss costs per $1,000 of exposure shall be rounded to three decimal places.

E. All hurricane loss costs that are not consistent with the requirements of Standard A-6, Hurricane Loss Outputs and Logical Relationships to Risk, and have been explained in Disclosure A-6.17 shall be shaded.

F. Create an exposure set and report hurricane loss costs results for strong owners frame buildings (Notional Set 6) for each of the points in "Location Grid B" as described in the file "NotionalInput17.xlsx." Provide a color-coded contour map of the hurricane loss costs. Provide a scatter plot of the hurricane loss costs (y-axis) against distance to closest coast (x- axis).

Notional Hurricane Policy Specifications

Policy Type	Assumptions
Owners	**Coverage A = Building** • Replacement Cost included subject to Coverage A limit • Law and Ordinance not included **Coverage B = Appurtenant Structure** • Replacement Cost included subject to Coverage B limit • Law and Ordinance not included **Coverage C = Contents** • Replacement Cost included subject to Coverage C limit **Coverage D = Time Element** • Time limit = 12 months • Per diem = $150.00/day per policy, if used ❖ Hurricane loss costs per $1,000 shall be related to the Coverage A limit ❖ Hurricane loss costs for the various specified deductibles shall be determined based on annual deductibles ❖ All-other perils deductible = $500
Renters	**Coverage C = Contents** • Replacement Cost included subject to Coverage C limit **Coverage D = Time Element** • Time limit = 12 months • Per diem = $150.00/day per policy, if used. ❖ Hurricane loss costs per $1,000 shall be related to the Coverage C limit ❖ Hurricane loss costs for the various specified deductibles shall be determined based on annual deductibles ❖ All-other perils deductible = $500
Condo Unit Owners	**Coverage A = Building** • Replacement Cost included subject to Coverage A limit **Coverage C = Contents** • Replacement Cost included subject to Coverage C limit **Coverage D = Time Element** • Time limit = 12 months • Per diem = $150.00/day per policy, if used. ❖ Hurricane loss costs per $1,000 shall be related to the Coverage C limit ❖ Hurricane loss costs for the various specified deductibles shall be determined based on annual deductibles

- All-other perils deductible = $500

Manufactured Homes

Coverage A = Building
- Replacement Cost included subject to Coverage A limit

Coverage B = Appurtenant Structure
- Replacement Cost included subject to Coverage B limit

Coverage C = Contents
- Replacement Cost included subject to Coverage C limit

Coverage D = Time Element
- Time limit = 12 months
- Per diem = $150.00/day per policy, if used

- Hurricane loss costs per $1,000 shall be related to the Coverage A limit
- Hurricane loss costs for the various specified deductibles shall be determined based on annual deductibles
- All-other perils deductible = $500

Commercial Residential

Coverage A = Building
- Replacement Cost included subject to Coverage A limit

Coverage C = Contents
- Replacement Cost included subject to Coverage C limit

Coverage D = Time Element
- Time limit = 12 months
- Per diem = $150.00/day per policy, if used.

- Hurricane loss costs per $1,000 shall be related to the Coverage A limit
- Hurricane loss costs for the various specified deductibles shall be determined based on annual deductibles
- All-other perils deductible = $500

See Appendix J.

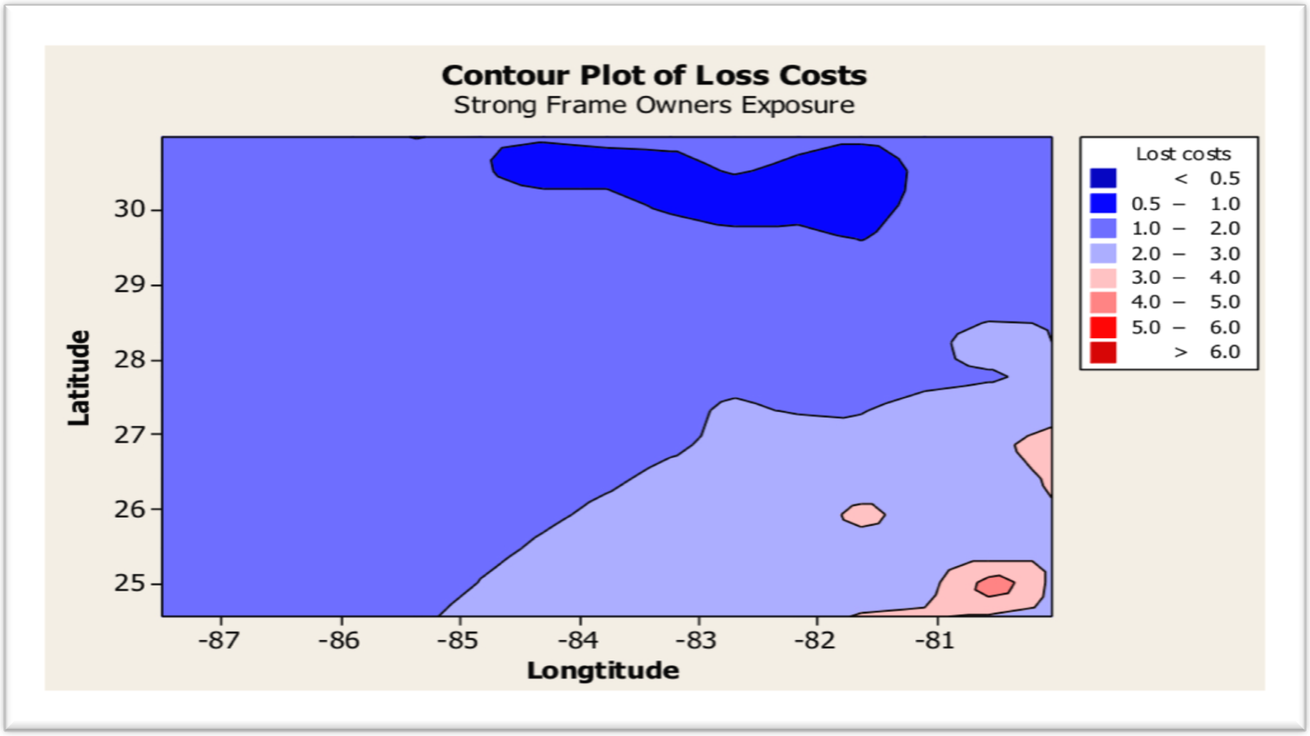

Figure 92. Contour Plot of Loss Costs - Strong Frame Owners Exposure

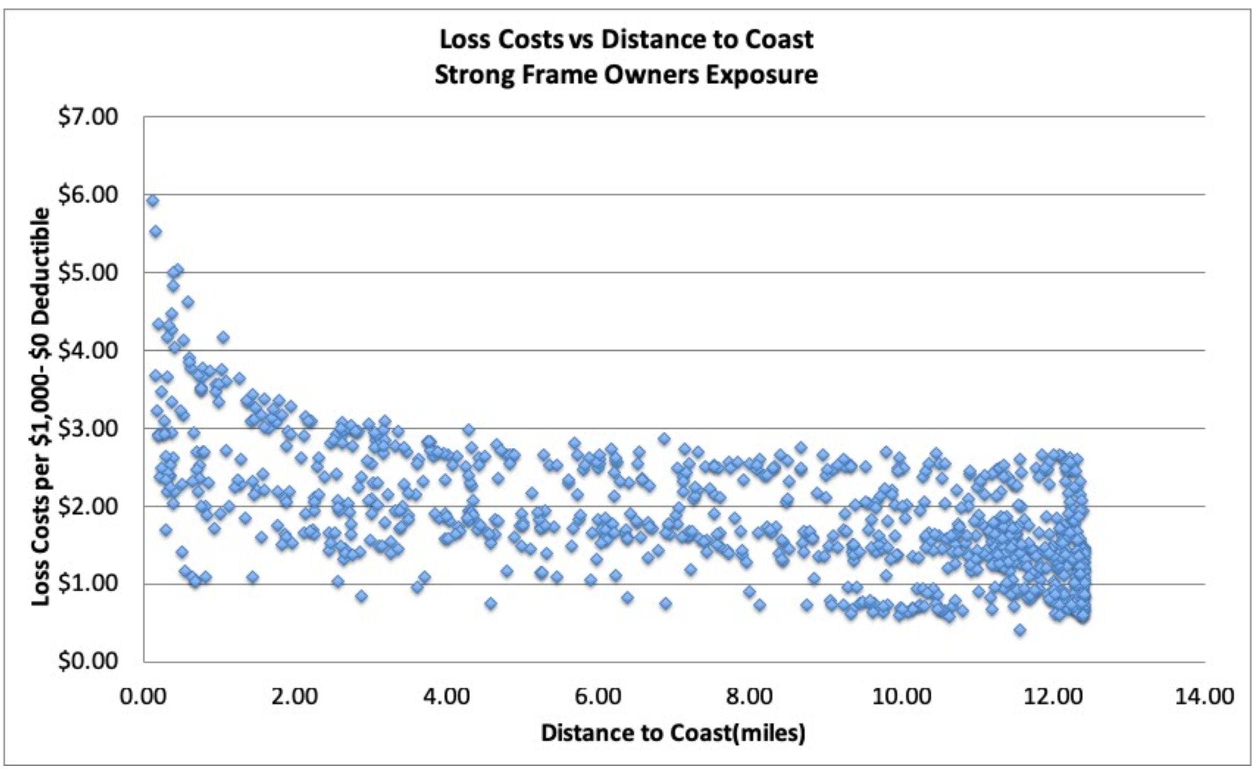

Figure 93. Loss Costs vs. Distance to the Coast Strong Frame Owners Exposures

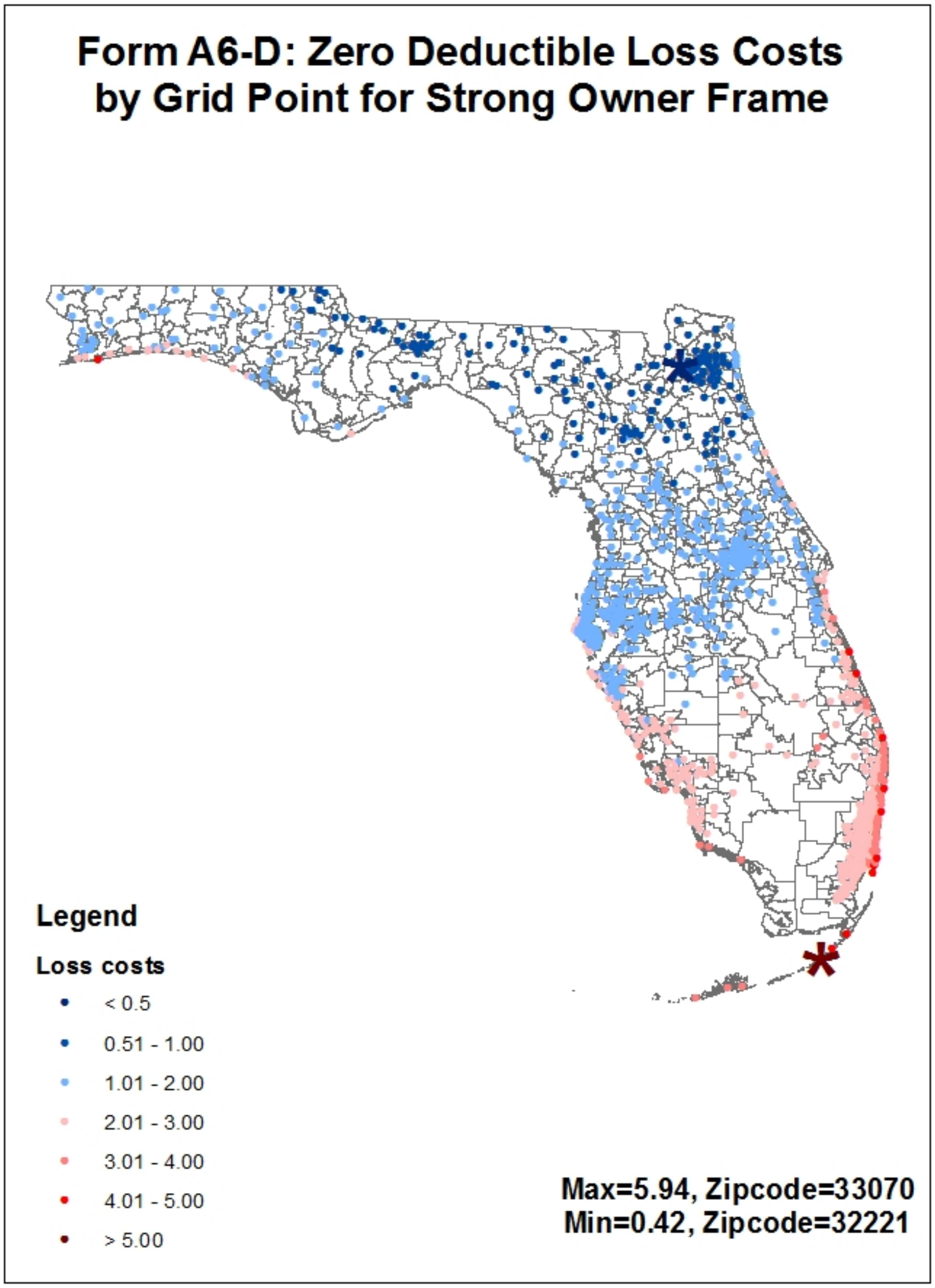

Figure 94. Zero Deductible Loss Costs by Grid Point for Strong Owner Frame.

Form A-7: Percentage Change in Logical Relationship to Hurricane Risk

A. Provide summaries of the percentage change in logical relationship to hurricane risk exhibits from the previously-accepted hurricane model in the format shown in the file named "2017FormA7.xlsx."

B. Create exposure sets for each exhibit by modeling all of the coverages from the appropriate Notional Set listed below at each of the locations in "Location Grid B" as described in the file "NotionalInput17.xlsx." Refer to the Notional Hurricane Policy Specifications provided in Form A-6, Logical Relationship to Hurricane Risk (Trade Secret Item), for additional modeling information.

C. Explain any assumptions, deviations, and differences from the prescribed exposure information. In particular, explain how the treatment of unknown is handled in each sensitivity.

Exhibit	Notional Set
Deductible Sensitivity	**Set 1**
Policy Form Sensitivity	**Set 2**
Policy Form/Construction Sensitivity	**Set 3**
Coverage Sensitivity	**Set 4**
Building Code/Enforcement (Year Built) Sensitivity	**Set 5**
Building Strength Sensitivity	**Set 6**
Condo Unit Floor Sensitivity	**Set 7**
Number of Stories Sensitivity	**Set 8**

D. Hurricane models shall treat points in "Location Grid B" as coordinates that would result from a geocoding process. Hurricane models shall treat points by simulating hurricane loss at exact location or by using the nearest modeled parcel/street/cell in the hurricane model.

Provide the results statewide (overall percentage change) and by the regions defined in Form A-5, Percentage Change in Hurricane Output Ranges (2012 FHCF Exposure Data).

E. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include all tables in Form A-7, Percentage Change in Logical Relationship to Hurricane Risk, in a submission appendix.

See Appendix K.

Form A-8A: Hurricane Probable Maximum Loss for Florida (2012 FHCF Exposure Data)

A. Provide a detailed explanation of how the Expected Annual Hurricane Losses and Return Periods are calculated.

For each range of losses:
Expected Annual Hurricane Losses = Total Loss / Number of years in the simulation,

Where:
Total Loss = Sum of losses for all simulated years with aggregate storm losses in the range.
Return Period = 1 / Probability of exceeding the average loss in the range,

Where:
Average Loss = Total Loss / Number of years with aggregate storm losses in the range,

And

Probability of exceeding the average loss in the range = (Number of years with aggregate storm losses > Average Loss) / Number of years in the simulation.

B. Complete Part A showing the personal and commercial residential hurricane probable maximum loss for Florida. For the Expected Annual Hurricane Losses column, provide personal and commercial residential, zero deductible statewide hurricane loss costs based on the 2012 Florida Hurricane Catastrophe personal and commercial residential zero deductible exposure data found in the file named "hlpm2012c.exe."

In the column, Return Period (Years), provide the return period associated with the average hurricane loss within the ranges indicated on a cumulative basis.

For example, if the average hurricane loss is $4,705 million for the range $4,501 million to $5,000 million, provide the return period associated with a hurricane loss that is $4,705 million or greater.

For each hurricane loss range in millions ($1,001-$1,500, $1,501-$2,000, $2,001-$2,500) the average hurricane loss within that range should be identified and then the return period associated with that hurricane loss calculated. The return period is then the reciprocal of the probability of the hurricane loss equaling or exceeding this average hurricane loss size.

The probability of equaling or exceeding the average of each range should be smaller as the ranges increase (and the average hurricane losses within the ranges increase). Therefore, the return period associated with each range and average

hurricane loss within that range should be larger as the ranges increase. Return periods shall be based on cumulative probabilities.

A return period for an average hurricane loss of $4,705 million within the $4,501- $5,000 million range should be lower than the return period for an average hurricane loss of $5,455 million associated with a $5,001- $6,000 million range.

C. Provide a graphical comparison of the current hurricane model Residential Return Periods hurricane loss curve to the previously-accepted hurricane model Residential Return Periods hurricane loss curve. Residential Return Period (Years) shall be shown on the y-axis on a log- 10 scale with Hurricane Losses in Billions shown on the x-axis. The legend shall indicate the corresponding hurricane model with a solid line representing the current year and a dotted line representing the previously-accepted hurricane model.

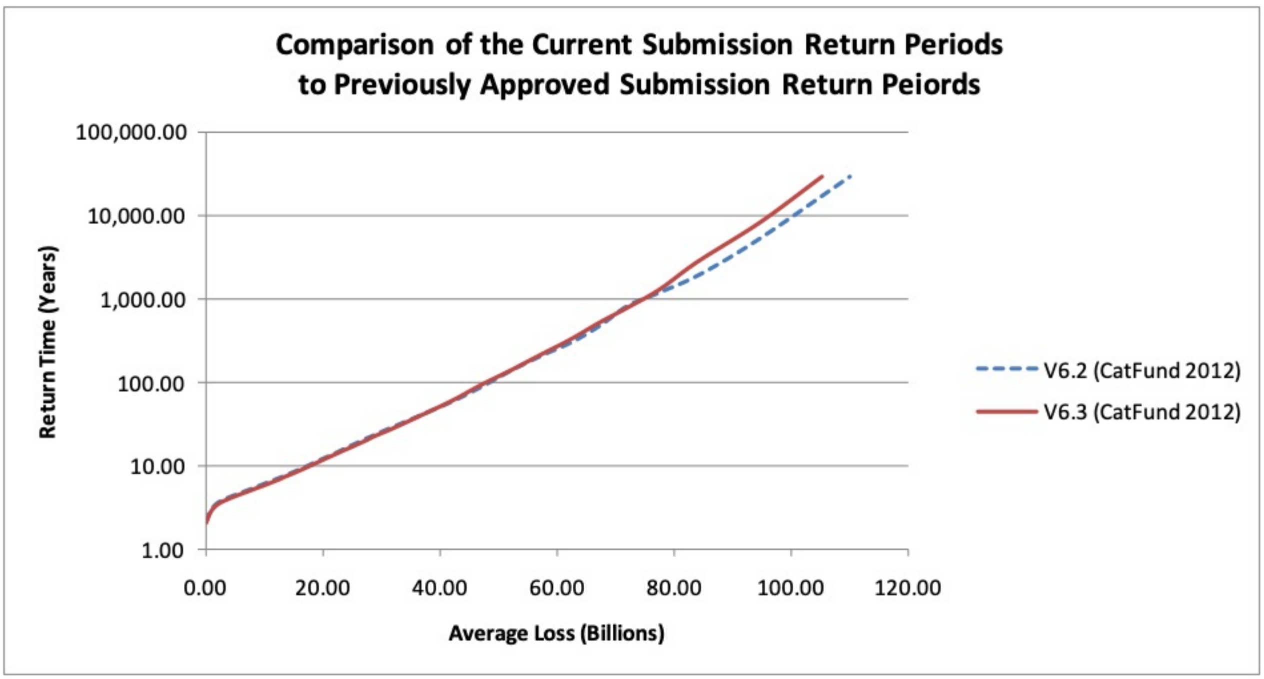

Figure 95. Comparison of return periods.

D. Provide the estimated hurricane loss and uncertainty interval for each of the Personal and Commercial Residential Return Periods given in Part B, Annual Aggregate, and Part C, Annual Occurrence. Describe how the uncertainty intervals are derived. Also, provide in Parts B and C, the Conditional Tail Expectation, the expected value of hurricane losses greater than the Estimated Hurricane Loss Level.

The uncertainty intervals (except for the top event) are approximate 95% confidence intervals.

Let $X_1, X_2, \ldots, X_N$ be the ordered set of annual losses produced by the simulation with $X_{(1)} \leq X_{(2)} \leq \ldots \leq X_{(N)}$. (Or alternatively for part C the ordered set of the largest loss from each year of the simulation.)

Since the sample is large enough to assume a normal approximation for the p^{th} quantile of the ordered set, an approximate 95% confidence interval for the PML is given by $(X_{(r)}, X_{(s)})$, where

$$r = Np - 1.96\sqrt{Np(1-p)}$$

$$s = Np + 1.96\sqrt{Np(1-p)}$$

and N and p are defined as

N = number of years in the simulation

and

p = 1 – 1 / return period.

If r and/or s are not integers, let r* be the smallest integer greater than r and let s* be the smallest integer greater than or equal to s. The 95% approximate confidence interval is given by $(X_{(r^*)}, X_{(s^*)})$

The top event itself is estimated by the highest order statistics, $X_{(N)}$. It is not possible to compute a confidence interval for the top event using the above method.

E. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form A-8A, Hurricane Probable Maximum Loss for Florida (2012 FHCF Exposure Data), in a submission appendix.

See Appendix L.

Form A-8B: Hurricane Probable Maximum Loss for Florida (2017 FHCF Exposure Data)

A. Provide a detailed explanation of how the Expected Annual Hurricane Losses and Return Periods are calculated.

For each range of losses:

Expected Annual Hurricane Losses = Total Loss / Number of years in the simulation,

Where:
Total Loss = Sum of losses for all simulated years with aggregate storm losses in the range.
Return Period = 1 / Probability of exceeding the average loss in the range,

Where:
Average Loss = Total Loss / Number of years with aggregate storm losses in the range,

And

Probability of exceeding the average loss in the range = (Number of years with aggregate storm losses > Average Loss) / Number of years in the simulation.

B. Complete Part A showing the personal and commercial residential hurricane probable maximum loss for Florida. For the Expected Annual Hurricane Losses column, provide personal and commercial residential, zero deductible statewide hurricane loss costs based on the 2017 Florida Hurricane Catastrophe Fund personal and commercial residential zero deductible exposure data found in the file named "hlpm2017c.exe."

In the column, Return Period (Years), provide the return period associated with the average hurricane loss within the ranges indicated on a cumulative basis.

For example, if the average hurricane loss is $4,705 million for the range $4,501 million to $5,000 million, provide the return period associated with a hurricane loss that is $4,705 million or greater.

For each hurricane loss range in millions ($1,001-$1,500, $1,501-$2,000, $2,001-$2,500) the average hurricane loss within that range should be identified and then the return period associated with that hurricane loss calculated. The return period is then the reciprocal of the probability of the hurricane loss equaling or exceeding this average hurricane loss size.

The probability of equaling or exceeding the average of each range should be smaller as the ranges increase (and the average hurricane losses within the ranges increase). Therefore, the return period associated with each range and average hurricane loss within that range should be larger as the ranges increase. Return periods shall be based on cumulative probabilities.

A return period for an average hurricane loss of $4,705 million within the $4,501-$5,000 million range should be lower than the return period for an average hurricane loss of $5,455 million associated with a $5,001- $6,000 million range.

C. Provide a graphical comparison of the current hurricane model Residential Return Periods hurricane loss curve to the previously-accepted hurricane model Residential Return Periods hurricane loss curve. Residential Return Period (Years) shall be shown on the y-axis on a log- 10 scale with Hurricane Losses in Billions shown on the x-axis. The legend shall indicate the corresponding hurricane model with a solid line representing the current year and a dotted line representing the previously-accepted hurricane model.

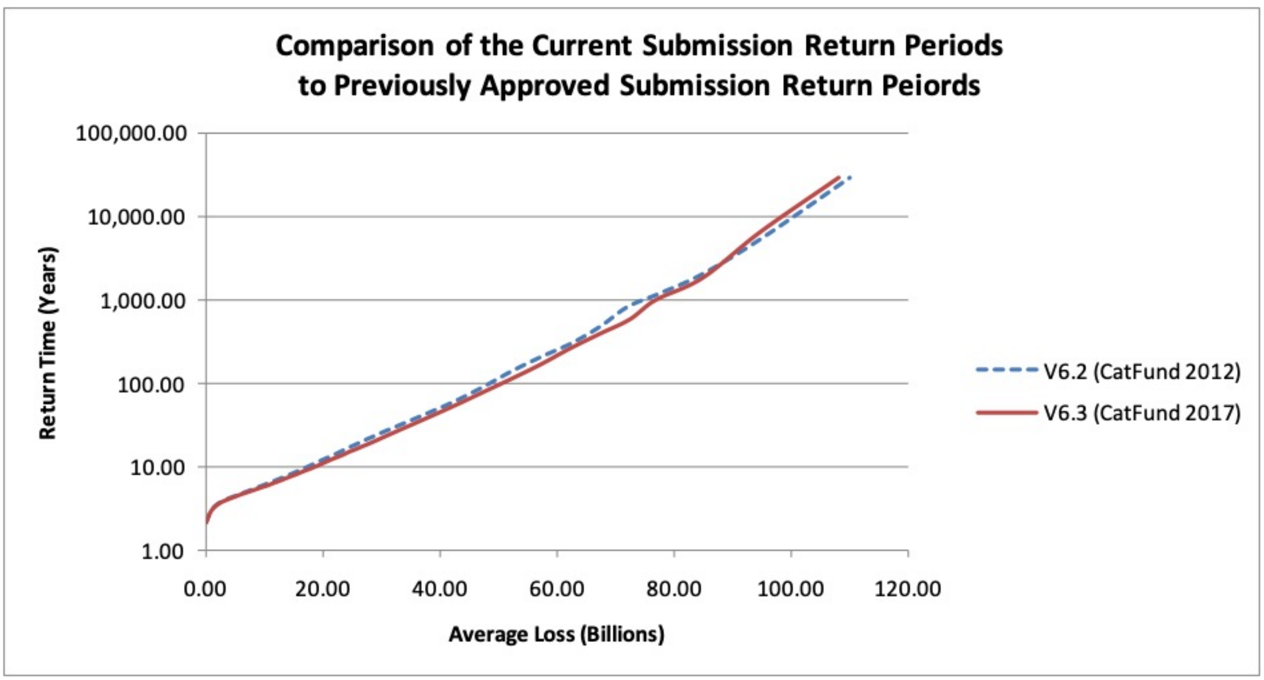

Figure 96. Comparison of return periods.

D. Provide the estimated hurricane loss and uncertainty interval for each of the Personal and Commercial Residential Return Periods given in Part B, Annual Aggregate, and Part C, Annual Occurrence. Describe how the uncertainty intervals are derived. Also, provide in Parts B and C, the Conditional Tail Expectation, the expected value of hurricane losses greater than the Estimated Hurricane Loss Level.

The uncertainty intervals (except for the top event) are approximate 95% confidence intervals.

Let $X_1, X_2, \ldots, X_N$ be the ordered set of annual losses produced by the simulation with $X_{(1)} \leq X_{(2)} \leq \ldots \leq X_{(N)}$. (Or alternatively for part C the ordered set of the largest loss from each year of the simulation.)

Since the sample is large enough to assume a normal approximation for the p^{th} quantile of the ordered set, an approximate 95% confidence interval for the PML is given by ($X_{(r)}$, $X_{(s)}$), where

$$r = Np - 1.96\sqrt{Np(1-p)}$$

$$s = Np + 1.96\sqrt{Np(1-p)}$$

and N and p are defined as

N = number of years in the simulation

and

p = 1 – 1 / return period.

If r and/or s are not integers, let r* be the smallest integer greater than r and let s* be the smallest integer greater than or equal to s. The 95% approximate confidence interval is given by ($X_{(r^*)}$, $X_{(s^*)}$)

The top event itself is estimated by the highest order statistics, $X_{(N)}$. It is not possible to compute a confidence interval for the top event using the above method.

E. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form A-8B, Hurricane Probable Maximum Loss for Florida (2017 FHCF Exposure Data), in a submission appendix.

See Appendix M.

COMPUTER/INFORMATION STANDARDS

CI-1 Hurricane Model Documentation

A. Hurricane model functionality and technical descriptions shall be documented formally in an archival format separate from the use of letters, slides, and unformatted text files.

The Florida Public Hurricane Loss Model (FPHLM) formally documents the model functionality and technical descriptions in the primary document repository, an archival format separate from the use of letters, slides, and unformatted text files. The primary document repository uses standard software practices to formally describe the model's requirements and complete software design and implementation specifications. All documentation related to the model is maintained in the project's primary document repository, a central location that is easily accessible.

B. The modeling organization shall maintain a primary document repository, containing or referencing a complete set of documentation specifying the hurricane model structure, detailed software description, and functionality. Documentation shall be indicative of current model development and software engineering practices.

The FPHLM maintains a primary document repository to satisfy the aforementioned requirements. In addition, the FPHLM maintains a user manual, designed for the end user, which provides a high-level introduction and a step-by-step guide to the entire system. All the documents are available for inspection on the project's primary document repository. Current software engineering best practices are used to render all the documents more readable, self-contained, consistent, and easy to understand. Every component of the system is documented with standard use case, class, data flow, sequence diagrams, etc. The diagrams describe in detail the structure, logic flow, information exchange among submodules, etc. of each component and increase the visibility of the system. The diagrams describing the component functionality and structure also make each component of the system reusable and easily maintainable.

C. All computer software (i.e., user interface, scientific, engineering, actuarial, data preparation, and validation) relevant to the hurricane model shall be consistently documented and dated.

The primary document repository contains all of the required documentation organized in chapters and sections linked to one another on the basis of their mutual relationships. Thus, the entire document can be viewed as a hierarchical referencing scheme in which each module is linked to its sub-module, which ultimately refers to the corresponding codes.

D. The modeling organization shall maintain (1) a table of all changes in the hurricane model from the previously-accepted hurricane model to the initial submission this year and (2) a table of all substantive changes since this year's initial submission.

These tables are maintained and documented and will be available for review.

E. Documentation shall be created separately from the source code.

The aforementioned primary document repository, created and maintained according to the requirements specified in this standard, is separate from source code and source code documentation.

F. The modeling organization shall maintain a list of all externally acquired currently used hurricane model-specific software and data assets. The list shall include (1) asset name, (2) asset version number, (3) asset acquisition date, (4) asset acquisition source, (5) asset acquisition mode (e.g., lease, purchase, open source), and (6) length of time asset has been in use by the modeling organization.

We created and maintain a list of all the externally acquired currently used hurricane model-specific software and data assets. The list will be available for review.

CI-2 Hurricane Model Requirements

The modeling organization shall maintain a complete set of requirements for each software component as well as for each database or data file accessed by a component. Requirements shall be updated whenever changes are made to the hurricane model.

The FPHLM is divided into several major modules, each of them providing one or more inputs to other modules. Requirements of each of the modules, including input/output formats, are precisely documented. In addition to maintaining a detailed documentation of each module of the system using standard software practices, several other documents are maintained as part of a large-scale project management requirement, including a quality assurance document, a system hardware and software specification document, a training document, a model maintenance document, a testing document, a user manual, etc. Moreover, detailed documentation has been developed for the database consisting of the schema and information about each table. Additionally, information about the format for each data file (in the form of an Excel or text file) accessed by different programs is documented. Whenever changes are made to a model, the corresponding requirements documentation is updated to reflect such changes.

Disclosure

1. Provide a description of the documentation for interface, human factors, functionality, documentation, data, human and material resources, security, and quality assurance.

The user interface, functionality requirements, and material resources of each of the modules are described in the relevant module documentation using formal modeling languages and representations. Database schema, table formats, security, software and hardware specifications, and training plans are separately documented for the whole system in the primary document repository. A separate software testing and quality assurance document describes the system quality, performance, and stability concerns. Additionally, a user manual and a human resource management document are maintained.

CI-3 Hurricane Model Architecture and Component Design

A. The modeling organization shall maintain and document (1) detailed control and data flowcharts and interface specifications for each software component, (2) schema definitions for each database and data file, (3) flowcharts illustrating hurricane model-related flow of information and its processing by modeling organization personnel or consultants, and (4) system model representations associated with (1)- (3). Documentation shall be to the level of components that make significant contributions to the hurricane model output.

Interface specifications for each of the software modules are included in the module's documentation. Diagrams are presented at various levels of the model documentation. High-level flowcharts are used to illustrate the flow of the whole system and the interactions among modules. More detailed diagrams are used in module-level descriptions.

The database schema is documented in the primary document repository. A detailed schema representation of the active database is documented with additional information such as database maintenance, tuning, data loading methodologies, etc. to provide a complete picture of the database maintained for the project.

Additionally, business process diagrams are used to illustrate the flow of model-related information and its processing by modeling organization personnel and consultants.

B. All flowcharts (e.g., software, data, and system models) shall be based on (1) a referenced industry standard (e.g., Unified Modeling Language (UML), Business Process Model and Notation (BPMN), Systems Modeling Language (SysML)), or (2) a comparable internally-developed standard which is separately documented.

Diagrams documenting the Florida Public Hurricane Loss Model are created according to standards International Organization for Standards (ISO) 5807, Business Process Model and Notation (BPMN) 2, and Unified Modeling Language (UML) 2.

Data flowcharts, program flowcharts, system flowcharts, program network charts, and system resources charts are created according to ISO 5807. Flowcharts illustrating model-related flow of information and its processing by team members follow BPMN 2. Other diagrams for both behavioral and structural object-oriented design documentation such as use case and class diagrams follow UML 2.

CI-4 Hurricane Model Implementation

A. The modeling organization shall maintain a complete procedure of coding guidelines consistent with accepted software engineering practices.

The FPHLM has developed and followed a set of coding guidelines that is consistent with accepted software engineering practices. These guidelines include policies for coding style, version control, code revision history maintenance, etc. Developers involved in the system development adhere to the instructions in these documents.

B. The modeling organization shall maintain a complete procedure used in creating, deriving, or procuring and verifying databases or data files accessed by components.

The FPHLM uses a PostgreSQL database to store, pre-process, and post-process model input and output data. The procedures for creating and using these databases is formalized in the form of stored procedures, which are documented in-line and in the primary document repository. Data files are generated by different modules and used as data interfaces between modules. Several data verification steps are undertaken to ensure their correctness. These steps are formalized in the form of Linux shell scripts and documented as part of the primary document repository.

C. All components shall be traceable, through explicit component identification in the hurricane model representations (e.g., flowcharts) down to the code level.

Traceability, from requirements to the code level and vice versa, is maintained throughout the system documentation.

D. The modeling organization shall maintain a table of all software components affecting hurricane loss costs and hurricane probable maximum loss levels with the following table columns: (1) component name, (2) number of lines of code, minus blank and comment lines, and (3) number of explanatory comment lines.

The FPHLM primary document repository includes a table of all software components affecting hurricane loss costs and hurricane probable maximum loss levels with the required columns.

E. Each component shall be sufficiently and consistently commented so that a software engineer unfamiliar with the code shall be able to comprehend the component logic at a reasonable level of abstraction.

Computer code comments are consistently used throughout all of the model's codebase to ease the understanding of its logic. These code-level comments include a summary of important changes, names of developers involved in each modification, function headers, and in-line comments to explain potentially ambiguous software code.

F. The modeling organization shall maintain the following documentation for all components or data modified by items identified in Standard G-1, Scope of the Hurricane Model and Its Implementation, Disclosure 5 and Audit 5:

1. A list of all equations and formulas used in documentation of the hurricane model with definitions of all terms and variables.

2. A cross-referenced list of implementation source code terms and variable names corresponding to items within F.1 above.

Tables mapping the equations and formulas used in the model's documentation to the source code terms and variable names are provided in the glossaries to the model's documentation, thus combining F.1 and F.2 into a single table. These tables enhance the model's documentation and include the equations and formulas for each module (not just the modified ones from the prior year's submission).

Disclosure

1. Specify the hardware, operating system, other software, and all computer languages required to use the hurricane model.

The user-facing part of the system consists of a web-based application that is hosted on a Tomcat web application server. The backend server environment is Linux and the server-side scripts that support the model's functionality are written in Bash, Java Server Pages (JSP) and JavaBeans. Backend probabilistic calculations are coded in C++ using the IMSL library and called through Java Native Interface (JNI). The system uses a PostgreSQL database that runs on a Linux server. Server-side software requirements are the IMSL library CNL 5.0, JDBC 3, JNI 1.3.1, and JDK 1.6. The end-user workstation requirements are minimal. Any current version of Internet Explorer, Firefox, Chrome, or Safari running on a currently supported version of Windows, Mac or Linux should deliver optimal user experience. Typically, the manufacturer's minimal set of hardware features for the current version of the web browser and operating system combination is sufficient for an optimal operation of the application.

CI-5 Hurricane Model Verification

A. General

For each component, the modeling organization shall maintain procedures for verification, such as code inspections, reviews, calculation crosschecks, and walkthroughs, sufficient to demonstrate code correctness. Verification procedures shall include tests performed by modeling organization personnel other than the original component developers.

The FPHLM software verification is done in three stages:

1. Code inspection and verification by the code developer.
- Inspection of the input and validation of the output by the system modeler.
- Review and extensive testing of the code by modeler personnel who are not part of the original component development.

The first level of verification includes code-level debugging, walking through the code to ensure a proper flow, inspection of internal variables through intermediate output printing and error logging, use of exception handling mechanisms, calculation crosschecks, and verification of the output against sample calculations provided by the system modeler.

In the second level of the verification, the modeler is provided with sample inputs and corresponding outputs. The modeler then conducts black-box testing to verify the results against his or her model. Finally, each component is rigorously tested by modeler personnel not responsible for original component development.

B. Component Testing

1. The modeling organization shall use testing software to assist in documenting and analyzing all components.

Component testing and data testing are done in the third level of verification. The system is rigorously checked for the correctness, precision, robustness, and stability of the whole system. Calculations are performed outside the system and compared against the system-generated results to ensure the system correctness. Extreme and unexpected inputs are given to the system to check the robustness. Wide series of test cases are developed to check the stability and the consistency of the system.

2. Unit tests shall be performed and documented for each component.

Unit testing is done at the first and third levels of verification. The developer tests all the units as the unit is developed and modified. Then all the units are tested again by the external testing team. Both black-box and white-box tests are performed and documented in a separate testing document.

3. Regression tests shall be performed and documented on incremental builds.

Regression testing is performed for each module. In this kind of testing methodology, the modules that have undergone some changes and revisions are retested to ensure that the changes have not affected the entire system in any undesired manner.

4. Aggregation tests shall be performed and documented to ensure the correctness of all hurricane model components. Sufficient testing shall be performed to ensure that all components have been executed at least once.

Aggregation testing is performed at all three levels of verification. Aggregation testing is performed by running each major module as a complete package. It is ensured that all components have been executed at least once during the testing procedure. All the test cases executed are described in the software testing and verification documentation.

C. Data Testing

1. The modeling organization shall use testing software to assist in documenting and analyzing all databases and data files accessed by components.

The FPHLM uses a PostgreSQL database to store the required data. Data integrity and consistency are maintained by the Relational Database Management System itself. Moreover, different queries are issued and PL/SQL is implemented to check the database. PostgreSQL has a very robust loader, which is used to load the data into the database. The loader maintains a log that depicts if the loading procedure has taken place properly and completely without any discrepancy. Data files are manually tested using commercial data manipulation software such as Microsoft Excel and Microsoft Access.

2. The modeling organization shall perform and document integrity, consistency, and correctness checks on all databases and data files accessed by the components.

All the tests are well documented in a separate testing document.

Disclosures

1. State whether any two executions of the hurricane model with no changes in input data, parameters, code, and seeds of random number generators produce the same hurricane loss costs and hurricane probable maximum loss levels.

The model produces the same loss costs and probable maximum loss levels if it is executed more than once with no changes in input data, parameters, code, and seeds of random number generators.

2. Provide an overview of the component testing procedures.

The FPHLM software testing and verification is done in three stages.

[A] Code inspection and the verification by the code developer.
The code developer performs a sufficient amount of testing on the code and does not deliver the code until he or she is satisfied with the correctness and robustness of the code.
The first level of verification includes code-level debugging, walking through the code to ensure proper flow, inspection of internal variables through intermediate output printing and error logging, use of exception handling mechanisms, calculation crosschecks, and verification of the output against sample calculations provided by the system modeler.

[B] Verification of results by the person who developed the system model.
Once the first level of testing is done, the developer sends the sample inputs and the generated results back to the modeler. Then the system modeler double-checks the results against his or her model. The code is not used in the production environment unless approved by the modeler.

[C] Review and extensive testing of the code by modeler personnel other than the original component developers.
The system is rigorously checked by modeler personnel (testers) other than the original component developers for the correctness, precision, robustness, and stability of the whole system. Calculations are performed outside the system and compared against the system generated results to ensure the system correctness. Extreme and unexpected inputs are given to the system to check the robustness. Wide series of test cases are developed to check the stability and the consistency of the system. Unit testing, regression testing, and aggregation testing (both white-box and black-box) are performed and documented.

Any flaw in the code is reported to the developer, and the bug-corrected code is again sent to the tester. The tester then performs unit testing again on the modified units. Additionally, regression testing is performed to determine if the modification affects any other parts of the code.

3. Provide a description of verification approaches used for externally acquired data, software, and models.

The verification approaches used for externally acquired data, software, and models are documented in the primary document repository.

CI-6 Hurricane Model Maintenance and Revision

A. The modeling organization shall maintain a clearly written policy for hurricane model review, maintenance, and revision, including verification and validation of revised components, databases, and data files.

The FPHLM is periodically enhanced to reflect the state of the art in hurricane loss modeling, historical event information, and the distribution of the population in the state of Florida. The primary document repository contains a clear policy for model revision.

B. A revision to any portion of the hurricane model that results in a change in any Florida residential hurricane loss cost or hurricane probable maximum loss level shall result in a new hurricane model version identification.

Whenever a revision results in a change in any Florida residential hurricane loss cost or probable maximum loss level, a new model version identification will be assigned to the revision. Verification and validation of the revised units are repeated according to the above-mentioned "software verification procedures" document.

C. The modeling organization shall use tracking software to identify and describe all errors, as well as modifications to code, data, and documentation.

The FPHLM uses Subversion to identify and describe all errors, as well as modifications to code, data, and documentation.

D. The modeling organization shall maintain a list of all hurricane model versions since the initial submission for this year. Each hurricane model description shall have a unique version identification and a list of additions, deletions, and changes that define that version.

A list of all model versions since the initial submission is maintained as part of the model's documentation. Each model revision has a unique version number and a list of additions, deletions, and changes that define that version. The unique model version will consist of the scheme "V[major].[minor]." The terms "[major]" and "[minor]" are positive integers that correspond to substantial and minor changes in the model, respectively. A minor change in the model would cause the minor number to be incremented by one, and similarly, a major change in the model would cause the major number to be incremented by one with the minor reset to zero. The rules that prompt changes in the major and minor numbers are described in Disclosure 2.

Disclosures

1. Identify procedures used to review and maintain code, data, and documentation.

The FPHLM's software development team employs version control software for all software development. In particular, the FPHLM uses Subversion, an accepted and effective system for managing simultaneous development of files. Subversion maintains a record of the changes to each file and allows the user to revert to a previous version, merge versions, and track changes. This software is able to record the information for each file, the date of each change, the author of each change, the file version, and the comparison of the file before and after the changes.

2. Describe the rules underlying the hurricane model and code revision identification systems.

The model identification system consists of the scheme "V[major].[minor]." The terms "[major]" and "[minor]" are positive integers that correspond to major and minor changes in the model, respectively. A minor change causes the minor number to be incremented by one, and similarly, a major change causes the major number to be incremented by one with the minor number reset to zero. The rules that prompt major or minor changes in the model are the following:

Any of the following events will trigger a change in the major number:

- Major updates in any of the main modules of the FPHLM: major modification of the Storm Forecast Module,Wind Field Model, Wind Speed Correction Module, Vulnerability Module, or Insured Loss Module.
- Addition or removal of options affecting how input data is processed by the model.
- Addition or removal of attributes in the model's input data specification.

Any of the following events will trigger a change in the minor number:

- Minor changes to the Storm Forecast Module, Wind Field Model, Wind Speed Correction Module, Vulnerability Module, or Insured Loss Module: minor updates such as a change in the Holland B parameter or any change to correct deficiencies that do not result in a new algorithm for the component.
- Updates to correct errors in the computer code: modifications in the code to correct deficiencies or errors such as a code bug in the computer program.
- Changes in the probability distribution functions using updated or corrected historical data, such as the updates of the HURDAT2 database: each year the model updates its HURDAT database with the latest HURDAT2 data released by the National Hurricane Center, which is used as the input in the Storm Generation Model.
- Updates of the ZIP Code list: every two years the ZIP Codes used in the model must be updated according to information originating from the United States Postal Service.

- Updates in the validation of the vulnerability matrices: the incorporation of new data, such as updated winds and insurance data, may trigger a tune-up of the vulnerability matrices used in the Insurance Loss Model.
- Modification to the set of valid values for any of the attributes in the model's input data specification.

If any change results in a change in loss costs estimates or probable maximum loss level, there will be at least a change in the minor revision number.

CI-7 Hurricane Model Security

The modeling organization shall have implemented and fully documented security procedures for (1) secure access to individual computers where the software components or data can be created or modified, (2) secure operation of the hurricane model by clients, if relevant, to ensure that the correct software operation cannot be compromised, (3) anti-virus software installation for all machines where all components and data are being accessed, and (4) secure access to documentation, software, and data in the event of a catastrophe.

The FPHLM maintains a set of security procedures to protect data and documents from deliberate and inadvertent changes. These procedures include both physical and electronic measures. A set of policies identifies different security issues and addresses each of them. All the security measures are properly documented in the primary document.

Disclosure

1. Describe methods used to ensure the security and integrity of the code, data, and documentation.

Electronic measures include the use of different authorization levels, special network security enforcements, and regular backups. Each developer is given a separate username and password and assigned a level of authorization so that even a developer cannot change another developer's code. The users of the system are given usernames and passwords so that unauthorized users cannot use the system. External users are not allowed direct access to any of the data sources of the system. The network is extensively monitored for any unauthorized actions using standard industry practices. Since the system runs on a Linux sever environment, minimal virus attacks are expected. Any sensitive or confidential data (insurance data, for example) are kept on an unshared disk on a system that has user access control and requires a login. Screen locks are enforced whenever the machine is left unattended. In addition, for system security and reliability purposes, we also deploy a development environment besides the production environment. Modifications to the code and data are done in the development environment and tested by in-house developers. The final production code and data can only be checked into the production environment by the authorized personnel. The models resulting from the FPHLM project can only be used by the authorized users. Authorized user accounts are created by the project manager. Regular backups of the server are taken and stored in two ways: physically and electronically. Backups are performed daily and are kept for six weeks. Nightly backups of all UNIX data disks and selected Windows data disks (at user requests) are performed over the network onto LT02 and LT03 tapes. The tape drives have built-in diagnostics and verification to ensure that the data is written correctly to the tapes. This ensures that if the tape is written successfully, it will be readable, provided no physical damage occurred to the tape. A copy of each backup is placed in a secure and hurricane-protected building. Additionally, the application server and the database server are physically secured in a secure server room with alarm systems. In case of disasters, we have implemented a set of preparation procedures and recovery plans as outlined in "FIU SCIS Hurricane Preparation Procedures."

APPENDICES

Appendix A – Expert Review Letters

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Assessment of the meteorological portion of the State of Florida Public Hurricane Model

February 15, 2007
Gary M. Barnes
Professor, Department of Meteorology
School of Ocean and Earth Science and Technology
University of Hawaii at Manoa

Introduction

My review of the State of Florida Public Hurricane Model is based on a three day visit to Florida International University in December, and an examination of the submission draft provided to me in February. I have had full access to the meteorological portion of the model, access to the draft for the Florida commission, and access to prior submittals to the commission from several other groups in order to establish a sense of what is desired by the commission. I am pleased to report that the issues that I have raised have received their attention and I believe that the model meets all the standards set forth by the commission. Ultimately this model, when linked to engineering and actuarial components, will provide objective guidance for the estimation of wind losses from hurricanes for the state of Florida. It does not address losses from other aspects of a tropical cyclone such as storm surge, or fresh water flooding. I now offer specific comments on each of the six meteorological standards established by the commission to ascertain this model's suitability.

M-1 Official Hurricane Set

The consortium of scientists working on the Public model have adopted HURDAT (1900- 2006) to determine landfall frequency and intensity at landfall. The NWS report by Ho et al. (1987), DeMaria's extension of the best track, H*Wind analyses (Powell & Houston, 1996, 1998; Powell et al. 1996, 1998) and NOAA Hurricane Research Division aircraft data are used to estimate the radius of maximum winds (RMW) at landfall. The strength of HURDAT is that it is the most complete and accessible historical record for hurricanes making landfall or passing closely by Florida. HURDAT weaknesses include the abbreviated record and questionable intensity estimates for those hurricanes early in the record, especially those that remain offshore. Evidence for the shortness of record is the impact of the last few hurricane seasons on landfall return frequency. The meteorological team has scrutinized the base set developed by the commission and made a number of adjustments to the dataset based on refereed literature and the HURDAT record. I have looked at several of these adjustments in detail and find the corrections to be an improvement over the initial base set.

M-2 Hurricane Characteristics

The model has two main components. The track portion of the model produces a storm with either an initial location or genesis point and an intensity that is derived from an empirical distribution derived from HURDAT (2006). Storm motion and intensity is then initialized by using a Monte Carlo approach, drawing from probability density functions (PDFs) based on the historical dataset to create a life for a bogus hurricane. Examination of the PDFs reveals that they are faithful to the observed patterns for storms nearing Florida, and the evolution of any particular hurricane appears realistic.

The second component of the meteorological model is the wind field generated for a given hurricane, which only comes into play when the hurricane comes close enough to place high winds over any given ZIP Code of Florida. To generate a wind field the minimum sea-level pressure (MSLP) found in the eye, the RMW at landfall, and a distant environmental pressure (1013 mb) are entered into the Holland (1980) B model for the axisymmetric pressure distribution around the hurricane. The behavior of the RMW is based on a variety of sources that include Ho et al. (1987), DeMaria's extension of the best track data, H*wind analyses, and aircraft reconnaissance radial wind profiles. The B coefficient is based on the extensive aircraft dataset acquired in reconnaissance and research flights over the last few decades. RMW and B use a random or error term to introduce variety into the model. The Holland pressure field is used to produce a gradient wind at the top of the boundary layer. The winds in the boundary layer are estimated following the work proposed by Ooyama (1969) and later utilized by Shapiro (1983) which includes friction and advection effects. These boundary layer winds are reduced to surface winds (10 m) using reduction factors based on the work of Powell et al. (2003). Maximum sustained winds and 3 second gusts are estimated using the guidance of Vickery and Skerlj (2005). Once the hurricane winds come ashore there are further adjustments to the wind to account for local roughness as well as the roughness of the terrain found upstream of the location under scrutiny. The pressure decay of the hurricane is modeled to fit the observations presented by Vickery (2005).

Gradient balance has been demonstrated to be an accurate representation for vortex scale winds above the boundary layer by Willoughby (1990) and is a fine initial condition. The slab boundary layer concept of Ooyama and Shapiro has been shown to produce wind fields much like observed once storm translation and surface friction come into play. The reduction to 10 m altitude is based on Powell et al. (2003); they use the state of the art Global Positioning System sondes to compare surface and boundary layer winds.

Perhaps the most questionable part of the wind portion of the model is the reliance on the estimates of the RMW at landfall. The scatter in RMW for a given MSLP is large; larger RMWs coupled with the B parameter control the size of the annulus of the damaging winds. The typical length of an aircraft leg from the eye is about 150 km so the choice of the B parameter is based on a small radial distance in the majority of hurricanes. The collection of quality wind observations over land in hurricanes remains a daunting task; therefore the actual response of the hurricane winds to variations in roughness is less certain. Applying roughness as a function of ZIP Code is a coarse approximation to reality. However, this is the approach chosen by the commission, and given the data limitations, a reasonable course to take.

M-3 Landfall Intensity

The model uses one minute winds at 10 m elevation to determine intensity at landfall and categorizes each hurricane according to the Saffir-Simpson classification. The model considers any hurricane that makes landfall or comes close enough to place high winds over Florida. Multiple landfalls are accounted for, and decay over land between these landfalls is also estimated. Maximum wind speeds for each category of the Saffir-Simpson scheme are reasonable as is the worst possible hurricane the model generates. Simulations are conducted for a hypothetical 60,000 years. Any real climate change would alter results, but maybe not as much as have an actual record of order of 1,000 years to base the PDFs on.

M-4 Hurricane Probabilities

Form M-1 demonstrates that the model is simulating the landfalls very well for the entire state, region A (NW Florida) and region B (SW Florida). There are subsections of the state where the historical and the simulated landfalls have a discrepancy. In region C (SE Florida) the observations show an unrealistic bias toward Category 3 storms. This is likely due to an overestimate of intensity for the hurricanes prior to the advent of aircraft sampling or advanced satellite techniques. The historical distribution for region C also does not fit any accepted distributions that we typically see for atmospheric phenomena. This discrepancy is probably due to the shortness of the historical record. I note that other models also have difficulty with this portion of the coast. I believe the modeled distribution, based on tens of thousands of years, is more defensible than the purported standard. Regions D (NE Florida) and E (Georgia) have virtually no distribution to simulate, again pointing to a very short historical record. There is no documented physical reason why these two regions have escaped landfall events. Perhaps a preferred shape of the Bermuda High may bias the situation, but this remains speculative.

M-5 Land Friction and Weakening

Land use and land cover are based on high resolution satellite imagery. Roughness for a particular location is then based on HAZUS tables that assign a roughness to a particular land use. There are newer assessments from other groups but the techniques were not consistently applied throughout the state, nor are the updated HAZUS maps for 2000 available yet. Winds at a particular location are a function of the roughness at that point and conditions upwind. A pressure decay model based on the work of Vickery (2005) produces weakening winds that are reasonable approximations of the observed decay rates of several hurricanes that made landfall in Florida in 2004 and 2005.

The maps (Form M-2) of the 100 year return period maximum sustained winds shows the following trends: (1) a reduction in the sustained winds from south to north, (2) a reduction of winds from coastal to inland ZIP Codes, and (3) the highest winds in the Keys and along the SE and SW coasts. The plotting thresholds requested by the commission partially obfuscate the gradients in wind speed, but Form M-2 produced with finer contours highlights the above trends clearly. The open terrain maps look logical; the actual terrain maps are perhaps overly sensitive to the local roughness. Convective scale motions, which cannot be resolved in this type of model, would probably be responsible for making the winds closer to the open terrain results.

M-6 Logical Relationships of Hurricane Characteristics

The RMW is a crucial but poorly measured variable. Making RMW a function of intensity and latitude explains only a small portion of the variance (~20%). Examination of aircraft reconnaissance radial profiles shows that RMW is highly variable. Currently there are no other schemes available to explain more of the variance. Form M-3 reflects the large range of RMW. Note that only the more intense hurricanes (MSLP < 940 mb) show a trend, and only with the upper part of the range. Even open ocean studies of the RMW show such large scatter.

Tests done during my visits show that wind speed decreases as a function of roughness, all other variables being held constant. The evolution of the wind field as a hurricane comes ashore is logical.

Summary

The consortium that has assembled the meteorological portion of the Public Model for Hurricane Wind Losses for the State of Florida is using the HURDAT with corrections based on other refereed literature. These data yield a series of probability density functions that describe frequency, location, and intensity at landfall. Once a hurricane reaches close enough to the coast the gradient winds are estimated using the equations by Holland (1980), then a sophisticated wind model (Ooyama 1969, Shapiro 1983) is applied to calculate the boundary layer winds. Reduction of this wind to a surface value is based on recent boundary layer theory and observations. Here the consortium has exploited other sources of data (e.g., NOAA/AOML/HRD aircraft wind profiles and GPS sondes) to produce a surface wind field. As the wind field transitions from marine to land exposure changes in roughness are taken into account. Form M-1 (frequency and category at landfall as a function of coastal segment) and Form M-2 (100 year return maximum sustained winds for Florida) highlight the good performance of the model.

I suspect that the differences between the historical record and the simulation are largely due to the shortness and uncertainty of the record. If the consortium had the luxury of 1000 years of observations agreement between the record and the simulation would be improved. I believe that the meteorological portion of the model is meeting all the standards established by the commission. Tests of the model against H*Wind analyses and the production of wind speed swaths go beyond the typical quality controls of prior models and demonstrate that this model is worthy of consideration by the commission.

AMI Risk Consultants, Inc.
Actuarial & Risk Management Consulting Services
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April 4, 2019

Dr. Shahid Hamid
Chair and Professor of Finance,
Department of Finance, College of Business
RB 223 Florida International University
11200 SW 8th Street
Miami, FL 33199

Re: Florida Public Hurricane Loss Model
Version 7.0
Independent Actuarial Review

Dear Dr. Hamid:

AMI Risk Consultants, Inc. was engaged by the International Hurricane Research Center ("IHRC") at Florida International University ("FIU") to review the actuarial components of its hurricane model, Florida Public Hurricane Loss Model, Version 7.0. I am a Fellow of the Casualty Actuarial Society, a Member of the American Academy of Actuaries, and have more than twenty-five years of actuarial experience in the property/casualty insurance industry. I am an employee of the actuarial consulting firm AMI Risk Consultants, Inc.

It is my understanding that between Versions 6.2 and 6.3 there were minimal changes to the Florida Public Hurricane Loss Model ("FPHLM"). Those changes included:

- Updates to HURDAT and
- Updates to ZIP Code centroids.

My review is based the IHRC's November 2018 model submission to the Commission. I revisited each of the Actuarial Standards, and have the following comments:

Standard A-1: I reviewed the data input and output record formats for Personal and Commercial Residential policies. The input records have been expanded so that both hurricane and flood exposures can be collected. The output record has not changed.

Standard A-2: Although Version 6.3 incorporates a new set of stochastic storms, the criteria for inclusion/exclusion have not changed, and the computer code categorizing each storm is also unchanged. There is a new requirement that there be a documented procedure for distinguishing wind-related hurricane losses from other peril losses.

Standard A-3: The approach to estimating loss costs by coverage has not changed in this version of the model for either Personal or Commercial Residential.

Standard A-4: The treatment of the items detailed in this standard, such as expenses, inflation, storm surge, geocoding, and demand surge has not changed with this version of the model.

Standard A-5: The methods used by the model to reflect the impact of deductibles and policy limits on losses have not changed since the prior submission.

Standard A-6: I tested the loss costs for compliance with this standard. I examined Forms A-1, A-2A, A-2B, A-3A, A-3B, A-4A, A-4B, A-8A and A-8B for reasonability, and compared the results to the prior submission where applicable. I examined loss cost changes by county, separating the impacts of each component that changed. Larger positive and negative changes were examined at the zip code level.

I identified the instances in Form A-6 that appeared to deviate from the standard, and determined the reason for each.

I tested loss costs at the zip code level in instances where compliance could not be verified from the weighted averages in Form A-4.

Conclusion:

My conclusion is that the Florida Public Hurricane Model -v7.0 reflects reasonable actuarial assumptions, and meets the Commission's Standards A-1 through A-6.

If you have any questions about my review, I would be happy to discuss them.

Sincerely,

Gail Flannery

Gail Flannery, FCAS, MAAA
Consulting Actuary

AMI Risk Consultants, Inc.

Appendix B - Form A-1: Zero Deductible Personal Residential Hurricane Loss Costs by ZIP Code

Florida International University
Florida Public Hurricane Loss Model 7.0
March 29, 2019

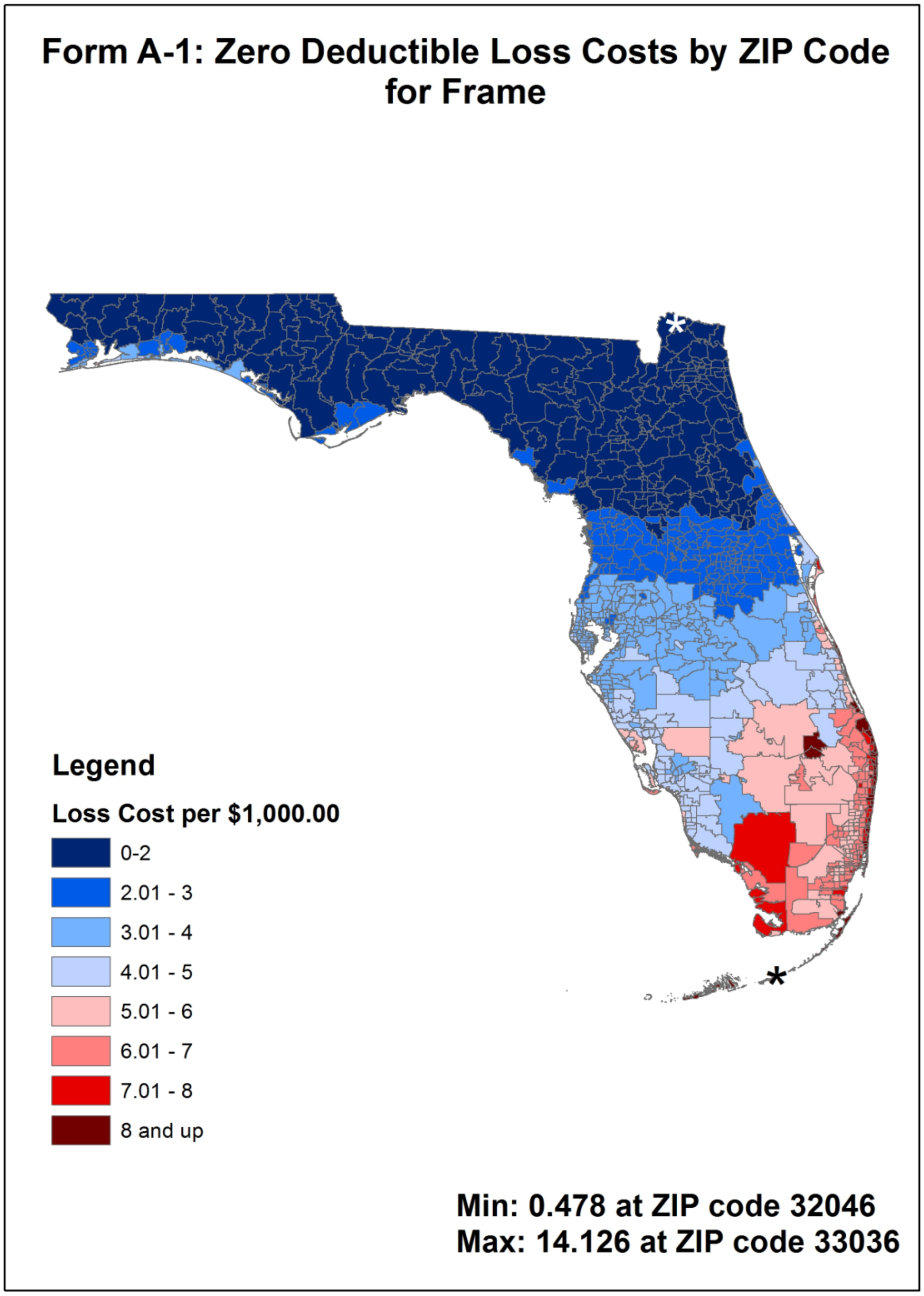

Figure 97. Zero deductible loss costs by ZIP code for frame.

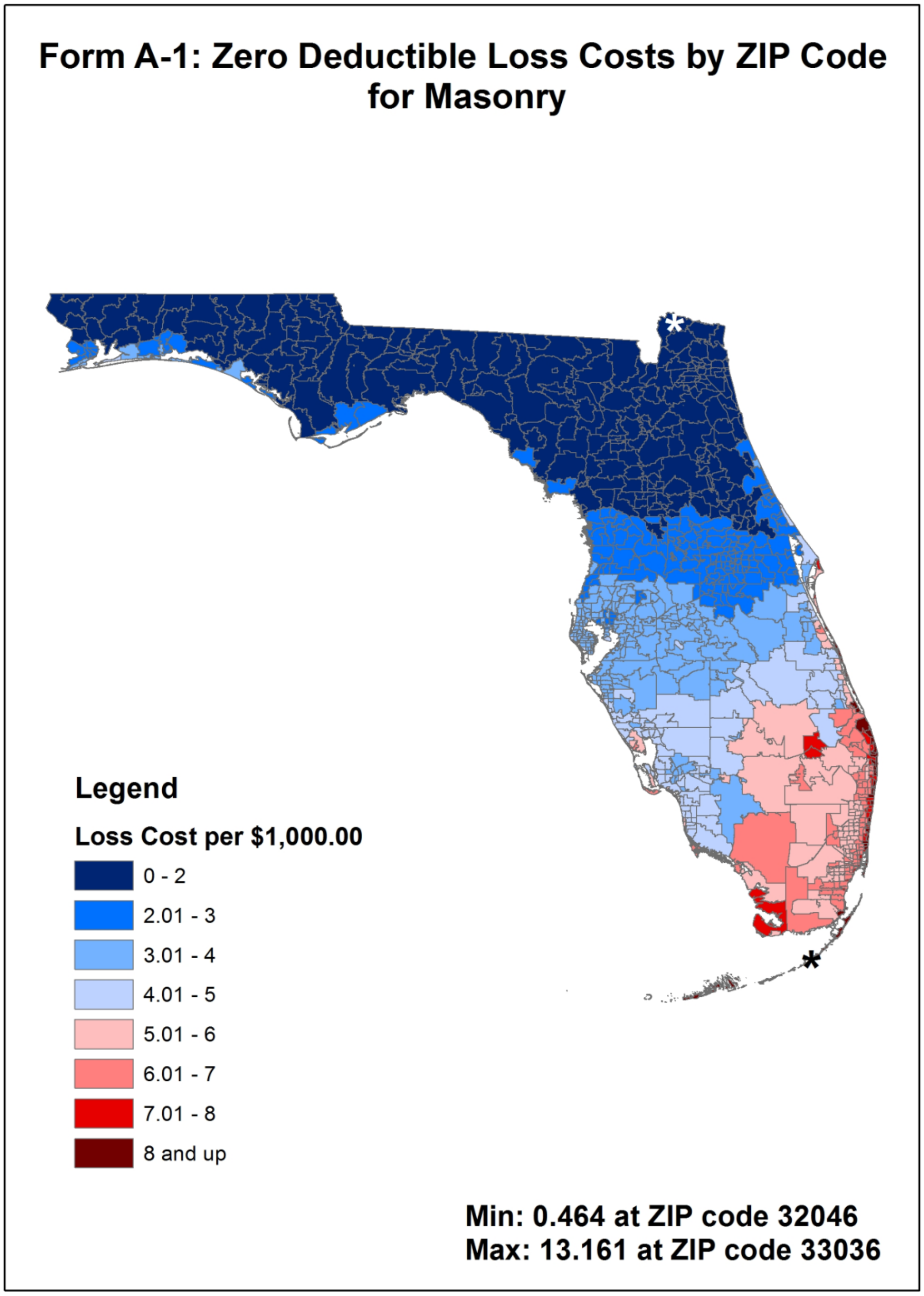

Figure 98. Zero deductible loss costs by ZIP code for masonry.

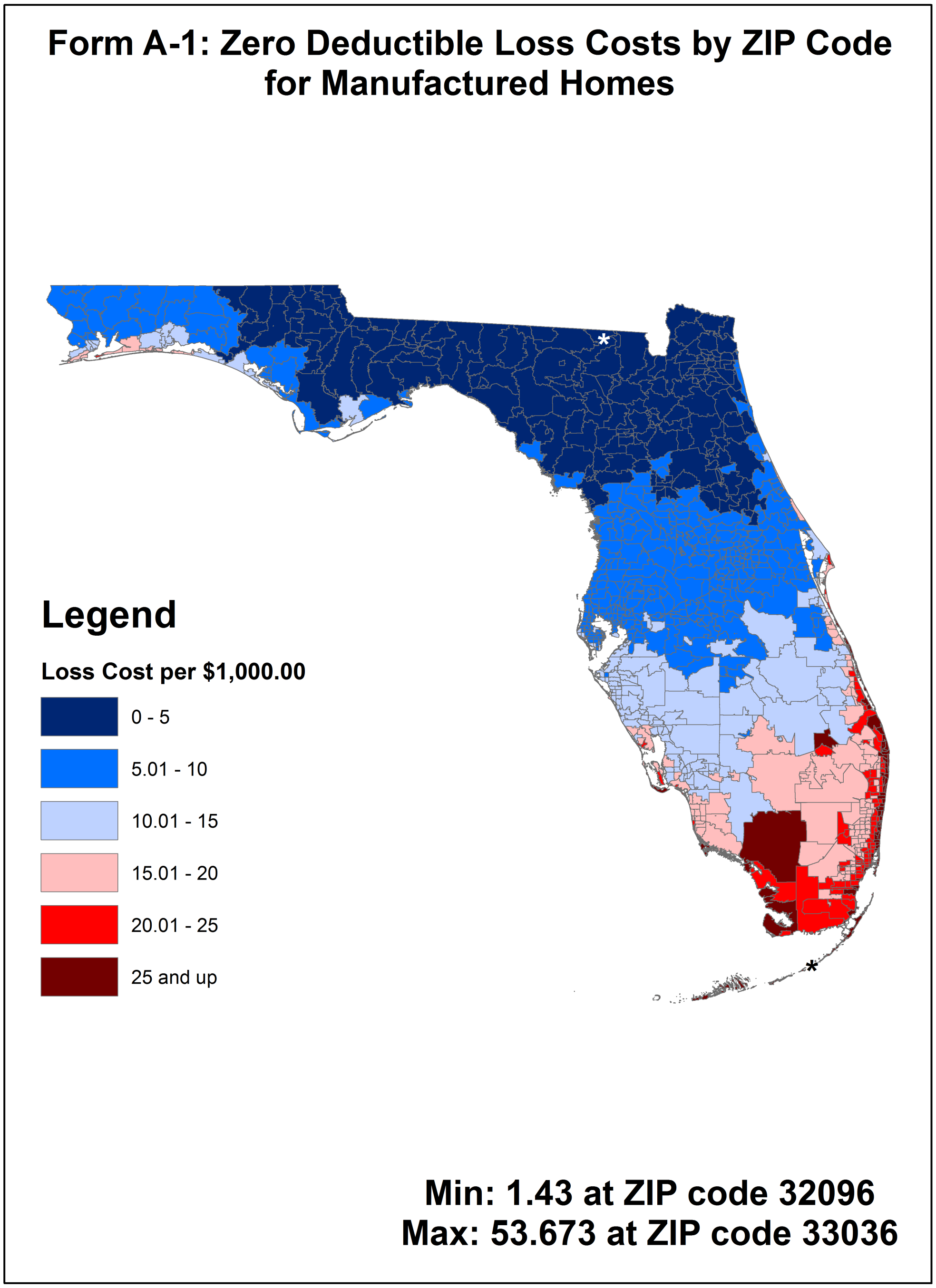

Figure 99. Zero deductible loss costs by ZIP code for manufactured home

Appendix C – Form A-2A: Base Hurricane Storm Set Statewide Hurricane Losses (2012 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Form A-2A: Base Hurricane Storm Set Statewide Hurricane Losses (2012 FHCF Exposure Data)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: November 5, 2018

ID	Hurricane Landfall/Closest Approach Date	Year	Name	Region as defined in Figure 3 - Category	Personal and Commercial Residential Insured Hurricane Losses ($)	Dollar Contribution
005	08/10/1901	1901	NoName04-1901	F-1	342,871,478	2,905,690
010	09/11/1903	1903	NoName03-1903	C-1/A-1	10,424,864,295	88,346,308
015	10/17/1904	1904	NoName04-1904	C-1	3,627,281,851	30,739,677
020	06/17/1906	1906	NoName02-1906	B-1	3,742,042,822	31,712,227
025	09/27/1906	1906	NoName06-1906	F-2/ByP-2	831,353,933	7,045,372
030	10/18/1906	1906	NoName08-1906	B-3	18,234,916,738	154,533,193
035	10/11/1909	1909	NoName11-1909	B-3	989,837,155	8,388,450
040	10/18/1910	1910	NoName05-1910	B-2	29,282,008,208	248,152,612
045	08/11/1911	1911	NoName02-1911	A-1	373,964,015	3,169,187
050	09/14/1912	1912	NoName04-1912	F-1/ByP-1	29,667,621	251,421
055	08/01/1915	1915	NoName01-1915	D-1	828,537,640	7,021,505
060	09/04/1915	1915	NoName04-1915	A-1	423,785,556	3,591,403
065	07/05/1916	1916	NoName02-1916	F-3/ByP-2	535,600,568	4,538,988
070	10/18/1916	1916	NoName14-1916	A-2	1,087,612,743	9,217,057
075	09/29/1917	1917	NoName04-1917	A-3	1,721,997,265	14,593,197
080	09/10/1919	1919	NoName02-1919	ByP-4	193,832,012	1,642,644
085	10/25/1921	1921	TampaBay06-1921	B-3	19,253,498,150	163,165,239
090	09/15/1924	1924	NoName05-1924	A-1	32,662,554	276,801
095	10/21/1924	1924	NoName10-1924	B-1	7,666,129,060	64,967,195
100	07/28/1926	1926	NoName01-1926	D-2	3,643,216,673	30,874,718
105	09/18/1926	1926	GreatMiami07-1926	C-4/A-3	40,553,243,683	343,671,557
110	10/21/1926	1926	NoName10-1926	ByP-3	3,287,169,002	27,857,364
115	08/08/1928	1928	NoName01-1928	C-2	4,267,778,629	36,167,616
120	09/17/1928	1928	LakeOkeechobee04-1928	C-4	44,432,184,806	376,543,939
125	09/28/1929	1929	NoName02-1929	C-3/A-1	13,443,536,833	113,928,278
130	09/01/1932	1932	NoName03-1932	F-1/ByP-1	2,240,637,548	18,988,454
135	07/30/1933	1933	NoName05-1933	C-1	1,206,463,324	10,224,265
140	09/04/1933	1933	NoName11-1933	C-3	12,429,238,633	105,332,531
145	09/03/1935	1935	LaborDay03-1935	C-5/A-2	19,361,185,543	164,077,844
150	11/04/1935	1935	NoName07-1935	C-2	7,246,167,051	61,408,195
155	07/31/1936	1936	NoName05-1936	A-2	2,315,700,663	19,624,582
160	08/11/1939	1939	NoName02-1939	C-1/A-1	3,280,728,808	27,802,787
165	10/06/1941	1941	NoName05-1941	C-2/A-1	9,044,661,367	76,649,673
170	10/19/1944	1944	NoName13-1944	B-2	25,707,891,289	217,863,485

ID	Hurricane Landfall/Closest Approach Date	Year	Name	Region as defined in Figure 3 - Category	Personal and Commercial Residential Insured Hurricane Losses ($)	Dollar Contribution
175	06/24/1945	1945	NoName01-1945	A-1	6,392,475,554	54,173,522
180	09/15/1945	1945	NoName09-1945	C-4	16,311,802,246	138,235,612
185	10/08/1946	1946	NoName06-1946	B-1	13,438,347,540	113,884,301
190	09/17/1947	1947	NoName04-1947	C-4	25,267,727,718	214,133,286
195	10/12/1947	1947	NoName09-1947	B-1/E-2	8,384,922,632	71,058,666
200	09/22/1948	1948	NoName08-1948	B-3	13,591,391,141	115,181,281
205	10/05/1948	1948	NoName09-1948	B-2	8,297,961,492	70,321,708
210	08/26/1949	1949	NoName02-1949	C-4	30,653,636,218	259,776,578
215	08/31/1950	1950	Baker-1950	F-1/ByP-1	585,455,044	4,961,483
220	09/05/1950	1950	Easy-1950	A-3	9,382,872,794	79,515,871
225	10/18/1950	1950	King-1950	C-4	19,284,685,993	163,429,542
230	09/26/1953	1953	Florence-1953	A-1	507,202,095	4,298,323
235	10/09/1953	1953	Hazel-1953	B-1	3,170,336,027	26,867,254
240	09/25/1956	1956	Flossy-1956	A-1	806,721,254	6,836,621
245	09/10/1960	1960	Donna-1960	B-4	22,118,665,262	187,446,316
250	09/15/1960	1960	Ethel-1960	F-1	233	2
255	08/27/1964	1964	Cleo-1964	C-2	15,339,206,506	129,993,275
260	09/10/1964	1964	Dora-1964	D-2	3,963,111,604	33,585,692
265	10/14/1964	1964	Isbell-1964	B-3	9,768,050,274	82,780,087
270	09/08/1965	1965	Betsy-1965	C-3	8,953,631,601	75,878,234
275	06/09/1966	1966	Alma-1966	A-2	13,385,062,475	113,432,733
280	10/04/1966	1966	Inez-1966	B-1	312,570,834	2,648,905
285	10/19/1968	1968	Gladys-1968	A-1	4,991,079,749	42,297,286
290	08/18/1969	1969	Camille-1969	F-5	0	0
295	06/19/1972	1972	Agnes-1972	A-1	100,401,005	850,856
300	09/23/1975	1975	Eloise-1975	A-3	1,126,475,994	9,546,407
305	09/04/1979	1979	David-1979	C-2/E-1	9,323,383,821	79,011,727
310	09/13/1979	1979	Frederic-1979	F-4/ByP-3	1,073,328,119	9,096,001
315	09/02/1985	1985	Elena-1985	F-3/ByP-3	197,697,411	1,675,402
320	11/21/1985	1985	Kate-1985	A-2	431,462,252	3,656,460
325	10/12/1987	1987	Floyd-1987	B-1	268,272,092	2,273,492
330	08/24/1992	1992	Andrew-1992	C-5	17,939,234,961	152,027,415
335	08/03/1995	1995	Erin-1995	C-1/A-2	4,857,780,976	41,167,635
340	10/04/1995	1995	Opal-1995	A-3	2,899,462,842	24,571,719
345	07/19/1997	1997	Danny-1997	F-1/ByP-1	73,204,162	620,374
350	09/03/1998	1998	Earl-1998	A-1	9,751,570	82,640
355	09/25/1998	1998	Georges-1998	B-2/F-2	1,077,619,188	9,132,366
360	10/15/1999	1999	Irene-1999	B-1	5,878,576,528	49,818,445
365	08/13/2004	2004	Charley-2004	B-4	6,738,433,386	57,105,368

ID	Hurricane Landfall/Closest Approach Date	Year	Name	Region as defined in Figure 3 - Category	Personal and Commercial Residential Insured Hurricane Losses ($)	Dollar Contribution
370	09/05/2004	2004	Frances-2004	C-2	12,022,576,938	101,886,245
375	09/16/2004	2004	Ivan-2004	F-3/ByP-3	673,643,615	5,708,844
380	09/26/2004	2004	Jeanne-2004	C-3	12,727,877,049	107,863,365
385	07/10/2005	2005	Dennis-2005	A-3	890,285,193	7,544,790
390	08/25/2005	2005	Katrina-2005	C-1	4,458,594,526	37,784,699
395	09/20/2005	2005	Rita-2005	ByP-2	123,083,030	1,043,077
400	10/24/2005	2005	Wilma-2005	B-3	17,584,450,648	149,020,768
401	09/10/2008	2008	Ike-2008	ByP-1	83,161	705
405	09/02/2016	2016	Hermine-2016	A-1	239,185,067	2,026,992
410	10/07/2016	2016	Matthew-2016	ByP-3	4,494,973,425	38,092,995
415	09/10/2017	2017	Irma-2017	B-4	14,324,632,393	121,395,190
Total					**646,523,653,157**	**5,479,014,010**

Appendix D – Form A-2B: Base Hurricane Storm Set Statewide Hurricane Losses (2017 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Form A-2B: Base Hurricane Storm Set Statewide Hurricane Losses (2017 FHCF Exposure Data)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: November 5, 2018

ID	Hurricane Landfall/Closest Approach Date	Year	Name	Region as defined in Figure 3 - Category	Personal and Commercial Residential Insured Hurricane Losses ($)	Dollar Contribution
005	08/10/1901	1901	NoName04-1901	F-1	338,718,333	2,870,494
010	09/11/1903	1903	NoName03-1903	C-1/A-1	10,476,177,600	88,781,166
015	10/17/1904	1904	NoName04-1904	C-1	3,451,586,992	29,250,737
020	06/17/1906	1906	NoName02-1906	B-1	3,524,918,748	29,872,193
025	09/27/1906	1906	NoName06-1906	F-2/ByP-2	843,324,492	7,146,818
030	10/18/1906	1906	NoName08-1906	B-3	17,276,607,168	146,411,925
035	10/11/1909	1909	NoName11-1909	B-3	853,716,243	7,234,883
040	10/18/1910	1910	NoName05-1910	B-2	32,520,690,004	275,599,068
045	08/11/1911	1911	NoName02-1911	A-1	384,579,792	3,259,151
050	09/14/1912	1912	NoName04-1912	F-1/ByP-1	18,331,903	155,355
055	08/01/1915	1915	NoName01-1915	D-1	949,484,220	8,046,476
060	09/04/1915	1915	NoName04-1915	A-1	452,152,864	3,831,804
065	07/05/1916	1916	NoName02-1916	F-3/ByP-2	536,219,966	4,544,237
070	10/18/1916	1916	NoName14-1916	A-2	1,152,645,249	9,768,180
075	09/29/1917	1917	NoName04-1917	A-3	1,765,344,015	14,960,543
080	09/10/1919	1919	NoName02-1919	ByP-4	166,966,158	1,414,967
085	10/25/1921	1921	TampaBay06-1921	B-3	21,918,873,930	185,753,169
090	09/15/1924	1924	NoName05-1924	A-1	33,272,717	281,972
095	10/21/1924	1924	NoName10-1924	B-1	7,710,778,979	65,345,585
100	07/28/1926	1926	NoName01-1926	D-2	4,205,019,808	35,635,761
105	09/18/1926	1926	GreatMiami07-1926	C-4/A-3	40,203,352,656	340,706,378
110	10/21/1926	1926	NoName10-1926	ByP-3	3,063,205,872	25,959,372
115	08/08/1928	1928	NoName01-1928	C-2	4,696,834,653	39,803,683
120	09/17/1928	1928	LakeOkeechobee04-1928	C-4	48,347,045,233	409,720,722
125	09/28/1929	1929	NoName02-1929	C-3/A-1	13,814,398,306	117,071,172
130	09/01/1932	1932	NoName03-1932	F-1/ByP-1	1,903,402,712	16,130,531
135	07/30/1933	1933	NoName05-1933	C-1	1,190,497,566	10,088,962
140	09/04/1933	1933	NoName11-1933	C-3	13,017,624,134	110,318,849
145	09/03/1935	1935	LaborDay03-1935	C-5/A-2	20,946,823,792	177,515,456
150	11/04/1935	1935	NoName07-1935	C-2	7,263,272,627	61,553,158
155	07/31/1936	1936	NoName05-1936	A-2	2,225,491,993	18,860,102
160	08/11/1939	1939	NoName02-1939	C-1/A-1	3,677,183,990	31,162,576
165	10/06/1941	1941	NoName05-1941	C-2/A-1	9,460,539,969	80,174,068

ID	Hurricane Landfall/Closest Approach Date	Year	Name	Region as defined in Figure 3 - Category	Personal and Commercial Residential Insured Hurricane Losses ($)	Dollar Contribution
170	10/19/1944	1944	NoName13-1944	B-2	29,150,965,833	247,042,083
175	06/24/1945	1945	NoName01-1945	A-1	6,985,323,011	59,197,653
180	09/15/1945	1945	NoName09-1945	C-4	18,439,210,093	156,264,492
185	10/08/1946	1946	NoName06-1946	B-1	15,365,132,307	130,212,986
190	09/17/1947	1947	NoName04-1947	C-4	26,639,537,112	225,758,789
195	10/12/1947	1947	NoName09-1947	B-1/E-2	8,387,960,340	71,084,410
200	09/22/1948	1948	NoName08-1948	B-3	13,890,311,871	117,714,507
205	10/05/1948	1948	NoName09-1948	B-2	7,744,662,278	65,632,731
210	08/26/1949	1949	NoName02-1949	C-4	33,255,680,771	281,827,803
215	08/31/1950	1950	Baker-1950	F-1/ByP-1	585,840,987	4,964,754
220	09/05/1950	1950	Easy-1950	A-3	10,610,586,478	89,920,224
225	10/18/1950	1950	King-1950	C-4	18,940,498,706	160,512,701
230	09/26/1953	1953	Florence-1953	A-1	510,478,480	4,326,089
235	10/09/1953	1953	Hazel-1953	B-1	3,565,630,452	30,217,207
240	09/25/1956	1956	Flossy-1956	A-1	775,754,860	6,574,194
245	09/10/1960	1960	Donna-1960	B-4	25,155,404,148	213,181,391
250	09/15/1960	1960	Ethel-1960	F-1	0	0
255	08/27/1964	1964	Cleo-1964	C-2	15,017,963,842	127,270,880
260	09/10/1964	1964	Dora-1964	D-2	4,511,620,250	38,234,070
265	10/14/1964	1964	Isbell-1964	B-3	9,848,294,376	83,460,122
270	09/08/1965	1965	Betsy-1965	C-3	8,770,193,805	74,323,676
275	06/09/1966	1966	Alma-1966	A-2	14,135,673,883	119,793,846
280	10/04/1966	1966	Inez-1966	B-1	263,494,710	2,233,006
285	10/19/1968	1968	Gladys-1968	A-1	5,560,467,841	47,122,609
290	08/18/1969	1969	Camille-1969	F-5	0	0
295	06/19/1972	1972	Agnes-1972	A-1	103,959,230	881,010
300	09/23/1975	1975	Eloise-1975	A-3	1,118,790,840	9,481,278
305	09/04/1979	1979	David-1979	C-2/E-1	9,727,965,840	82,440,388
310	09/13/1979	1979	Frederic-1979	F-4/ByP-3	1,100,428,602	9,325,666
315	09/02/1985	1985	Elena-1985	F-3/ByP-3	191,673,285	1,624,350
320	11/21/1985	1985	Kate-1985	A-2	479,552,418	4,064,004
325	10/12/1987	1987	Floyd-1987	B-1	221,090,542	1,873,649
330	08/24/1992	1992	Andrew-1992	C-5	18,018,709,958	152,700,932
335	08/03/1995	1995	Erin-1995	C-1/A-2	5,435,853,299	46,066,553
340	10/04/1995	1995	Opal-1995	A-3	2,929,805,572	24,828,861
345	07/19/1997	1997	Danny-1997	F-1/ByP-1	63,100,160	534,747
350	09/03/1998	1998	Earl-1998	A-1	11,442,957	96,974
355	09/25/1998	1998	Georges-1998	B-2/F-2	802,819,739	6,803,557

ID	Hurricane Landfall/Closest Approach Date	Year	Name	Region as defined in Figure 3 - Category	Personal and Commercial Residential Insured Hurricane Losses ($)	Dollar Contribution
360	10/15/1999	1999	Irene-1999	B-1	5,450,310,513	46,189,072
365	08/13/2004	2004	Charley-2004	B-4	8,260,232,381	70,001,969
370	09/05/2004	2004	Frances-2004	C-2	12,715,670,230	107,759,917
375	09/16/2004	2004	Ivan-2004	F-3/ByP-3	666,851,974	5,651,288
380	09/26/2004	2004	Jeanne-2004	C-3	14,501,770,046	122,896,356
385	07/10/2005	2005	Dennis-2005	A-3	943,561,545	7,996,284
390	08/25/2005	2005	Katrina-2005	C-1	4,245,048,811	35,974,990
395	09/20/2005	2005	Rita-2005	ByP-2	104,423,925	884,949
400	10/24/2005	2005	Wilma-2005	B-3	18,337,266,833	155,400,566
401	09/10/2008	2008	Ike-2008	ByP-1	71,732	608
405	09/02/2016	2016	Hermine-2016	A-1	184,135,627	1,560,471
410	10/07/2016	2016	Matthew-2016	ByP-3	4,938,099,687	41,848,302
415	09/10/2017	2017	Irma-2017	B-4	16,515,824,835	139,964,617
Total					**683,568,229,696**	**5,792,951,099**

Appendix E – Form A-3A: 2004 Hurricane Season Losses (2012 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Form A-3A: 2004 Hurricane Season Losses (2012 FHCF Exposure Data)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: November 5, 2018

Form A-3A: 2004 Hurricane Season Losses (2012 FHCF Exposure Data)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
January 31, 2019

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32024	0	0.00%	0	0.00%	0	0.00%	9,258,476	0.07%	9,258,476	0.03%
32025	0	0.00%	0	0.00%	0	0.00%	8,798,480	0.07%	8,798,480	0.03%
32034	0	0.00%	0	0.00%	0	0.00%	7,120,115	0.06%	7,120,117	0.02%
32038	0	0.00%	0	0.00%	0	0.00%	3,687,275	0.03%	3,687,275	0.01%
32052	0	0.00%	1,878,542	0.02%	0	0.00%	0	0.00%	1,910,705	0.01%
32053	0	0.00%	1,112,352	0.01%	0	0.00%	0	0.00%	1,131,622	0.00%
32054	0	0.00%	0	0.00%	0	0.00%	3,593,164	0.03%	3,593,164	0.01%
32055	0	0.00%	0	0.00%	0	0.00%	6,730,753	0.05%	6,730,753	0.02%
32059	0	0.00%	926,833	0.01%	0	0.00%	0	0.00%	926,833	0.00%
32060	0	0.00%	7,771,386	0.07%	0	0.00%	0	0.00%	7,921,984	0.02%
32064	0	0.00%	2,010,282	0.02%	0	0.00%	0	0.00%	2,043,550	0.01%
32066	0	0.00%	1,890,081	0.02%	0	0.00%	0	0.00%	1,890,081	0.01%
32080	0	0.00%	38,575,622	0.32%	0	0.00%	38,651,195	0.31%	77,226,974	0.24%
32082	0	0.00%	68,798,796	0.58%	0	0.00%	68,956,302	0.54%	137,755,098	0.43%
32084	0	0.00%	22,296,944	0.19%	0	0.00%	22,347,353	0.18%	44,644,297	0.14%
32086	0	0.00%	2,003,092	0.02%	0	0.00%	22,452,282	0.18%	24,455,375	0.08%
32095	0	0.00%	642,284	0.01%	0	0.00%	8,461,390	0.07%	9,103,674	0.03%
32102	0	0.00%	0	0.00%	0	0.00%	1,697,478	0.01%	1,697,478	0.01%
32112	0	0.00%	0	0.00%	0	0.00%	2,729,017	0.02%	2,793,155	0.01%
32113	0	0.00%	2,383,702	0.02%	0	0.00%	3,218,708	0.03%	5,602,410	0.02%
32114	24,744,755	0.37%	18,342,081	0.15%	0	0.00%	21,918,770	0.17%	65,005,605	0.20%
32117	22,035,839	0.33%	14,526,559	0.12%	0	0.00%	18,589,671	0.15%	55,152,070	0.17%
32118	73,602,576	1.10%	57,111,827	0.48%	0	0.00%	63,096,426	0.50%	193,810,828	0.61%
32119	37,098,657	0.55%	27,156,291	0.23%	0	0.00%	32,689,024	0.26%	96,943,972	0.30%
32124	4,330,827	0.06%	3,729,342	0.03%	0	0.00%	4,381,190	0.03%	12,441,359	0.04%
32127	50,516,245	0.75%	50,970,248	0.43%	0	0.00%	61,069,940	0.48%	162,556,434	0.51%
32128	41,705,441	0.62%	28,716,746	0.24%	0	0.00%	35,528,429	0.28%	105,950,617	0.33%
32129	29,756,354	0.44%	19,416,102	0.16%	0	0.00%	24,942,463	0.20%	74,114,919	0.23%
32130	0	0.00%	0	0.00%	0	0.00%	3,008,238	0.02%	3,066,912	0.01%
32132	9,300,924	0.14%	9,384,833	0.08%	0	0.00%	11,304,710	0.09%	29,990,466	0.09%
32134	0	0.00%	0	0.00%	0	0.00%	3,360,126	0.03%	3,427,698	0.01%
32136	21,437,851	0.32%	18,074,287	0.15%	0	0.00%	21,680,237	0.17%	61,192,375	0.19%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percen t of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32137	0	0.00%	61,761,662	0.52%	0	0.00%	79,279,826	0.63%	141,042,205	0.44%
32141	24,285,425	0.36%	24,505,771	0.21%	0	0.00%	29,603,446	0.23%	78,394,642	0.24%
32148	0	0.00%	0	0.00%	0	0.00%	3,239,516	0.03%	3,239,516	0.01%
32159	0	0.00%	31,393,654	0.26%	0	0.00%	49,000,221	0.39%	80,393,875	0.25%
32162	0	0.00%	91,656,885	0.77%	0	0.00%	91,882,512	0.73%	183,539,397	0.57%
32163	0	0.00%	2,219,852	0.02%	0	0.00%	2,403,107	0.02%	4,622,959	0.01%
32164	0	0.00%	40,823,875	0.34%	0	0.00%	40,929,510	0.32%	81,753,385	0.26%
32168	42,722,732	0.64%	29,094,622	0.24%	0	0.00%	43,208,842	0.34%	115,026,195	0.36%
32169	49,161,786	0.73%	56,533,542	0.47%	0	0.00%	62,377,419	0.49%	168,072,746	0.53%
32174	83,661,491	1.25%	67,086,837	0.56%	0	0.00%	84,618,041	0.67%	235,366,369	0.74%
32176	50,834,690	0.76%	41,322,273	0.35%	0	0.00%	47,186,557	0.37%	139,343,520	0.44%
32179	0	0.00%	4,129,849	0.03%	0	0.00%	5,523,123	0.04%	9,652,972	0.03%
32180	0	0.00%	0	0.00%	0	0.00%	1,612,859	0.01%	1,612,859	0.01%
32190	0	0.00%	0	0.00%	0	0.00%	525,740	0.00%	525,799	0.00%
32195	0	0.00%	2,283,873	0.02%	0	0.00%	3,001,983	0.02%	5,285,856	0.02%
32233	0	0.00%	1,857,652	0.02%	0	0.00%	17,477,730	0.14%	19,335,382	0.06%
32250	0	0.00%	6,340,035	0.05%	0	0.00%	28,522,306	0.23%	34,862,342	0.11%
32266	0	0.00%	7,204,097	0.06%	0	0.00%	7,222,638	0.06%	14,426,735	0.05%
32301	0	0.00%	14,638,770	0.12%	0	0.00%	0	0.00%	14,638,770	0.05%
32303	0	0.00%	28,893,960	0.24%	0	0.00%	0	0.00%	28,893,960	0.09%
32304	0	0.00%	9,186,583	0.08%	0	0.00%	0	0.00%	9,186,583	0.03%
32305	0	0.00%	6,417,341	0.05%	0	0.00%	0	0.00%	6,417,341	0.02%
32308	0	0.00%	18,506,783	0.15%	0	0.00%	0	0.00%	18,506,827	0.06%
32309	0	0.00%	29,714,812	0.25%	0	0.00%	0	0.00%	29,714,812	0.09%
32310	0	0.00%	5,187,491	0.04%	0	0.00%	0	0.00%	5,187,491	0.02%
32311	0	0.00%	16,254,785	0.14%	0	0.00%	0	0.00%	16,254,811	0.05%
32312	0	0.00%	40,032,050	0.33%	0	0.00%	0	0.00%	40,032,073	0.13%
32317	0	0.00%	13,527,644	0.11%	0	0.00%	0	0.00%	13,527,644	0.04%
32331	0	0.00%	1,729,578	0.01%	0	0.00%	0	0.00%	1,729,578	0.01%
32336	0	0.00%	589,287	0.00%	0	0.00%	0	0.00%	589,287	0.00%
32340	0	0.00%	4,278,748	0.04%	0	0.00%	0	0.00%	4,278,748	0.01%
32344	0	0.00%	7,960,833	0.07%	0	0.00%	0	0.00%	7,960,833	0.02%
32346	0	0.00%	2,330,852	0.02%	0	0.00%	0	0.00%	2,330,852	0.01%
32347	0	0.00%	4,213,282	0.04%	0	0.00%	0	0.00%	4,213,282	0.01%
32348	0	0.00%	3,906,774	0.03%	0	0.00%	0	0.00%	3,906,774	0.01%
32350	0	0.00%	564,395	0.00%	0	0.00%	0	0.00%	564,395	0.00%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percen t of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32359	0	0.00%	1,936,822	0.02%	0	0.00%	0	0.00%	1,936,822	0.01%
32407	0	0.00%	0	0.00%	2,668,958	0.40%	0	0.00%	2,669,045	0.01%
32408	0	0.00%	0	0.00%	3,033,280	0.45%	0	0.00%	3,033,558	0.01%
32413	0	0.00%	0	0.00%	26,981,152	4.01%	0	0.00%	26,981,347	0.08%
32501	0	0.00%	0	0.00%	10,206,968	1.52%	0	0.00%	10,206,968	0.03%
32502	0	0.00%	0	0.00%	2,599,771	0.39%	0	0.00%	2,599,771	0.01%
32503	0	0.00%	0	0.00%	39,190,043	5.82%	0	0.00%	39,190,043	0.12%
32504	0	0.00%	0	0.00%	30,313,264	4.50%	0	0.00%	30,313,264	0.09%
32505	0	0.00%	0	0.00%	16,515,658	2.45%	0	0.00%	16,515,658	0.05%
32506	0	0.00%	0	0.00%	35,508,800	5.27%	0	0.00%	35,508,800	0.11%
32507	0	0.00%	0	0.00%	74,508,377	11.06%	0	0.00%	74,508,377	0.23%
32514	0	0.00%	0	0.00%	36,091,362	5.36%	0	0.00%	36,091,362	0.11%
32526	0	0.00%	0	0.00%	41,932,771	6.22%	0	0.00%	41,932,771	0.13%
32531	0	0.00%	0	0.00%	3,032,108	0.45%	0	0.00%	3,032,108	0.01%
32533	0	0.00%	0	0.00%	32,413,263	4.81%	0	0.00%	32,413,263	0.10%
32534	0	0.00%	0	0.00%	12,108,994	1.80%	0	0.00%	12,108,994	0.04%
32535	0	0.00%	0	0.00%	2,422,637	0.36%	0	0.00%	2,422,637	0.01%
32541	0	0.00%	0	0.00%	32,826,961	4.87%	0	0.00%	32,826,961	0.10%
32547	0	0.00%	0	0.00%	21,400,230	3.18%	0	0.00%	21,400,230	0.07%
32548	0	0.00%	0	0.00%	23,327,844	3.46%	0	0.00%	23,327,844	0.07%
32550	0	0.00%	0	0.00%	6,310,108	0.94%	0	0.00%	6,310,108	0.02%
32561	0	0.00%	0	0.00%	39,670,546	5.89%	0	0.00%	39,670,546	0.12%
32563	0	0.00%	0	0.00%	32,195,509	4.78%	0	0.00%	32,195,509	0.10%
32564	0	0.00%	0	0.00%	1,058,624	0.16%	0	0.00%	1,058,624	0.00%
32565	0	0.00%	0	0.00%	3,984,378	0.59%	0	0.00%	3,984,378	0.01%
32566	0	0.00%	0	0.00%	43,024,118	6.39%	0	0.00%	43,024,118	0.13%
32568	0	0.00%	0	0.00%	2,565,159	0.38%	0	0.00%	2,565,159	0.01%
32569	0	0.00%	0	0.00%	10,568,661	1.57%	0	0.00%	10,568,661	0.03%
32570	0	0.00%	0	0.00%	20,452,886	3.04%	0	0.00%	20,452,886	0.06%
32571	0	0.00%	0	0.00%	28,634,028	4.25%	0	0.00%	28,634,028	0.09%
32577	0	0.00%	0	0.00%	5,303,652	0.79%	0	0.00%	5,303,652	0.02%
32578	0	0.00%	0	0.00%	1,785,409	0.27%	0	0.00%	1,785,409	0.01%
32579	0	0.00%	0	0.00%	10,681,226	1.59%	0	0.00%	10,681,226	0.03%
32580	0	0.00%	0	0.00%	2,800,533	0.42%	0	0.00%	2,800,533	0.01%
32583	0	0.00%	0	0.00%	15,482,467	2.30%	0	0.00%	15,482,467	0.05%
32601	0	0.00%	3,205,279	0.03%	0	0.00%	8,588,265	0.07%	11,793,544	0.04%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percen t of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32603	0	0.00%	0	0.00%	0	0.00%	1,546,734	0.01%	1,723,210	0.01%
32605	0	0.00%	1,564,004	0.01%	0	0.00%	20,460,514	0.16%	22,024,519	0.07%
32606	0	0.00%	2,965,641	0.02%	0	0.00%	18,360,127	0.15%	21,325,768	0.07%
32607	0	0.00%	3,762,054	0.03%	0	0.00%	17,153,656	0.14%	20,915,709	0.07%
32608	0	0.00%	26,203,762	0.22%	0	0.00%	26,262,731	0.21%	52,466,493	0.16%
32609	0	0.00%	814,329	0.01%	0	0.00%	6,134,854	0.05%	6,949,183	0.02%
32615	0	0.00%	0	0.00%	0	0.00%	10,351,652	0.08%	10,633,049	0.03%
32617	0	0.00%	2,143,960	0.02%	0	0.00%	2,768,526	0.02%	4,912,486	0.02%
32618	0	0.00%	3,298,554	0.03%	0	0.00%	3,307,176	0.03%	6,605,730	0.02%
32621	0	0.00%	1,640,677	0.01%	0	0.00%	1,404,069	0.01%	3,044,746	0.01%
32622	0	0.00%	0	0.00%	0	0.00%	709,075	0.01%	720,909	0.00%
32625	0	0.00%	3,092,367	0.03%	0	0.00%	1,583,383	0.01%	4,675,750	0.01%
32626	0	0.00%	4,082,874	0.03%	0	0.00%	0	0.00%	4,143,265	0.01%
32628	0	0.00%	1,378,302	0.01%	0	0.00%	0	0.00%	1,378,302	0.00%
32631	0	0.00%	0	0.00%	0	0.00%	539,668	0.00%	539,692	0.00%
32640	0	0.00%	0	0.00%	0	0.00%	4,803,263	0.04%	4,893,065	0.02%
32641	0	0.00%	0	0.00%	0	0.00%	4,054,173	0.03%	4,120,879	0.01%
32643	0	0.00%	0	0.00%	0	0.00%	6,540,290	0.05%	6,695,792	0.02%
32648	0	0.00%	720,421	0.01%	0	0.00%	0	0.00%	720,421	0.00%
32653	0	0.00%	525,607	0.00%	0	0.00%	12,180,773	0.10%	12,706,380	0.04%
32656	0	0.00%	0	0.00%	0	0.00%	7,445,433	0.06%	7,445,433	0.02%
32664	0	0.00%	630,483	0.01%	0	0.00%	632,100	0.01%	1,262,583	0.00%
32666	0	0.00%	0	0.00%	0	0.00%	4,165,408	0.03%	4,165,408	0.01%
32667	0	0.00%	2,985,650	0.03%	0	0.00%	2,993,458	0.02%	5,979,108	0.02%
32668	0	0.00%	3,600,108	0.03%	0	0.00%	3,132,760	0.02%	6,732,868	0.02%
32669	0	0.00%	9,649,195	0.08%	0	0.00%	9,672,699	0.08%	19,321,894	0.06%
32680	0	0.00%	2,959,622	0.02%	0	0.00%	0	0.00%	3,003,169	0.01%
32686	0	0.00%	3,214,905	0.03%	0	0.00%	4,162,940	0.03%	7,377,844	0.02%
32692	0	0.00%	599,807	0.01%	0	0.00%	0	0.00%	599,807	0.00%
32693	0	0.00%	4,685,950	0.04%	0	0.00%	0	0.00%	4,756,034	0.01%
32694	0	0.00%	0	0.00%	0	0.00%	746,076	0.01%	746,076	0.00%
32696	0	0.00%	5,786,026	0.05%	0	0.00%	5,152,622	0.04%	10,938,648	0.03%
32701	26,949,283	0.40%	14,063,986	0.12%	0	0.00%	20,568,708	0.16%	61,581,977	0.19%
32702	0	0.00%	0	0.00%	0	0.00%	1,207,123	0.01%	1,207,123	0.00%
32703	25,349,492	0.38%	688,380	0.01%	0	0.00%	36,656,812	0.29%	62,694,684	0.20%
32707	59,595,184	0.89%	25,128,912	0.21%	0	0.00%	49,698,843	0.39%	134,422,939	0.42%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32708	97,772,358	1.46%	39,892,820	0.33%	0	0.00%	81,534,334	0.64%	219,199,511	0.68%
32709	2,806,274	0.04%	1,243,216	0.01%	0	0.00%	2,338,541	0.02%	6,388,032	0.02%
32712	1,041,803	0.02%	1,052,011	0.01%	0	0.00%	53,212,538	0.42%	55,306,351	0.17%
32713	26,024,390	0.39%	0	0.00%	0	0.00%	26,326,519	0.21%	52,678,281	0.16%
32714	32,925,997	0.49%	4,121,982	0.03%	0	0.00%	33,273,729	0.26%	70,321,709	0.22%
32720	1,040,170	0.02%	1,050,437	0.01%	0	0.00%	20,531,744	0.16%	22,622,352	0.07%
32724	23,361,468	0.35%	1,113,541	0.01%	0	0.00%	23,633,561	0.19%	48,108,569	0.15%
32725	45,600,886	0.68%	848,411	0.01%	0	0.00%	46,128,107	0.36%	92,577,404	0.29%
32726	0	0.00%	13,904,319	0.12%	0	0.00%	20,032,922	0.16%	33,937,241	0.11%
32730	6,524,682	0.10%	0	0.00%	0	0.00%	4,870,154	0.04%	11,748,726	0.04%
32732	12,937,272	0.19%	4,945,050	0.04%	0	0.00%	9,425,675	0.07%	27,307,996	0.09%
32735	0	0.00%	3,398,029	0.03%	0	0.00%	4,673,337	0.04%	8,071,365	0.03%
32736	0	0.00%	0	0.00%	0	0.00%	11,858,074	0.09%	12,015,370	0.04%
32738	51,073,882	0.76%	0	0.00%	0	0.00%	41,036,937	0.32%	92,588,636	0.29%
32744	3,186,633	0.05%	0	0.00%	0	0.00%	3,223,776	0.03%	6,456,425	0.02%
32746	85,146,274	1.27%	45,345,719	0.38%	0	0.00%	66,141,076	0.52%	196,633,069	0.61%
32750	31,038,017	0.46%	20,301,557	0.17%	0	0.00%	31,396,443	0.25%	82,736,017	0.26%
32751	46,340,914	0.69%	24,689,760	0.21%	0	0.00%	35,843,252	0.28%	106,873,926	0.33%
32754	14,084,140	0.21%	10,902,198	0.09%	0	0.00%	17,204,551	0.14%	42,190,889	0.13%
32757	0	0.00%	1,432,152	0.01%	0	0.00%	30,070,196	0.24%	31,502,366	0.10%
32759	2,484,582	0.04%	2,507,088	0.02%	0	0.00%	3,534,071	0.03%	8,525,741	0.03%
32763	12,325,354	0.18%	843,001	0.01%	0	0.00%	12,464,658	0.10%	25,633,012	0.08%
32764	4,557,521	0.07%	2,174,617	0.02%	0	0.00%	3,026,306	0.02%	9,758,444	0.03%
32765	133,099,083	1.98%	50,329,844	0.42%	0	0.00%	97,595,198	0.77%	281,024,124	0.88%
32766	35,892,320	0.53%	17,154,649	0.14%	0	0.00%	26,860,258	0.21%	79,907,227	0.25%
32767	0	0.00%	0	0.00%	0	0.00%	982,324	0.01%	997,663	0.00%
32771	60,362,525	0.90%	36,746,171	0.31%	0	0.00%	48,828,444	0.39%	145,937,140	0.46%
32773	32,898,624	0.49%	14,836,220	0.12%	0	0.00%	21,172,479	0.17%	68,907,323	0.22%
32776	0	0.00%	9,434,600	0.08%	0	0.00%	12,262,853	0.10%	21,697,453	0.07%
32778	0	0.00%	15,758,289	0.13%	0	0.00%	22,105,445	0.17%	37,863,750	0.12%
32779	67,984,912	1.01%	45,847,559	0.38%	0	0.00%	68,760,023	0.54%	182,592,494	0.57%
32780	41,676,834	0.62%	42,058,539	0.35%	0	0.00%	66,347,458	0.52%	150,082,831	0.47%
32784	0	0.00%	6,529,305	0.05%	0	0.00%	9,345,897	0.07%	15,875,202	0.05%
32789	94,100,493	1.40%	44,811,094	0.37%	0	0.00%	79,293,238	0.63%	218,204,826	0.68%
32792	66,078,704	0.98%	28,959,864	0.24%	0	0.00%	55,382,750	0.44%	150,421,318	0.47%
32796	22,355,768	0.33%	22,559,714	0.19%	0	0.00%	30,077,299	0.24%	74,992,782	0.23%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32798	0	0.00%	0	0.00%	0	0.00%	3,461,467	0.03%	3,492,509	0.01%
32801	26,138,657	0.39%	14,478,171	0.12%	0	0.00%	22,252,349	0.18%	62,869,176	0.20%
32803	41,523,786	0.62%	18,005,603	0.15%	0	0.00%	34,718,725	0.27%	94,248,115	0.29%
32804	47,919,170	0.71%	21,309,406	0.18%	0	0.00%	40,183,187	0.32%	109,411,762	0.34%
32805	14,026,275	0.21%	7,530,878	0.06%	0	0.00%	14,177,368	0.11%	35,734,521	0.11%
32806	63,514,347	0.95%	23,839,840	0.20%	0	0.00%	46,618,371	0.37%	133,972,558	0.42%
32807	35,938,327	0.54%	13,306,664	0.11%	0	0.00%	26,363,533	0.21%	75,608,524	0.24%
32808	25,263,338	0.38%	1,536,626	0.01%	0	0.00%	33,932,811	0.27%	60,732,775	0.19%
32809	33,191,519	0.49%	12,880,910	0.11%	0	0.00%	24,421,799	0.19%	70,494,228	0.22%
32810	29,860,265	0.44%	908,198	0.01%	0	0.00%	30,200,568	0.24%	60,969,030	0.19%
32811	16,632,504	0.25%	9,601,462	0.08%	0	0.00%	16,760,077	0.13%	42,994,043	0.13%
32812	59,854,171	0.89%	22,655,979	0.19%	0	0.00%	43,988,207	0.35%	126,498,356	0.40%
32814	14,785,872	0.22%	9,097,206	0.08%	0	0.00%	11,288,246	0.09%	35,171,324	0.11%
32816	7,271,635	0.11%	3,817,985	0.03%	0	0.00%	5,428,377	0.04%	16,517,997	0.05%
32817	54,334,723	0.81%	20,542,094	0.17%	0	0.00%	39,937,578	0.32%	114,814,395	0.36%
32818	33,862,439	0.50%	1,541,676	0.01%	0	0.00%	44,884,991	0.35%	80,289,105	0.25%
32819	62,103,745	0.92%	33,861,801	0.28%	0	0.00%	62,779,865	0.50%	158,745,410	0.50%
32820	12,373,653	0.18%	6,852,210	0.06%	0	0.00%	9,304,721	0.07%	28,530,584	0.09%
32821	28,447,578	0.42%	3,382,724	0.03%	0	0.00%	21,084,171	0.17%	52,914,474	0.17%
32822	54,443,747	0.81%	21,509,834	0.18%	0	0.00%	39,699,910	0.31%	115,653,492	0.36%
32824	62,942,496	0.94%	26,334,027	0.22%	0	0.00%	51,545,525	0.41%	140,822,048	0.44%
32825	88,392,563	1.32%	35,616,941	0.30%	0	0.00%	65,311,895	0.52%	189,321,399	0.59%
32826	32,305,050	0.48%	12,552,529	0.11%	0	0.00%	18,165,753	0.14%	63,023,332	0.20%
32827	21,204,337	0.32%	10,253,203	0.09%	0	0.00%	17,421,769	0.14%	48,879,309	0.15%
32828	104,987,338	1.56%	49,836,248	0.42%	0	0.00%	78,582,813	0.62%	233,406,399	0.73%
32829	30,685,304	0.46%	14,976,385	0.13%	0	0.00%	21,353,263	0.17%	67,014,953	0.21%
32832	31,487,092	0.47%	19,183,044	0.16%	0	0.00%	25,733,379	0.20%	76,403,515	0.24%
32833	16,402,826	0.24%	7,891,726	0.07%	0	0.00%	12,230,604	0.10%	36,525,156	0.11%
32835	50,316,281	0.75%	27,756,351	0.23%	0	0.00%	50,849,414	0.40%	128,922,046	0.40%
32836	49,531,465	0.74%	28,692,879	0.24%	0	0.00%	59,888,877	0.47%	138,113,222	0.43%
32837	92,330,207	1.38%	36,193,595	0.30%	0	0.00%	68,173,055	0.54%	196,696,857	0.61%
32839	25,950,334	0.39%	12,204,335	0.10%	0	0.00%	21,848,852	0.17%	60,003,521	0.19%
32901	0	0.00%	30,028,896	0.25%	0	0.00%	37,840,599	0.30%	67,869,729	0.21%
32903	0	0.00%	57,709,419	0.48%	0	0.00%	67,470,368	0.53%	125,180,344	0.39%
32904	0	0.00%	40,739,075	0.34%	0	0.00%	55,991,641	0.44%	96,730,796	0.30%
32905	0	0.00%	27,957,338	0.23%	0	0.00%	46,443,269	0.37%	74,401,023	0.23%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
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32906	0	0.00%	0	0.00%	0	0.00%	537,963	0.00%	845,508	0.00%
32907	0	0.00%	46,370,186	0.39%	0	0.00%	84,168,843	0.66%	130,539,029	0.41%
32908	0	0.00%	11,250,879	0.09%	0	0.00%	18,358,117	0.15%	29,608,996	0.09%
32909	0	0.00%	40,420,624	0.34%	0	0.00%	59,225,165	0.47%	99,645,793	0.31%
32920	17,478,619	0.26%	29,463,380	0.25%	0	0.00%	36,095,370	0.29%	83,037,368	0.26%
32922	6,845,620	0.10%	13,088,221	0.11%	0	0.00%	18,020,925	0.14%	37,954,766	0.12%
32926	14,632,594	0.22%	22,179,293	0.19%	0	0.00%	35,788,313	0.28%	72,600,199	0.23%
32927	27,394,402	0.41%	27,643,851	0.23%	0	0.00%	44,028,247	0.35%	99,066,500	0.31%
32931	25,576,074	0.38%	72,306,413	0.60%	0	0.00%	88,076,953	0.70%	185,959,440	0.58%
32932	0	0.00%	0	0.00%	0	0.00%	0	0.00%	707,205	0.00%
32934	511,311	0.01%	34,590,630	0.29%	0	0.00%	47,926,143	0.38%	83,028,085	0.26%
32935	0	0.00%	64,604,722	0.54%	0	0.00%	80,278,147	0.63%	144,883,352	0.45%
32937	7,437,144	0.11%	93,243,998	0.78%	0	0.00%	99,716,992	0.79%	200,398,134	0.63%
32940	43,890,162	0.65%	90,821,017	0.76%	0	0.00%	118,599,765	0.94%	253,310,945	0.79%
32948	0	0.00%	3,339,527	0.03%	0	0.00%	4,982,175	0.04%	8,321,702	0.03%
32949	0	0.00%	6,722,794	0.06%	0	0.00%	8,592,850	0.07%	15,315,643	0.05%
32950	0	0.00%	11,941,736	0.10%	0	0.00%	14,424,595	0.11%	26,366,331	0.08%
32951	0	0.00%	47,354,825	0.40%	0	0.00%	87,929,389	0.69%	135,284,647	0.42%
32952	21,660,069	0.32%	59,800,004	0.50%	0	0.00%	68,433,476	0.54%	149,893,549	0.47%
32953	21,105,907	0.31%	41,567,772	0.35%	0	0.00%	57,435,171	0.45%	120,108,849	0.38%
32955	35,308,391	0.53%	61,991,939	0.52%	0	0.00%	84,722,522	0.67%	182,022,852	0.57%
32958	0	0.00%	59,372,634	0.50%	0	0.00%	73,492,734	0.58%	132,865,426	0.42%
32960	0	0.00%	44,642,585	0.37%	0	0.00%	52,053,860	0.41%	96,696,552	0.30%
32962	0	0.00%	50,653,877	0.42%	0	0.00%	57,917,426	0.46%	108,571,529	0.34%
32963	0	0.00%	169,701,216	1.42%	0	0.00%	364,413,103	2.88%	534,114,961	1.67%
32966	0	0.00%	30,846,352	0.26%	0	0.00%	44,365,429	0.35%	75,211,842	0.24%
32967	0	0.00%	37,849,200	0.32%	0	0.00%	47,482,956	0.38%	85,332,312	0.27%
32968	0	0.00%	30,114,766	0.25%	0	0.00%	32,358,012	0.26%	62,472,778	0.20%
32976	0	0.00%	25,882,526	0.22%	0	0.00%	76,979,790	0.61%	102,862,318	0.32%
33060	0	0.00%	5,444,254	0.05%	0	0.00%	0	0.00%	5,444,781	0.02%
33062	0	0.00%	37,719,000	0.32%	0	0.00%	0	0.00%	37,724,438	0.12%
33064	0	0.00%	9,573,711	0.08%	0	0.00%	0	0.00%	9,575,746	0.03%
33067	0	0.00%	2,821,584	0.02%	0	0.00%	0	0.00%	2,822,353	0.01%
33069	0	0.00%	20,081,873	0.17%	0	0.00%	0	0.00%	20,084,093	0.06%
33073	0	0.00%	4,299,926	0.04%	0	0.00%	0	0.00%	4,300,056	0.01%
33076	0	0.00%	2,116,099	0.02%	0	0.00%	0	0.00%	2,116,394	0.01%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33401	0	0.00%	75,120,478	0.63%	0	0.00%	55,700,354	0.44%	130,821,057	0.41%
33403	0	0.00%	19,470,133	0.16%	0	0.00%	14,193,294	0.11%	33,663,454	0.11%
33404	0	0.00%	71,606,559	0.60%	0	0.00%	52,773,076	0.42%	124,380,120	0.39%
33405	0	0.00%	34,196,834	0.29%	0	0.00%	18,190,255	0.14%	52,387,096	0.16%
33406	0	0.00%	35,110,965	0.29%	0	0.00%	21,832,774	0.17%	56,943,779	0.18%
33407	0	0.00%	41,099,507	0.34%	0	0.00%	29,950,660	0.24%	71,050,800	0.22%
33408	0	0.00%	100,747,677	0.84%	0	0.00%	80,207,280	0.63%	180,955,489	0.57%
33409	0	0.00%	38,383,126	0.32%	0	0.00%	25,699,664	0.20%	64,082,954	0.20%
33410	0	0.00%	109,881,070	0.92%	0	0.00%	96,602,344	0.76%	206,483,546	0.65%
33411	0	0.00%	135,911,660	1.14%	0	0.00%	91,439,263	0.72%	227,351,169	0.71%
33412	0	0.00%	52,361,818	0.44%	0	0.00%	46,345,464	0.37%	98,707,303	0.31%
33413	0	0.00%	21,201,232	0.18%	0	0.00%	14,151,687	0.11%	35,352,935	0.11%
33414	0	0.00%	128,392,469	1.07%	0	0.00%	100,213,911	0.79%	228,606,488	0.71%
33415	0	0.00%	43,843,451	0.37%	0	0.00%	34,008,552	0.27%	77,852,208	0.24%
33417	0	0.00%	51,636,466	0.43%	0	0.00%	34,190,270	0.27%	85,826,952	0.27%
33418	0	0.00%	187,250,907	1.57%	0	0.00%	152,093,171	1.20%	339,344,243	1.06%
33426	0	0.00%	29,394,246	0.25%	0	0.00%	15,878,406	0.13%	45,272,712	0.14%
33428	0	0.00%	38,834,828	0.32%	0	0.00%	0	0.00%	38,835,421	0.12%
33430	0	0.00%	5,172,348	0.04%	0	0.00%	5,180,517	0.04%	10,352,875	0.03%
33431	0	0.00%	29,046,040	0.24%	0	0.00%	0	0.00%	29,047,961	0.09%
33432	0	0.00%	51,236,449	0.43%	0	0.00%	0	0.00%	51,240,554	0.16%
33433	0	0.00%	57,360,044	0.48%	0	0.00%	0	0.00%	57,362,085	0.18%
33434	0	0.00%	42,298,425	0.35%	0	0.00%	0	0.00%	42,300,737	0.13%
33435	0	0.00%	54,765,365	0.46%	0	0.00%	32,184,135	0.25%	86,949,885	0.27%
33436	0	0.00%	86,968,987	0.73%	0	0.00%	48,178,981	0.38%	135,148,266	0.42%
33437	0	0.00%	84,591,629	0.71%	0	0.00%	62,639,319	0.49%	147,231,282	0.46%
33438	0	0.00%	1,147,885	0.01%	0	0.00%	980,150	0.01%	2,128,035	0.01%
33440	0	0.00%	8,298,433	0.07%	0	0.00%	8,318,909	0.07%	16,617,343	0.05%
33441	0	0.00%	19,899,142	0.17%	0	0.00%	0	0.00%	19,901,796	0.06%
33442	0	0.00%	29,288,619	0.25%	0	0.00%	0	0.00%	29,291,320	0.09%
33444	0	0.00%	22,074,128	0.18%	0	0.00%	5,272,424	0.04%	27,346,737	0.09%
33445	0	0.00%	52,954,955	0.44%	0	0.00%	15,517,001	0.12%	68,472,158	0.21%
33446	0	0.00%	70,487,730	0.59%	0	0.00%	54,097,374	0.43%	124,585,478	0.39%
33449	0	0.00%	21,247,103	0.18%	0	0.00%	17,428,232	0.14%	38,675,335	0.12%
33455	0	0.00%	88,362,723	0.74%	0	0.00%	80,509,607	0.64%	168,872,395	0.53%
33458	0	0.00%	143,728,308	1.20%	0	0.00%	116,729,063	0.92%	260,457,498	0.81%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33460	0	0.00%	32,893,485	0.28%	0	0.00%	20,384,838	0.16%	53,278,399	0.17%
33461	0	0.00%	36,849,909	0.31%	0	0.00%	20,617,201	0.16%	57,467,322	0.18%
33462	0	0.00%	52,594,949	0.44%	0	0.00%	28,942,426	0.23%	81,537,561	0.25%
33463	0	0.00%	65,738,842	0.55%	0	0.00%	37,009,689	0.29%	102,748,694	0.32%
33467	0	0.00%	111,450,761	0.93%	0	0.00%	88,421,113	0.70%	199,872,192	0.62%
33468	0	0.00%	1,112,704	0.01%	0	0.00%	865,465	0.01%	1,978,168	0.01%
33469	0	0.00%	74,792,048	0.63%	0	0.00%	68,507,950	0.54%	143,300,081	0.45%
33470	0	0.00%	50,396,242	0.42%	0	0.00%	42,403,169	0.33%	92,799,411	0.29%
33471	0	0.00%	4,011,977	0.03%	0	0.00%	4,022,362	0.03%	8,034,338	0.03%
33472	0	0.00%	35,079,146	0.29%	0	0.00%	19,006,274	0.15%	54,085,420	0.17%
33473	0	0.00%	10,033,883	0.08%	0	0.00%	8,611,642	0.07%	18,645,526	0.06%
33476	0	0.00%	3,867,408	0.03%	0	0.00%	3,122,800	0.02%	6,990,211	0.02%
33477	0	0.00%	104,146,859	0.87%	0	0.00%	94,210,637	0.74%	198,357,847	0.62%
33478	0	0.00%	43,159,360	0.36%	0	0.00%	40,057,878	0.32%	83,217,238	0.26%
33480	0	0.00%	232,348,728	1.94%	0	0.00%	155,961,211	1.23%	388,310,736	1.21%
33483	0	0.00%	45,345,033	0.38%	0	0.00%	15,170,154	0.12%	60,515,731	0.19%
33484	0	0.00%	55,301,202	0.46%	0	0.00%	19,223,901	0.15%	74,525,413	0.23%
33486	0	0.00%	24,205,796	0.20%	0	0.00%	0	0.00%	24,206,186	0.08%
33487	0	0.00%	63,082,814	0.53%	0	0.00%	23,377,232	0.18%	86,460,426	0.27%
33493	0	0.00%	994,789	0.01%	0	0.00%	996,668	0.01%	1,991,457	0.01%
33496	0	0.00%	58,769,830	0.49%	0	0.00%	8,798,562	0.07%	67,568,393	0.21%
33498	0	0.00%	21,913,632	0.18%	0	0.00%	0	0.00%	22,344,754	0.07%
33510	0	0.00%	1,448,763	0.01%	0	0.00%	18,401,177	0.15%	19,849,940	0.06%
33511	0	0.00%	1,820,310	0.02%	0	0.00%	33,520,731	0.26%	35,341,041	0.11%
33513	0	0.00%	7,053,919	0.06%	0	0.00%	7,072,123	0.06%	14,126,042	0.04%
33514	0	0.00%	961,167	0.01%	0	0.00%	1,250,653	0.01%	2,211,821	0.01%
33521	0	0.00%	0	0.00%	0	0.00%	0	0.00%	723,815	0.00%
33523	0	0.00%	12,198,912	0.10%	0	0.00%	12,230,159	0.10%	24,429,071	0.08%
33525	0	0.00%	12,495,991	0.10%	0	0.00%	17,080,228	0.13%	29,576,219	0.09%
33527	0	0.00%	8,118,784	0.07%	0	0.00%	11,316,350	0.09%	19,435,133	0.06%
33534	0	0.00%	0	0.00%	0	0.00%	5,631,515	0.04%	5,775,532	0.02%
33538	0	0.00%	4,790,855	0.04%	0	0.00%	4,802,854	0.04%	9,593,708	0.03%
33540	0	0.00%	3,992,261	0.03%	0	0.00%	6,155,640	0.05%	10,147,900	0.03%
33541	0	0.00%	10,233,153	0.09%	0	0.00%	15,040,723	0.12%	25,273,889	0.08%
33542	0	0.00%	9,841,076	0.08%	0	0.00%	15,260,839	0.12%	25,101,914	0.08%
33543	0	0.00%	22,249,553	0.19%	0	0.00%	29,226,425	0.23%	51,475,978	0.16%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percen t of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33544	0	0.00%	20,261,453	0.17%	0	0.00%	25,350,814	0.20%	45,612,267	0.14%
33545	0	0.00%	9,804,934	0.08%	0	0.00%	11,560,735	0.09%	21,365,669	0.07%
33547	0	0.00%	0	0.00%	0	0.00%	21,143,366	0.17%	21,466,624	0.07%
33548	0	0.00%	7,239,481	0.06%	0	0.00%	7,258,252	0.06%	14,497,733	0.05%
33549	0	0.00%	16,219,762	0.14%	0	0.00%	16,258,594	0.13%	32,478,356	0.10%
33556	0	0.00%	31,864,534	0.27%	0	0.00%	31,942,687	0.25%	63,807,222	0.20%
33558	0	0.00%	21,761,642	0.18%	0	0.00%	21,809,738	0.17%	43,571,380	0.14%
33559	0	0.00%	10,247,125	0.09%	0	0.00%	10,269,875	0.08%	20,517,001	0.06%
33563	0	0.00%	0	0.00%	0	0.00%	14,908,953	0.12%	15,371,424	0.05%
33565	0	0.00%	9,102,325	0.08%	0	0.00%	18,220,021	0.14%	27,322,346	0.09%
33566	0	0.00%	12,336,237	0.10%	0	0.00%	19,047,361	0.15%	31,383,604	0.10%
33567	0	0.00%	5,419,825	0.05%	0	0.00%	7,620,182	0.06%	13,040,006	0.04%
33569	0	0.00%	617,336	0.01%	0	0.00%	26,292,715	0.21%	26,910,057	0.08%
33570	0	0.00%	0	0.00%	0	0.00%	11,666,492	0.09%	11,959,967	0.04%
33572	0	0.00%	1,062,257	0.01%	0	0.00%	20,937,840	0.17%	22,000,097	0.07%
33573	0	0.00%	10,686,097	0.09%	0	0.00%	31,072,646	0.25%	41,758,805	0.13%
33576	0	0.00%	5,714,098	0.05%	0	0.00%	5,728,765	0.05%	11,442,863	0.04%
33578	0	0.00%	5,631,081	0.05%	0	0.00%	23,661,277	0.19%	29,292,384	0.09%
33579	0	0.00%	752,022	0.01%	0	0.00%	16,219,821	0.13%	16,971,848	0.05%
33584	0	0.00%	0	0.00%	0	0.00%	16,267,187	0.13%	16,502,937	0.05%
33585	0	0.00%	1,026,213	0.01%	0	0.00%	1,028,849	0.01%	2,055,062	0.01%
33592	0	0.00%	5,460,019	0.05%	0	0.00%	5,473,460	0.04%	10,933,479	0.03%
33594	0	0.00%	1,203,482	0.01%	0	0.00%	31,253,116	0.25%	32,456,598	0.10%
33596	0	0.00%	0	0.00%	0	0.00%	27,417,348	0.22%	27,818,893	0.09%
33597	0	0.00%	4,454,152	0.04%	0	0.00%	4,465,648	0.04%	8,919,800	0.03%
33598	0	0.00%	0	0.00%	0	0.00%	5,911,078	0.05%	6,231,622	0.02%
33601	0	0.00%	0	0.00%	0	0.00%	0	0.00%	618,417	0.00%
33602	0	0.00%	17,497,360	0.15%	0	0.00%	9,462,226	0.07%	26,959,586	0.08%
33604	0	0.00%	859,512	0.01%	0	0.00%	856,080	0.01%	1,715,592	0.01%
33605	0	0.00%	1,069,096	0.01%	0	0.00%	1,063,022	0.01%	2,132,118	0.01%
33606	0	0.00%	19,264,007	0.16%	0	0.00%	2,265,037	0.02%	21,529,043	0.07%
33607	0	0.00%	1,113,277	0.01%	0	0.00%	1,107,264	0.01%	2,220,541	0.01%
33609	0	0.00%	3,574,275	0.03%	0	0.00%	3,554,867	0.03%	7,129,142	0.02%
33610	0	0.00%	0	0.00%	0	0.00%	11,842,970	0.09%	12,309,606	0.04%
33611	0	0.00%	26,965,565	0.23%	0	0.00%	3,836,848	0.03%	30,802,414	0.10%
33612	0	0.00%	1,883,040	0.02%	0	0.00%	15,813,975	0.12%	17,697,014	0.06%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percen t of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33613	0	0.00%	17,512,351	0.15%	0	0.00%	17,528,831	0.14%	35,041,183	0.11%
33614	0	0.00%	3,242,314	0.03%	0	0.00%	3,223,719	0.03%	6,466,033	0.02%
33615	0	0.00%	25,617,179	0.21%	0	0.00%	3,757,401	0.03%	29,374,580	0.09%
33616	0	0.00%	7,960,488	0.07%	0	0.00%	1,442,599	0.01%	9,403,087	0.03%
33617	0	0.00%	3,531,245	0.03%	0	0.00%	22,199,281	0.18%	25,730,526	0.08%
33618	0	0.00%	25,518,339	0.21%	0	0.00%	25,550,906	0.20%	51,069,245	0.16%
33619	0	0.00%	609,720	0.01%	0	0.00%	10,741,678	0.08%	11,351,398	0.04%
33624	0	0.00%	29,849,218	0.25%	0	0.00%	29,913,780	0.24%	59,762,997	0.19%
33625	0	0.00%	16,470,842	0.14%	0	0.00%	16,508,910	0.13%	32,979,752	0.10%
33626	0	0.00%	29,251,017	0.24%	0	0.00%	1,373,940	0.01%	30,624,957	0.10%
33629	0	0.00%	37,157,313	0.31%	0	0.00%	3,036,384	0.02%	40,193,697	0.13%
33634	0	0.00%	10,602,121	0.09%	0	0.00%	887,924	0.01%	11,490,045	0.04%
33635	0	0.00%	8,685,601	0.07%	0	0.00%	639,997	0.01%	9,325,598	0.03%
33637	0	0.00%	1,538,477	0.01%	0	0.00%	7,042,636	0.06%	8,581,113	0.03%
33647	0	0.00%	58,626,692	0.49%	0	0.00%	78,845,329	0.62%	137,472,021	0.43%
33701	0	0.00%	14,687,518	0.12%	0	0.00%	0	0.00%	14,688,299	0.05%
33702	0	0.00%	6,425,887	0.05%	0	0.00%	0	0.00%	6,427,547	0.02%
33703	0	0.00%	23,565,421	0.20%	0	0.00%	0	0.00%	23,565,703	0.07%
33704	0	0.00%	18,469,080	0.15%	0	0.00%	0	0.00%	18,470,223	0.06%
33705	0	0.00%	15,616,639	0.13%	0	0.00%	0	0.00%	15,616,883	0.05%
33706	0	0.00%	67,217,615	0.56%	0	0.00%	0	0.00%	67,219,272	0.21%
33707	0	0.00%	45,525,780	0.38%	0	0.00%	0	0.00%	45,527,385	0.14%
33708	0	0.00%	68,240,398	0.57%	0	0.00%	0	0.00%	68,242,616	0.21%
33709	0	0.00%	17,447,548	0.15%	0	0.00%	0	0.00%	17,448,021	0.05%
33710	0	0.00%	24,867,861	0.21%	0	0.00%	0	0.00%	24,867,913	0.08%
33711	0	0.00%	13,726,286	0.11%	0	0.00%	0	0.00%	13,726,664	0.04%
33712	0	0.00%	11,471,154	0.10%	0	0.00%	0	0.00%	11,471,323	0.04%
33713	0	0.00%	16,993,999	0.14%	0	0.00%	0	0.00%	16,994,062	0.05%
33714	0	0.00%	8,273,408	0.07%	0	0.00%	0	0.00%	8,273,674	0.03%
33715	0	0.00%	40,075,867	0.34%	0	0.00%	18,331,002	0.14%	58,406,870	0.18%
33716	0	0.00%	5,709,248	0.05%	0	0.00%	0	0.00%	5,709,847	0.02%
33755	0	0.00%	16,064,961	0.13%	0	0.00%	2,963,837	0.02%	19,028,798	0.06%
33756	0	0.00%	29,123,891	0.24%	0	0.00%	7,686,370	0.06%	36,810,261	0.12%
33759	0	0.00%	12,061,883	0.10%	0	0.00%	0	0.00%	12,062,312	0.04%
33760	0	0.00%	9,618,196	0.08%	0	0.00%	0	0.00%	9,618,683	0.03%
33761	0	0.00%	21,388,298	0.18%	0	0.00%	6,583,657	0.05%	27,971,955	0.09%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33762	0	0.00%	8,684,286	0.07%	0	0.00%	0	0.00%	8,684,501	0.03%
33763	0	0.00%	1,627,647	0.01%	0	0.00%	0	0.00%	1,627,878	0.01%
33764	0	0.00%	21,645,073	0.18%	0	0.00%	0	0.00%	21,645,849	0.07%
33765	0	0.00%	8,061,128	0.07%	0	0.00%	0	0.00%	8,061,301	0.03%
33767	0	0.00%	48,324,191	0.40%	0	0.00%	29,266,649	0.23%	77,590,840	0.24%
33770	0	0.00%	18,927,998	0.16%	0	0.00%	3,161,612	0.03%	22,089,610	0.07%
33771	0	0.00%	14,502,204	0.12%	0	0.00%	0	0.00%	14,503,936	0.05%
33772	0	0.00%	32,507,345	0.27%	0	0.00%	0	0.00%	32,508,018	0.10%
33773	0	0.00%	11,938,824	0.10%	0	0.00%	0	0.00%	11,938,899	0.04%
33774	0	0.00%	29,053,569	0.24%	0	0.00%	5,398,520	0.04%	34,452,090	0.11%
33776	0	0.00%	32,405,920	0.27%	0	0.00%	1,083,326	0.01%	33,489,247	0.10%
33777	0	0.00%	27,531,890	0.23%	0	0.00%	0	0.00%	27,532,936	0.09%
33778	0	0.00%	16,015,278	0.13%	0	0.00%	0	0.00%	16,015,583	0.05%
33781	0	0.00%	12,406,105	0.10%	0	0.00%	0	0.00%	12,406,626	0.04%
33782	0	0.00%	15,003,808	0.13%	0	0.00%	0	0.00%	15,004,294	0.05%
33785	0	0.00%	32,272,090	0.27%	0	0.00%	21,465,202	0.17%	53,737,292	0.17%
33786	0	0.00%	9,471,135	0.08%	0	0.00%	7,174,669	0.06%	16,645,804	0.05%
33801	0	0.00%	2,063,658	0.02%	0	0.00%	28,271,712	0.22%	30,335,459	0.09%
33803	0	0.00%	2,264,669	0.02%	0	0.00%	42,779,840	0.34%	45,044,546	0.14%
33805	0	0.00%	560,204	0.00%	0	0.00%	15,776,698	0.12%	16,336,902	0.05%
33809	0	0.00%	19,177,910	0.16%	0	0.00%	37,124,175	0.29%	56,302,091	0.18%
33810	0	0.00%	27,910,026	0.23%	0	0.00%	49,409,139	0.39%	77,319,164	0.24%
33811	0	0.00%	618,898	0.01%	0	0.00%	28,083,159	0.22%	28,702,057	0.09%
33812	0	0.00%	519,496	0.00%	0	0.00%	18,182,106	0.14%	18,701,602	0.06%
33813	0	0.00%	1,113,339	0.01%	0	0.00%	68,309,116	0.54%	69,422,510	0.22%
33815	0	0.00%	0	0.00%	0	0.00%	5,154,378	0.04%	5,296,047	0.02%
33820	0	0.00%	0	0.00%	0	0.00%	0	0.00%	692,954	0.00%
33823	16,904,128	0.25%	0	0.00%	0	0.00%	31,565,277	0.25%	48,819,522	0.15%
33825	40,552,321	0.60%	12,974,243	0.11%	0	0.00%	31,131,713	0.25%	84,658,277	0.26%
33827	8,000,791	0.12%	3,648,235	0.03%	0	0.00%	5,775,875	0.05%	17,424,900	0.05%
33830	20,252,783	0.30%	674,334	0.01%	0	0.00%	26,795,235	0.21%	47,722,352	0.15%
33834	4,273,785	0.06%	0	0.00%	0	0.00%	2,746,698	0.02%	7,047,386	0.02%
33837	33,749,874	0.50%	17,635,571	0.15%	0	0.00%	28,552,310	0.23%	79,937,756	0.25%
33838	5,131,164	0.08%	1,801,376	0.02%	0	0.00%	3,994,188	0.03%	10,926,728	0.03%
33839	3,155,855	0.05%	1,775,383	0.01%	0	0.00%	3,192,705	0.03%	8,123,943	0.03%
33841	10,072,426	0.15%	0	0.00%	0	0.00%	6,482,427	0.05%	16,613,155	0.05%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percen t of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33843	19,594,400	0.29%	4,373,857	0.04%	0	0.00%	10,641,804	0.08%	34,610,061	0.11%
33844	41,310,948	0.62%	18,174,204	0.15%	0	0.00%	41,790,743	0.33%	101,275,896	0.32%
33847	0	0.00%	0	0.00%	0	0.00%	0	0.00%	622,420	0.00%
33848	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1,035,669	0.00%
33849	0	0.00%	0	0.00%	0	0.00%	622,708	0.00%	954,772	0.00%
33850	5,713,606	0.09%	0	0.00%	0	0.00%	7,572,335	0.06%	13,357,754	0.04%
33851	1,406,888	0.02%	550,581	0.00%	0	0.00%	1,247,437	0.01%	3,204,906	0.01%
33852	27,469,409	0.41%	27,719,169	0.23%	0	0.00%	43,481,781	0.34%	98,670,360	0.31%
33853	21,907,871	0.33%	6,397,562	0.05%	0	0.00%	15,306,100	0.12%	43,611,533	0.14%
33854	1,136,019	0.02%	637,702	0.01%	0	0.00%	893,354	0.01%	2,667,075	0.01%
33855	2,449,845	0.04%	1,561,314	0.01%	0	0.00%	2,826,754	0.02%	6,837,913	0.02%
33857	959,733	0.01%	1,900,063	0.02%	0	0.00%	2,725,222	0.02%	5,585,019	0.02%
33859	23,344,664	0.35%	6,284,328	0.05%	0	0.00%	12,670,574	0.10%	42,299,566	0.13%
33860	0	0.00%	0	0.00%	0	0.00%	15,484,669	0.12%	15,687,866	0.05%
33865	1,092,752	0.02%	0	0.00%	0	0.00%	506,926	0.00%	1,606,863	0.01%
33867	0	0.00%	0	0.00%	0	0.00%	0	0.00%	619,201	0.00%
33868	0	0.00%	4,669,763	0.04%	0	0.00%	8,855,023	0.07%	13,524,786	0.04%
33870	29,269,980	0.44%	12,674,840	0.11%	0	0.00%	29,594,058	0.23%	71,538,877	0.22%
33872	27,778,017	0.41%	12,876,121	0.11%	0	0.00%	28,094,272	0.22%	68,748,410	0.21%
33873	16,330,646	0.24%	0	0.00%	0	0.00%	9,928,853	0.08%	26,358,983	0.08%
33875	17,304,019	0.26%	9,414,651	0.08%	0	0.00%	21,120,194	0.17%	47,838,865	0.15%
33876	8,538,245	0.13%	6,609,387	0.06%	0	0.00%	12,126,026	0.10%	27,273,659	0.09%
33877	521,868	0.01%	0	0.00%	0	0.00%	0	0.00%	1,091,399	0.00%
33880	27,549,808	0.41%	1,198,100	0.01%	0	0.00%	36,320,761	0.29%	65,068,669	0.20%
33881	33,569,348	0.50%	17,577,357	0.15%	0	0.00%	41,248,996	0.33%	92,395,702	0.29%
33884	72,444,359	1.08%	29,338,514	0.25%	0	0.00%	63,798,779	0.50%	165,581,652	0.52%
33890	9,978,561	0.15%	0	0.00%	0	0.00%	3,468,067	0.03%	13,482,072	0.04%
33896	16,193,883	0.24%	3,066,380	0.03%	0	0.00%	16,347,717	0.13%	35,607,980	0.11%
33897	985,780	0.01%	0	0.00%	0	0.00%	25,165,139	0.20%	26,151,038	0.08%
33898	41,506,180	0.62%	10,087,498	0.08%	0	0.00%	24,413,837	0.19%	76,007,515	0.24%
33901	28,408,465	0.42%	0	0.00%	0	0.00%	0	0.00%	28,408,563	0.09%
33903	59,241,480	0.88%	0	0.00%	0	0.00%	0	0.00%	59,241,628	0.19%
33904	104,271,432	1.55%	0	0.00%	0	0.00%	0	0.00%	104,271,661	0.33%
33905	30,996,447	0.46%	0	0.00%	0	0.00%	0	0.00%	30,996,472	0.10%
33907	28,609,114	0.43%	0	0.00%	0	0.00%	0	0.00%	28,609,373	0.09%
33908	123,237,916	1.84%	0	0.00%	0	0.00%	0	0.00%	123,238,646	0.39%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
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33909	41,164,679	0.61%	0	0.00%	0	0.00%	0	0.00%	41,164,742	0.13%
33912	50,036,165	0.75%	0	0.00%	0	0.00%	0	0.00%	50,036,245	0.16%
33913	35,656,051	0.53%	0	0.00%	0	0.00%	0	0.00%	35,656,254	0.11%
33914	122,266,054	1.82%	0	0.00%	0	0.00%	0	0.00%	122,266,375	0.38%
33916	15,726,012	0.23%	0	0.00%	0	0.00%	0	0.00%	15,727,138	0.05%
33917	51,925,933	0.77%	0	0.00%	0	0.00%	0	0.00%	51,926,374	0.16%
33919	85,253,468	1.27%	0	0.00%	0	0.00%	0	0.00%	85,254,492	0.27%
33920	6,762,503	0.10%	0	0.00%	0	0.00%	0	0.00%	7,054,452	0.02%
33921	49,578,965	0.74%	17,748,779	0.15%	0	0.00%	17,767,330	0.14%	85,095,074	0.27%
33922	19,999,267	0.30%	0	0.00%	0	0.00%	0	0.00%	19,999,267	0.06%
33924	50,831,679	0.76%	9,541,449	0.08%	0	0.00%	7,603,391	0.06%	67,976,519	0.21%
33928	40,939,766	0.61%	0	0.00%	0	0.00%	0	0.00%	40,940,290	0.13%
33931	55,979,513	0.83%	12,960,512	0.11%	0	0.00%	0	0.00%	68,940,141	0.22%
33935	0	0.00%	0	0.00%	0	0.00%	6,714,477	0.05%	6,819,963	0.02%
33936	14,514,047	0.22%	0	0.00%	0	0.00%	0	0.00%	14,514,156	0.05%
33946	16,824,722	0.25%	2,707,297	0.02%	0	0.00%	8,850,335	0.07%	28,382,353	0.09%
33947	25,934,253	0.39%	0	0.00%	0	0.00%	1,090,576	0.01%	27,024,891	0.08%
33948	49,044,751	0.73%	0	0.00%	0	0.00%	0	0.00%	49,044,928	0.15%
33950	130,738,679	1.95%	0	0.00%	0	0.00%	7,961,317	0.06%	138,700,426	0.43%
33952	77,892,194	1.16%	0	0.00%	0	0.00%	0	0.00%	77,892,426	0.24%
33953	15,633,836	0.23%	0	0.00%	0	0.00%	0	0.00%	15,634,002	0.05%
33954	26,771,495	0.40%	0	0.00%	0	0.00%	0	0.00%	26,902,263	0.08%
33955	61,527,670	0.92%	0	0.00%	0	0.00%	0	0.00%	61,528,044	0.19%
33956	27,359,970	0.41%	0	0.00%	0	0.00%	0	0.00%	27,475,825	0.09%
33957	110,088,146	1.64%	10,796,630	0.09%	0	0.00%	0	0.00%	120,885,027	0.38%
33960	0	0.00%	538,134	0.00%	0	0.00%	685,079	0.01%	1,606,449	0.01%
33966	17,648,532	0.26%	0	0.00%	0	0.00%	0	0.00%	17,648,680	0.06%
33967	24,533,977	0.37%	0	0.00%	0	0.00%	0	0.00%	24,533,977	0.08%
33971	17,831,357	0.27%	0	0.00%	0	0.00%	0	0.00%	17,831,417	0.06%
33972	8,712,274	0.13%	0	0.00%	0	0.00%	0	0.00%	9,099,686	0.03%
33973	4,112,810	0.06%	0	0.00%	0	0.00%	0	0.00%	4,112,810	0.01%
33974	7,623,656	0.11%	0	0.00%	0	0.00%	0	0.00%	7,623,656	0.02%
33976	7,052,579	0.11%	0	0.00%	0	0.00%	0	0.00%	7,052,579	0.02%
33980	40,423,960	0.60%	0	0.00%	0	0.00%	0	0.00%	40,424,432	0.13%
33981	22,819,215	0.34%	0	0.00%	0	0.00%	0	0.00%	22,819,246	0.07%
33982	32,847,483	0.49%	0	0.00%	0	0.00%	6,932,617	0.05%	39,780,100	0.12%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
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33983	57,150,867	0.85%	0	0.00%	0	0.00%	2,064,948	0.02%	59,216,037	0.19%
33990	66,698,253	0.99%	0	0.00%	0	0.00%	0	0.00%	66,698,256	0.21%
33991	45,422,077	0.68%	0	0.00%	0	0.00%	0	0.00%	45,422,077	0.14%
33993	40,823,399	0.61%	0	0.00%	0	0.00%	0	0.00%	40,823,399	0.13%
34102	0	0.00%	40,942,506	0.34%	0	0.00%	0	0.00%	40,946,214	0.13%
34103	0	0.00%	45,472,225	0.38%	0	0.00%	22,554,469	0.18%	68,028,736	0.21%
34105	0	0.00%	8,904,902	0.07%	0	0.00%	0	0.00%	8,908,287	0.03%
34108	0	0.00%	60,725,649	0.51%	0	0.00%	0	0.00%	60,735,829	0.19%
34109	0	0.00%	9,097,585	0.08%	0	0.00%	0	0.00%	9,102,933	0.03%
34110	15,379,457	0.23%	15,535,962	0.13%	0	0.00%	0	0.00%	30,916,816	0.10%
34134	59,117,253	0.88%	59,684,149	0.50%	0	0.00%	0	0.00%	118,801,511	0.37%
34135	11,897,004	0.18%	0	0.00%	0	0.00%	0	0.00%	11,897,545	0.04%
34145	0	0.00%	65,283,609	0.55%	0	0.00%	0	0.00%	65,295,606	0.20%
34202	0	0.00%	0	0.00%	0	0.00%	3,945,157	0.03%	3,945,420	0.01%
34205	0	0.00%	4,984,912	0.04%	0	0.00%	0	0.00%	4,985,437	0.02%
34207	0	0.00%	14,682,161	0.12%	0	0.00%	0	0.00%	14,682,421	0.05%
34208	0	0.00%	0	0.00%	0	0.00%	652,756	0.01%	652,756	0.00%
34209	0	0.00%	9,407,804	0.08%	0	0.00%	0	0.00%	9,408,667	0.03%
34210	0	0.00%	19,957,616	0.17%	0	0.00%	0	0.00%	19,958,532	0.06%
34212	0	0.00%	0	0.00%	0	0.00%	1,621,215	0.01%	1,621,286	0.01%
34215	0	0.00%	2,169,365	0.02%	0	0.00%	1,699,784	0.01%	3,869,162	0.01%
34216	0	0.00%	5,021,021	0.04%	0	0.00%	0	0.00%	5,134,709	0.02%
34217	0	0.00%	29,562,231	0.25%	0	0.00%	5,032,340	0.04%	34,594,783	0.11%
34218	0	0.00%	0	0.00%	0	0.00%	0	0.00%	598,527	0.00%
34219	0	0.00%	0	0.00%	0	0.00%	20,949,265	0.17%	21,335,971	0.07%
34221	0	0.00%	3,074,325	0.03%	0	0.00%	3,058,132	0.02%	6,132,469	0.02%
34223	33,836,994	0.50%	5,093,913	0.04%	0	0.00%	0	0.00%	38,931,316	0.12%
34224	35,704,622	0.53%	0	0.00%	0	0.00%	2,240,100	0.02%	37,944,796	0.12%
34228	0	0.00%	94,548,521	0.79%	0	0.00%	29,869,977	0.24%	124,419,931	0.39%
34229	0	0.00%	16,913,913	0.14%	0	0.00%	0	0.00%	16,914,789	0.05%
34231	0	0.00%	37,339,433	0.31%	0	0.00%	0	0.00%	37,341,015	0.12%
34234	0	0.00%	1,637,950	0.01%	0	0.00%	0	0.00%	1,638,392	0.01%
34236	0	0.00%	35,993,728	0.30%	0	0.00%	0	0.00%	35,997,410	0.11%
34238	0	0.00%	6,443,422	0.05%	0	0.00%	0	0.00%	6,444,707	0.02%
34239	0	0.00%	1,530,006	0.01%	0	0.00%	0	0.00%	1,530,130	0.00%
34242	0	0.00%	47,404,958	0.40%	0	0.00%	0	0.00%	47,407,726	0.15%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percen t of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
34251	0	0.00%	0	0.00%	0	0.00%	5,079,380	0.04%	5,079,380	0.02%
34266	54,104,879	0.81%	0	0.00%	0	0.00%	14,784,080	0.12%	68,888,958	0.22%
34269	18,872,669	0.28%	0	0.00%	0	0.00%	4,173,376	0.03%	23,046,044	0.07%
34275	0	0.00%	2,397,242	0.02%	0	0.00%	0	0.00%	2,397,641	0.01%
34285	8,728,853	0.13%	8,817,244	0.07%	0	0.00%	0	0.00%	17,546,748	0.05%
34286	30,003,246	0.45%	0	0.00%	0	0.00%	0	0.00%	30,208,677	0.09%
34287	29,026,370	0.43%	0	0.00%	0	0.00%	0	0.00%	29,027,115	0.09%
34288	21,160,470	0.32%	0	0.00%	0	0.00%	0	0.00%	21,552,682	0.07%
34289	3,386,470	0.05%	0	0.00%	0	0.00%	0	0.00%	3,780,255	0.01%
34291	5,880,523	0.09%	0	0.00%	0	0.00%	0	0.00%	5,880,523	0.02%
34293	39,899,886	0.59%	0	0.00%	0	0.00%	0	0.00%	39,902,586	0.12%
34420	0	0.00%	8,617,698	0.07%	0	0.00%	10,984,573	0.09%	19,602,271	0.06%
34428	0	0.00%	11,539,338	0.10%	0	0.00%	6,350,816	0.05%	17,890,154	0.06%
34429	0	0.00%	12,182,893	0.10%	0	0.00%	12,204,866	0.10%	24,387,760	0.08%
34431	0	0.00%	9,956,104	0.08%	0	0.00%	8,294,329	0.07%	18,250,433	0.06%
34432	0	0.00%	13,834,710	0.12%	0	0.00%	13,869,665	0.11%	27,704,375	0.09%
34433	0	0.00%	8,061,266	0.07%	0	0.00%	6,443,410	0.05%	14,504,676	0.05%
34434	0	0.00%	11,937,644	0.10%	0	0.00%	9,631,687	0.08%	21,569,331	0.07%
34436	0	0.00%	7,085,677	0.06%	0	0.00%	7,103,694	0.06%	14,189,371	0.04%
34442	0	0.00%	26,690,799	0.22%	0	0.00%	21,345,316	0.17%	48,036,115	0.15%
34446	0	0.00%	23,441,479	0.20%	0	0.00%	16,830,018	0.13%	40,271,497	0.13%
34448	0	0.00%	13,184,116	0.11%	0	0.00%	9,990,889	0.08%	23,175,006	0.07%
34449	0	0.00%	1,953,905	0.02%	0	0.00%	1,468,049	0.01%	3,421,955	0.01%
34450	0	0.00%	13,182,663	0.11%	0	0.00%	13,210,622	0.10%	26,393,285	0.08%
34452	0	0.00%	13,074,299	0.11%	0	0.00%	13,106,261	0.10%	26,180,560	0.08%
34453	0	0.00%	13,879,603	0.12%	0	0.00%	10,889,106	0.09%	24,768,709	0.08%
34461	0	0.00%	14,048,918	0.12%	0	0.00%	14,085,053	0.11%	28,133,971	0.09%
34465	0	0.00%	24,600,895	0.21%	0	0.00%	17,467,591	0.14%	42,068,486	0.13%
34470	0	0.00%	10,580,586	0.09%	0	0.00%	10,601,215	0.08%	21,181,801	0.07%
34471	0	0.00%	21,812,926	0.18%	0	0.00%	27,456,432	0.22%	49,269,358	0.15%
34472	0	0.00%	18,165,246	0.15%	0	0.00%	22,609,557	0.18%	40,774,804	0.13%
34473	0	0.00%	15,877,661	0.13%	0	0.00%	15,918,163	0.13%	31,795,825	0.10%
34474	0	0.00%	10,713,127	0.09%	0	0.00%	10,727,158	0.08%	21,440,285	0.07%
34475	0	0.00%	3,665,713	0.03%	0	0.00%	4,576,263	0.04%	8,241,976	0.03%
34476	0	0.00%	28,051,652	0.23%	0	0.00%	28,123,328	0.22%	56,174,980	0.18%
34479	0	0.00%	7,756,959	0.06%	0	0.00%	9,844,009	0.08%	17,600,968	0.06%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percen t of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
34480	0	0.00%	15,826,959	0.13%	0	0.00%	19,627,930	0.16%	35,454,889	0.11%
34481	0	0.00%	16,650,064	0.14%	0	0.00%	16,689,194	0.13%	33,339,257	0.10%
34482	0	0.00%	18,515,492	0.15%	0	0.00%	18,561,275	0.15%	37,076,766	0.12%
34484	0	0.00%	4,020,681	0.03%	0	0.00%	4,027,251	0.03%	8,047,932	0.03%
34488	0	0.00%	0	0.00%	0	0.00%	4,144,065	0.03%	4,248,530	0.01%
34491	0	0.00%	30,326,670	0.25%	0	0.00%	30,403,363	0.24%	60,730,033	0.19%
34498	0	0.00%	690,968	0.01%	0	0.00%	0	0.00%	701,185	0.00%
34601	0	0.00%	11,563,960	0.10%	0	0.00%	11,592,933	0.09%	23,156,893	0.07%
34602	0	0.00%	7,272,468	0.06%	0	0.00%	7,291,184	0.06%	14,563,651	0.05%
34604	0	0.00%	8,482,469	0.07%	0	0.00%	6,885,926	0.05%	15,368,395	0.05%
34606	0	0.00%	32,645,336	0.27%	0	0.00%	22,625,383	0.18%	55,270,720	0.17%
34607	0	0.00%	12,072,068	0.10%	0	0.00%	8,511,164	0.07%	20,583,232	0.06%
34608	0	0.00%	36,127,354	0.30%	0	0.00%	25,778,104	0.20%	61,905,458	0.19%
34609	0	0.00%	47,239,622	0.40%	0	0.00%	35,508,449	0.28%	82,748,070	0.26%
34610	0	0.00%	9,128,646	0.08%	0	0.00%	6,568,082	0.05%	15,696,728	0.05%
34613	0	0.00%	21,827,869	0.18%	0	0.00%	15,048,744	0.12%	36,876,613	0.12%
34614	0	0.00%	5,915,100	0.05%	0	0.00%	4,998,095	0.04%	10,913,195	0.03%
34637	0	0.00%	6,819,364	0.06%	0	0.00%	6,836,771	0.05%	13,656,136	0.04%
34638	0	0.00%	20,103,044	0.17%	0	0.00%	20,155,570	0.16%	40,258,614	0.13%
34639	0	0.00%	23,388,615	0.20%	0	0.00%	23,447,093	0.19%	46,835,707	0.15%
34652	0	0.00%	19,513,655	0.16%	0	0.00%	27,294,380	0.22%	46,808,035	0.15%
34653	0	0.00%	18,641,039	0.16%	0	0.00%	18,668,967	0.15%	37,310,006	0.12%
34654	0	0.00%	23,867,269	0.20%	0	0.00%	17,572,532	0.14%	41,439,802	0.13%
34655	0	0.00%	41,848,861	0.35%	0	0.00%	41,929,532	0.33%	83,778,393	0.26%
34667	0	0.00%	35,448,274	0.30%	0	0.00%	46,086,412	0.36%	81,534,686	0.25%
34668	0	0.00%	28,013,010	0.23%	0	0.00%	40,221,220	0.32%	68,234,229	0.21%
34669	0	0.00%	10,804,246	0.09%	0	0.00%	7,962,487	0.06%	18,766,733	0.06%
34677	0	0.00%	22,873,566	0.19%	0	0.00%	4,120,671	0.03%	26,994,237	0.08%
34681	0	0.00%	1,230,340	0.01%	0	0.00%	1,233,547	0.01%	2,463,886	0.01%
34683	0	0.00%	36,715,310	0.31%	0	0.00%	36,770,582	0.29%	73,485,892	0.23%
34684	0	0.00%	25,521,813	0.21%	0	0.00%	6,112,979	0.05%	31,634,792	0.10%
34685	0	0.00%	22,840,902	0.19%	0	0.00%	22,876,269	0.18%	45,717,171	0.14%
34688	0	0.00%	13,182,566	0.11%	0	0.00%	13,201,660	0.10%	26,384,226	0.08%
34689	0	0.00%	24,488,670	0.20%	0	0.00%	24,507,168	0.19%	48,995,838	0.15%
34690	0	0.00%	7,285,187	0.06%	0	0.00%	7,304,293	0.06%	14,589,480	0.05%
34691	0	0.00%	12,847,135	0.11%	0	0.00%	17,790,336	0.14%	30,637,471	0.10%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
34695	0	0.00%	18,636,336	0.16%	0	0.00%	0	0.00%	18,637,789	0.06%
34698	0	0.00%	37,970,597	0.32%	0	0.00%	9,705,660	0.08%	47,676,258	0.15%
34705	0	0.00%	1,378,344	0.01%	0	0.00%	1,977,434	0.02%	3,355,778	0.01%
34711	0	0.00%	54,641,740	0.46%	0	0.00%	87,675,071	0.69%	142,316,825	0.44%
34714	2,012,753	0.03%	2,033,138	0.02%	0	0.00%	19,537,172	0.15%	23,583,064	0.07%
34715	0	0.00%	11,135,077	0.09%	0	0.00%	18,075,401	0.14%	29,210,478	0.09%
34731	0	0.00%	11,499,522	0.10%	0	0.00%	15,041,431	0.12%	26,540,953	0.08%
34734	4,029,521	0.06%	4,066,325	0.03%	0	0.00%	7,665,125	0.06%	15,760,972	0.05%
34736	0	0.00%	10,655,774	0.09%	0	0.00%	16,461,288	0.13%	27,117,061	0.08%
34737	0	0.00%	4,657,888	0.04%	0	0.00%	6,853,451	0.05%	11,511,338	0.04%
34739	522,897	0.01%	922,102	0.01%	0	0.00%	1,603,563	0.01%	3,048,562	0.01%
34741	35,006,803	0.52%	17,600,903	0.15%	0	0.00%	26,022,611	0.21%	78,630,317	0.25%
34743	45,551,902	0.68%	20,294,483	0.17%	0	0.00%	37,440,445	0.30%	103,286,831	0.32%
34744	66,086,476	0.98%	30,995,428	0.26%	0	0.00%	53,735,869	0.42%	150,817,773	0.47%
34746	72,691,046	1.08%	34,334,144	0.29%	0	0.00%	57,897,919	0.46%	164,923,109	0.52%
34747	50,372,200	0.75%	41,305,387	0.35%	0	0.00%	60,516,796	0.48%	152,194,382	0.48%
34748	0	0.00%	31,332,248	0.26%	0	0.00%	43,526,971	0.34%	74,859,219	0.23%
34753	0	0.00%	2,609,989	0.02%	0	0.00%	4,026,010	0.03%	6,635,999	0.02%
34756	0	0.00%	3,719,183	0.03%	0	0.00%	6,133,054	0.05%	9,852,237	0.03%
34758	49,268,236	0.73%	23,003,571	0.19%	0	0.00%	40,009,432	0.32%	112,281,239	0.35%
34759	55,119,979	0.82%	26,761,856	0.22%	0	0.00%	43,550,391	0.34%	125,432,225	0.39%
34760	0	0.00%	0	0.00%	0	0.00%	1,383,576	0.01%	1,395,917	0.00%
34761	30,163,376	0.45%	1,907,258	0.02%	0	0.00%	51,345,293	0.41%	83,415,927	0.26%
34762	0	0.00%	0	0.00%	0	0.00%	776,321	0.01%	1,193,096	0.00%
34769	29,843,626	0.44%	13,384,998	0.11%	0	0.00%	23,756,528	0.19%	66,985,152	0.21%
34771	25,132,127	0.37%	12,700,248	0.11%	0	0.00%	22,096,736	0.17%	59,929,111	0.19%
34772	38,082,963	0.57%	18,144,490	0.15%	0	0.00%	30,816,375	0.24%	87,043,829	0.27%
34773	2,562,166	0.04%	1,919,701	0.02%	0	0.00%	3,008,457	0.02%	7,490,324	0.02%
34785	0	0.00%	8,540,002	0.07%	0	0.00%	11,264,545	0.09%	19,804,547	0.06%
34786	68,788,354	1.02%	69,419,813	0.58%	0	0.00%	104,743,833	0.83%	242,951,999	0.76%
34787	2,540,521	0.04%	2,565,669	0.02%	0	0.00%	63,826,764	0.50%	68,932,954	0.22%
34788	0	0.00%	11,527,923	0.10%	0	0.00%	17,559,954	0.14%	29,087,876	0.09%
34797	0	0.00%	1,714,869	0.01%	0	0.00%	3,626,549	0.03%	5,341,418	0.02%
34945	0	0.00%	7,915,546	0.07%	0	0.00%	10,007,858	0.08%	17,923,405	0.06%
34946	0	0.00%	8,411,100	0.07%	0	0.00%	10,431,943	0.08%	18,843,043	0.06%
34947	0	0.00%	9,384,231	0.08%	0	0.00%	10,423,901	0.08%	19,808,160	0.06%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
34949	0	0.00%	74,357,141	0.62%	0	0.00%	105,882,781	0.84%	180,241,062	0.56%
34950	0	0.00%	15,787,403	0.13%	0	0.00%	18,264,360	0.14%	34,051,828	0.11%
34951	0	0.00%	34,897,632	0.29%	0	0.00%	44,588,733	0.35%	79,486,375	0.25%
34952	0	0.00%	82,235,396	0.69%	0	0.00%	92,040,776	0.73%	174,276,426	0.54%
34953	0	0.00%	100,426,311	0.84%	0	0.00%	108,500,123	0.86%	208,926,434	0.65%
34956	0	0.00%	5,189,518	0.04%	0	0.00%	5,202,570	0.04%	10,392,088	0.03%
34957	0	0.00%	74,919,104	0.63%	0	0.00%	74,828,249	0.59%	149,747,466	0.47%
34972	0	0.00%	11,714,673	0.10%	0	0.00%	16,463,462	0.13%	28,178,135	0.09%
34974	0	0.00%	32,440,569	0.27%	0	0.00%	38,672,191	0.31%	71,555,533	0.22%
34981	0	0.00%	6,684,670	0.06%	0	0.00%	6,701,616	0.05%	13,386,287	0.04%
34982	0	0.00%	49,041,369	0.41%	0	0.00%	45,423,622	0.36%	94,465,218	0.30%
34983	0	0.00%	75,550,009	0.63%	0	0.00%	81,663,005	0.64%	157,213,018	0.49%
34984	0	0.00%	32,893,760	0.28%	0	0.00%	35,541,818	0.28%	68,435,578	0.21%
34986	0	0.00%	64,401,096	0.54%	0	0.00%	69,967,264	0.55%	134,368,617	0.42%
34987	0	0.00%	13,000,596	0.11%	0	0.00%	14,087,892	0.11%	27,088,501	0.08%
34990	0	0.00%	116,746,403	0.98%	0	0.00%	116,944,623	0.92%	233,691,130	0.73%
34994	0	0.00%	41,465,236	0.35%	0	0.00%	41,398,830	0.33%	82,864,129	0.26%
34996	0	0.00%	65,911,732	0.55%	0	0.00%	60,889,897	0.48%	126,801,755	0.40%
34997	0	0.00%	113,680,757	0.95%	0	0.00%	103,560,476	0.82%	217,241,326	0.68%
Total	6,707,811,477		11,938,106,833		671,599,745		12,646,551,160		31,981,784,969	

Appendix F – Form A-3B: 2004 Hurricane Season Losses (2017 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Form A-3B: 2004 Hurricane Season Losses (2017 FHCF Exposure Data)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: November 5, 2018

Form A-3B: 2004 Hurricane Season Losses (2017 FHCF Exposure Data)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
January 31, 2019

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32024	0	0.00%	0	0.00%	0	0.00%	10,229,492	0.07%	10,229,492	0.03%
32025	0	0.00%	0	0.00%	0	0.00%	8,873,745	0.06%	8,873,745	0.02%
32034	0	0.00%	0	0.00%	0	0.00%	3,750,900	0.03%	3,750,900	0.01%
32038	0	0.00%	0	0.00%	0	0.00%	3,946,522	0.03%	3,946,522	0.01%
32052	0	0.00%	2,001,304	0.02%	0	0.00%	0	0.00%	2,035,035	0.01%
32053	0	0.00%	1,184,623	0.01%	0	0.00%	0	0.00%	1,205,550	0.00%
32054	0	0.00%	0	0.00%	0	0.00%	3,822,748	0.03%	3,822,748	0.01%
32055	0	0.00%	0	0.00%	0	0.00%	6,804,871	0.05%	6,804,871	0.02%
32059	0	0.00%	992,409	0.01%	0	0.00%	0	0.00%	992,409	0.00%
32060	0	0.00%	8,022,277	0.06%	0	0.00%	0	0.00%	8,174,424	0.02%
32064	0	0.00%	3,349,581	0.03%	0	0.00%	1,187,086	0.01%	4,536,666	0.01%
32066	0	0.00%	1,983,931	0.02%	0	0.00%	0	0.00%	1,983,931	0.01%
32080	0	0.00%	35,809,369	0.28%	0	0.00%	35,921,463	0.25%	71,730,833	0.20%
32082	0	0.00%	72,388,400	0.57%	0	3.30%	72,632,828	0.50%	145,021,227	0.40%
32084	0	0.00%	26,136,379	0.21%	0	0.00%	26,217,552	0.18%	52,353,930	0.15%
32086	0	0.00%	1,892,175	0.02%	0	0.00%	26,310,992	0.18%	28,203,167	0.08%
32095	0	0.00%	528,137	0.00%	0	0.00%	13,385,172	0.09%	13,913,309	0.04%
32102	0	0.00%	0	0.00%	0	2.83%	1,690,751	0.01%	1,690,751	0.00%
32112	0	0.00%	0	0.00%	0	0.00%	2,820,460	0.02%	2,883,411	0.01%
32113	0	0.00%	2,572,455	0.02%	0	0.00%	3,895,689	0.03%	6,468,144	0.02%
32114	32,853,307	0.40%	23,849,505	0.19%	0	0.00%	29,078,327	0.20%	85,781,140	0.24%
32117	32,626,035	0.40%	19,685,298	0.16%	0	0.00%	27,063,757	0.19%	79,375,090	0.22%
32118	59,720,287	0.73%	49,987,560	0.40%	0	0.20%	54,363,170	0.38%	164,071,018	0.46%
32119	52,125,439	0.63%	37,644,565	0.30%	0	0.00%	45,994,819	0.32%	135,764,823	0.38%
32124	5,539,301	0.07%	4,783,214	0.04%	0	0.00%	5,597,992	0.04%	15,920,507	0.04%
32127	62,667,999	0.76%	63,096,818	0.50%	0	0.19%	77,025,334	0.53%	202,790,150	0.56%
32128	52,597,032	0.64%	34,927,318	0.28%	0	0.00%	44,454,958	0.31%	131,979,307	0.37%
32129	36,630,018	0.44%	22,385,325	0.18%	0	0.00%	30,368,201	0.21%	89,383,543	0.25%
32130	0	0.00%	0	0.00%	0	0.00%	3,308,391	0.02%	3,364,565	0.01%
32132	12,635,955	0.15%	12,725,886	0.10%	0	0.00%	15,576,020	0.11%	40,937,861	0.11%
32134	0	0.00%	0	0.00%	0	0.00%	3,574,662	0.02%	3,638,198	0.01%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32136	24,172,897	0.29%	20,157,296	0.16%	0	0.00%	24,425,295	0.17%	68,755,488	0.19%
32137	0	0.00%	65,551,496	0.52%	0	0.00%	87,673,585	0.61%	153,230,303	0.43%
32141	30,680,787	0.37%	30,899,137	0.24%	0	0.00%	37,747,717	0.26%	99,327,641	0.28%
32148	0	0.00%	0	0.00%	0	0.00%	2,970,780	0.02%	2,970,780	0.01%
32159	0	0.00%	33,108,799	0.26%	0	0.00%	54,351,939	0.38%	87,460,737	0.24%
32162	0	0.00%	102,065,843	0.81%	0	0.00%	102,413,310	0.71%	204,479,153	0.57%
32163	0	0.00%	40,150,668	0.32%	0	0.00%	43,604,533	0.30%	83,755,201	0.23%
32164	0	0.00%	45,589,643	0.36%	0	0.00%	45,752,049	0.32%	91,341,692	0.25%
32168	60,816,164	0.74%	39,099,740	0.31%	0	0.00%	61,440,140	0.43%	161,356,044	0.45%
32169	49,377,853	0.60%	56,723,741	0.45%	0	0.00%	61,818,201	0.43%	167,919,795	0.47%
32174	111,231,203	1.35%	84,561,092	0.67%	0	0.00%	112,396,923	0.78%	308,189,219	0.86%
32176	70,005,134	0.85%	56,902,957	0.45%	0	0.00%	65,204,090	0.45%	192,112,182	0.53%
32179	0	0.00%	4,313,732	0.03%	0	0.00%	6,635,379	0.05%	10,949,111	0.03%
32180	0	0.00%	0	0.00%	0	0.00%	1,705,671	0.01%	1,705,671	0.00%
32190	0	0.00%	0	0.00%	0	0.00%	549,684	0.00%	549,684	0.00%
32195	0	0.00%	2,470,042	0.02%	0	0.00%	3,624,566	0.03%	6,094,608	0.02%
32233	0	0.00%	689,017	0.01%	0	0.00%	18,217,918	0.13%	18,906,935	0.05%
32250	0	0.00%	3,188,700	0.03%	0	0.00%	29,045,157	0.20%	32,233,856	0.09%
32266	0	0.00%	7,673,877	0.06%	0	0.00%	7,701,190	0.05%	15,375,067	0.04%
32301	0	0.00%	15,689,813	0.12%	0	0.00%	0	0.00%	15,689,813	0.04%
32303	0	0.00%	31,500,098	0.25%	0	0.00%	0	0.00%	31,500,098	0.09%
32304	0	0.00%	10,180,174	0.08%	0	0.00%	0	0.00%	10,180,174	0.03%
32305	0	0.00%	6,547,201	0.05%	0	0.00%	0	0.00%	6,547,201	0.02%
32308	0	0.00%	19,478,110	0.15%	0	3.94%	0	0.00%	19,478,110	0.05%
32309	0	0.00%	34,301,837	0.27%	0	0.00%	0	0.00%	34,301,837	0.10%
32310	0	0.00%	5,293,356	0.04%	0	0.00%	0	0.00%	5,293,356	0.01%
32311	0	0.00%	18,190,241	0.14%	0	0.00%	0	0.00%	18,190,241	0.05%
32312	0	0.00%	45,814,575	0.36%	0	0.00%	0	0.00%	45,814,575	0.13%
32317	0	0.00%	15,450,886	0.12%	0	0.00%	0	0.00%	15,450,892	0.04%
32331	0	0.00%	1,943,305	0.02%	0	0.00%	0	0.00%	1,943,305	0.01%
32336	0	0.00%	638,280	0.01%	0	0.00%	0	0.00%	638,280	0.00%
32340	0	0.00%	4,539,723	0.04%	0	0.00%	0	0.00%	4,539,723	0.01%
32344	0	0.00%	8,949,284	0.07%	0	0.00%	0	0.00%	8,949,284	0.02%
32346	0	0.00%	2,259,776	0.02%	0	0.00%	0	0.00%	2,259,776	0.01%
32347	0	0.00%	4,608,071	0.04%	0	0.00%	0	0.00%	4,608,071	0.01%
32348	0	0.00%	4,375,510	0.03%	0	0.00%	0	0.00%	4,375,510	0.01%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32350	0	0.00%	615,065	0.00%	0	0.00%	0	0.00%	615,065	0.00%
32359	0	0.00%	2,244,139	0.02%	0	0.00%	0	0.00%	2,244,139	0.01%
32408	0	0.00%	0	0.00%	1,364,051	0.00%	0	0.00%	1,364,051	0.00%
32413	0	0.00%	0	0.00%	26,260,218	0.00%	0	0.00%	26,260,218	0.07%
32501	0	0.00%	0	0.00%	9,706,257	0.00%	0	0.00%	9,706,257	0.03%
32502	0	0.00%	0	0.00%	3,596,868	0.00%	0	0.00%	3,596,868	0.01%
32503	0	0.00%	0	0.00%	42,885,415	0.00%	0	0.00%	42,885,415	0.12%
32504	0	0.00%	0	0.00%	32,662,969	0.00%	0	0.00%	32,662,969	0.09%
32505	0	0.00%	0	0.00%	15,607,967	0.00%	0	0.00%	15,607,967	0.04%
32506	0	0.00%	0	0.00%	36,925,340	0.00%	0	0.00%	36,925,340	0.10%
32507	0	0.00%	0	0.00%	53,919,645	0.00%	0	0.00%	53,919,645	0.15%
32514	0	0.00%	0	0.00%	37,821,803	0.00%	0	0.00%	37,821,803	0.11%
32526	0	0.00%	0	0.00%	46,949,555	0.00%	0	0.00%	46,949,555	0.13%
32531	0	0.00%	0	0.00%	3,535,315	0.00%	0	0.00%	3,535,315	0.01%
32533	0	0.00%	0	0.00%	33,797,940	0.00%	0	0.00%	33,797,940	0.09%
32534	0	0.00%	0	0.00%	13,585,150	0.00%	0	0.00%	13,585,150	0.04%
32535	0	0.00%	0	0.00%	2,595,541	4.81%	0	0.00%	2,595,541	0.01%
32541	0	0.00%	0	0.00%	28,901,010	0.00%	0	0.00%	28,901,010	0.08%
32547	0	0.00%	0	0.00%	22,035,234	0.00%	0	0.00%	22,035,234	0.06%
32548	0	0.00%	0	0.00%	18,873,117	0.00%	0	0.00%	18,873,117	0.05%
32550	0	0.00%	0	0.00%	1,279,082	0.00%	0	0.00%	1,279,082	0.00%
32561	0	0.00%	0	0.00%	32,084,067	0.00%	0	0.00%	32,084,067	0.09%
32563	0	0.00%	0	0.00%	39,584,008	0.00%	0	0.00%	39,584,008	0.11%
32564	0	0.00%	0	0.00%	1,158,032	0.00%	0	0.00%	1,158,032	0.00%
32565	0	0.00%	0	0.00%	4,451,292	5.94%	0	0.00%	4,451,292	0.01%
32566	0	0.00%	0	0.00%	45,753,146	0.00%	0	0.00%	45,753,146	0.13%
32568	0	0.00%	0	0.00%	2,688,633	0.00%	0	0.00%	2,688,633	0.01%
32569	0	0.00%	0	0.00%	10,932,031	0.17%	0	0.00%	10,932,031	0.03%
32570	0	0.00%	0	0.00%	23,095,618	0.00%	0	0.00%	23,095,618	0.06%
32571	0	0.00%	0	0.00%	35,004,714	0.00%	0	0.00%	35,004,714	0.10%
32577	0	0.00%	0	0.00%	5,789,827	0.00%	0	0.00%	5,789,827	0.02%
32578	0	0.00%	0	0.00%	1,644,516	0.67%	0	0.00%	1,644,516	0.00%
32579	0	0.00%	0	0.00%	11,013,919	0.00%	0	0.00%	11,013,919	0.03%
32580	0	0.00%	0	0.00%	2,982,025	0.00%	0	0.00%	2,982,025	0.01%
32583	0	0.00%	0	0.00%	17,076,112	0.00%	0	0.00%	17,076,112	0.05%
32601	0	0.00%	4,529,483	0.04%	0	0.00%	10,376,640	0.07%	14,906,123	0.04%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32603	0	0.00%	0	0.00%	0	0.00%	1,728,397	0.01%	1,939,927	0.01%
32605	0	0.00%	881,135	0.01%	0	0.00%	21,287,959	0.15%	22,169,095	0.06%
32606	0	0.00%	1,926,660	0.02%	0	0.00%	18,907,356	0.13%	20,834,016	0.06%
32607	0	0.00%	2,997,185	0.02%	0	6.86%	17,557,004	0.12%	20,554,189	0.06%
32608	0	0.00%	28,333,733	0.22%	0	0.00%	28,425,978	0.20%	56,759,711	0.16%
32609	0	0.00%	600,921	0.00%	0	0.00%	6,407,430	0.04%	7,008,351	0.02%
32615	0	0.00%	0	0.00%	0	0.00%	11,613,311	0.08%	11,898,944	0.03%
32617	0	0.00%	2,378,265	0.02%	0	0.00%	3,725,206	0.03%	6,103,471	0.02%
32618	0	0.00%	3,494,185	0.03%	0	0.00%	3,506,654	0.02%	7,000,840	0.02%
32621	0	0.00%	1,690,838	0.01%	0	0.00%	1,476,964	0.01%	3,167,802	0.01%
32622	0	0.00%	0	0.00%	0	0.00%	760,091	0.01%	772,437	0.00%
32625	0	0.00%	2,547,487	0.02%	0	0.00%	1,309,298	0.01%	3,856,785	0.01%
32626	0	0.00%	4,136,315	0.03%	0	0.00%	0	0.00%	4,199,798	0.01%
32628	0	0.00%	1,381,485	0.01%	0	0.00%	0	0.00%	1,381,485	0.00%
32640	0	0.00%	0	0.00%	0	0.40%	4,944,531	0.03%	5,030,462	0.01%
32641	0	0.00%	0	0.00%	0	0.00%	4,217,130	0.03%	4,272,743	0.01%
32643	0	0.00%	0	0.00%	0	0.00%	7,430,906	0.05%	7,595,365	0.02%
32648	0	0.00%	684,234	0.01%	0	0.00%	0	0.00%	684,234	0.00%
32653	0	0.00%	0	0.00%	0	0.00%	13,282,357	0.09%	13,731,320	0.04%
32656	0	0.00%	0	0.00%	0	0.00%	7,623,857	0.05%	7,623,857	0.02%
32664	0	0.00%	771,330	0.01%	0	0.00%	774,027	0.01%	1,545,357	0.00%
32666	0	0.00%	0	0.00%	0	1.64%	4,407,139	0.03%	4,407,139	0.01%
32667	0	0.00%	3,240,080	0.03%	0	0.00%	3,251,637	0.02%	6,491,717	0.02%
32668	0	0.00%	3,692,471	0.03%	0	0.00%	3,255,042	0.02%	6,947,513	0.02%
32669	0	0.00%	11,962,600	0.09%	0	0.00%	12,003,000	0.08%	23,965,601	0.07%
32680	0	0.00%	3,039,151	0.02%	0	3.46%	0	0.00%	3,079,955	0.01%
32686	0	0.00%	3,495,534	0.03%	0	0.00%	5,047,628	0.03%	8,543,162	0.02%
32692	0	0.00%	706,682	0.01%	0	0.00%	0	0.00%	706,682	0.00%
32693	0	0.00%	5,033,196	0.04%	0	0.00%	0	0.00%	5,104,908	0.01%
32694	0	0.00%	0	0.00%	0	5.25%	863,676	0.01%	863,676	0.00%
32696	0	0.00%	6,102,657	0.05%	0	0.00%	5,535,770	0.04%	11,638,427	0.03%
32701	34,907,238	0.42%	15,828,277	0.13%	0	0.00%	25,884,511	0.18%	76,620,026	0.21%
32702	0	0.00%	0	0.00%	0	0.00%	1,198,464	0.01%	1,198,464	0.00%
32703	30,021,081	0.36%	997,034	0.01%	0	0.00%	47,580,638	0.33%	78,598,752	0.22%
32707	69,167,382	0.84%	25,645,607	0.20%	0	0.00%	57,273,927	0.40%	152,086,916	0.42%
32708	119,644,119	1.45%	45,252,723	0.36%	0	0.00%	99,284,505	0.69%	264,181,347	0.73%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32709	3,117,330	0.04%	1,270,835	0.01%	0	0.00%	2,588,790	0.02%	6,976,955	0.02%
32712	1,486,916	0.02%	1,492,907	0.01%	0	0.00%	64,063,901	0.44%	67,043,724	0.19%
32713	32,389,565	0.39%	0	0.00%	0	0.00%	32,733,305	0.23%	65,409,805	0.18%
32714	36,934,649	0.45%	3,365,019	0.03%	0	0.00%	37,281,952	0.26%	77,581,620	0.22%
32719	500,716	0.01%	0	0.00%	0	0.00%	0	0.00%	1,228,899	0.00%
32720	665,037	0.01%	668,191	0.01%	0	0.00%	22,784,968	0.16%	24,118,195	0.07%
32724	28,378,679	0.34%	777,765	0.01%	0	0.00%	28,676,916	0.20%	57,833,360	0.16%
32725	59,731,569	0.73%	743,586	0.01%	0	0.00%	60,363,264	0.42%	120,838,419	0.34%
32726	0	0.00%	14,787,612	0.12%	0	0.00%	23,980,762	0.17%	38,768,374	0.11%
32730	7,717,132	0.09%	0	0.00%	0	0.00%	5,534,526	0.04%	13,409,801	0.04%
32732	15,899,475	0.19%	5,510,312	0.04%	0	0.00%	11,551,233	0.08%	32,961,021	0.09%
32735	0	0.00%	4,157,403	0.03%	0	0.00%	5,940,368	0.04%	10,097,771	0.03%
32736	0	0.00%	0	0.00%	0	0.00%	14,358,494	0.10%	14,514,437	0.04%
32738	69,511,545	0.84%	0	0.00%	0	0.00%	52,506,343	0.36%	122,380,577	0.34%
32744	4,162,557	0.05%	0	0.00%	0	0.00%	4,206,938	0.03%	8,412,335	0.02%
32746	106,753,630	1.30%	52,757,695	0.42%	0	0.00%	81,980,533	0.57%	241,491,858	0.67%
32750	36,766,206	0.45%	22,271,579	0.18%	0	0.00%	37,151,065	0.26%	96,188,850	0.27%
32751	68,370,733	0.83%	30,378,396	0.24%	0	0.00%	50,863,063	0.35%	149,612,192	0.42%
32754	15,544,004	0.19%	11,835,759	0.09%	0	0.00%	18,998,629	0.13%	46,378,392	0.13%
32757	0	0.00%	1,372,472	0.01%	0	0.87%	39,797,260	0.28%	41,169,741	0.11%
32759	2,886,993	0.04%	2,907,499	0.02%	0	0.00%	4,071,605	0.03%	9,866,097	0.03%
32763	12,624,260	0.15%	0	0.00%	0	0.00%	12,759,179	0.09%	25,658,627	0.07%
32764	5,506,176	0.07%	2,279,326	0.02%	0	0.00%	3,494,204	0.02%	11,279,707	0.03%
32765	174,238,750	2.12%	59,710,985	0.47%	0	0.00%	127,184,899	0.88%	361,134,634	1.00%
32766	41,408,922	0.50%	18,824,800	0.15%	0	0.00%	30,855,025	0.21%	91,088,747	0.25%
32767	0	0.00%	0	0.00%	0	0.00%	968,586	0.01%	983,216	0.00%
32771	72,967,861	0.89%	42,304,781	0.33%	0	0.00%	58,397,123	0.40%	173,669,765	0.48%
32773	38,474,013	0.47%	15,738,915	0.12%	0	0.00%	24,040,660	0.17%	78,253,588	0.22%
32776	0	0.00%	11,224,739	0.09%	0	0.25%	15,212,513	0.11%	26,437,252	0.07%
32778	0	0.00%	18,461,095	0.15%	0	0.00%	26,878,347	0.19%	45,339,441	0.13%
32779	77,492,307	0.94%	49,496,290	0.39%	0	0.00%	78,307,153	0.54%	205,295,749	0.57%
32780	48,931,594	0.59%	49,265,086	0.39%	0	0.00%	79,914,456	0.55%	178,111,136	0.49%
32784	0	0.00%	7,019,831	0.06%	0	0.00%	11,092,902	0.08%	18,112,733	0.05%
32789	134,552,195	1.63%	55,492,182	0.44%	0	0.00%	112,407,829	0.78%	302,452,207	0.84%
32790	0	0.00%	0	0.00%	0	0.00%	0	0.00%	574,364	0.00%
32792	92,865,577	1.13%	32,719,564	0.26%	0	1.65%	76,901,957	0.53%	202,487,098	0.56%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
32796	26,766,279	0.33%	26,947,138	0.21%	0	0.00%	36,834,463	0.26%	90,547,880	0.25%
32798	0	0.00%	0	0.00%	0	0.00%	3,107,059	0.02%	3,135,235	0.01%
32801	25,526,044	0.31%	12,800,560	0.10%	0	0.00%	21,611,186	0.15%	59,937,791	0.17%
32803	55,652,256	0.68%	19,748,097	0.16%	0	0.00%	46,050,894	0.32%	121,451,248	0.34%
32804	66,530,248	0.81%	24,810,700	0.20%	0	0.45%	55,230,355	0.38%	146,571,303	0.41%
32805	16,646,810	0.20%	6,778,346	0.05%	0	0.00%	16,821,327	0.12%	40,246,482	0.11%
32806	90,687,148	1.10%	27,879,330	0.22%	0	0.00%	65,893,028	0.46%	184,459,506	0.51%
32807	50,601,278	0.61%	15,177,821	0.12%	0	0.00%	36,686,491	0.25%	102,465,590	0.28%
32808	32,797,575	0.40%	2,727,101	0.02%	0	0.00%	45,871,684	0.32%	81,396,359	0.23%
32809	45,647,034	0.55%	14,091,913	0.11%	0	0.00%	33,160,080	0.23%	92,899,027	0.26%
32810	39,049,042	0.47%	1,222,371	0.01%	0	0.00%	39,449,104	0.27%	79,720,518	0.22%
32811	22,278,988	0.27%	11,004,026	0.09%	0	0.00%	22,472,993	0.16%	55,756,008	0.15%
32812	83,732,300	1.02%	25,766,153	0.20%	0	0.00%	60,761,874	0.42%	170,260,327	0.47%
32814	13,602,597	0.17%	8,789,640	0.07%	0	0.00%	10,450,221	0.07%	32,842,458	0.09%
32816	3,101,792	0.04%	1,702,205	0.01%	0	0.00%	2,365,785	0.02%	7,169,781	0.02%
32817	70,485,879	0.86%	22,079,287	0.17%	0	0.00%	51,093,262	0.35%	143,658,428	0.40%
32818	41,379,041	0.50%	821,232	0.01%	0	0.00%	57,571,047	0.40%	99,771,320	0.28%
32819	76,678,506	0.93%	35,623,190	0.28%	0	0.00%	77,465,178	0.54%	189,766,874	0.53%
32820	15,091,326	0.18%	8,552,950	0.07%	0	0.00%	11,395,077	0.08%	35,039,353	0.10%
32821	30,824,978	0.37%	1,051,180	0.01%	0	2.56%	22,369,250	0.15%	54,245,408	0.15%
32822	65,361,656	0.79%	22,595,386	0.18%	0	0.00%	47,441,936	0.33%	135,398,978	0.38%
32824	84,596,849	1.03%	34,508,795	0.27%	0	0.00%	69,114,368	0.48%	188,220,012	0.52%
32825	114,681,841	1.39%	40,574,836	0.32%	0	0.00%	83,874,365	0.58%	239,131,042	0.66%
32826	37,773,874	0.46%	13,913,191	0.11%	0	0.00%	20,983,727	0.15%	72,670,791	0.20%
32827	41,418,714	0.50%	20,762,014	0.16%	0	0.00%	33,877,515	0.23%	96,058,244	0.27%
32828	114,774,863	1.39%	52,375,685	0.41%	0	0.00%	85,607,797	0.59%	252,758,346	0.70%
32829	34,436,994	0.42%	15,085,010	0.12%	0	0.00%	23,724,258	0.16%	73,246,261	0.20%
32830	821,463	0.01%	600,848	0.00%	0	0.00%	823,521	0.01%	2,245,832	0.01%
32832	48,962,745	0.59%	29,929,804	0.24%	0	0.00%	39,936,954	0.28%	118,829,503	0.33%
32833	19,865,795	0.24%	8,865,652	0.07%	0	0.00%	14,751,618	0.10%	43,483,065	0.12%
32835	65,968,968	0.80%	31,572,521	0.25%	0	0.00%	66,569,445	0.46%	164,110,934	0.46%
32836	63,188,294	0.77%	36,177,584	0.29%	0	0.00%	76,437,819	0.53%	175,803,696	0.49%
32837	119,481,011	1.45%	39,228,649	0.31%	0	0.00%	87,146,177	0.60%	245,855,837	0.68%
32839	36,116,278	0.44%	14,012,962	0.11%	0	0.00%	30,074,396	0.21%	80,203,636	0.22%
32901	0	0.00%	33,626,779	0.27%	0	0.00%	41,926,768	0.29%	75,553,548	0.21%
32903	0	0.00%	65,550,660	0.52%	0	0.00%	76,561,436	0.53%	142,112,096	0.39%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
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32904	0	0.00%	47,441,130	0.37%	0	0.00%	64,957,301	0.45%	112,398,430	0.31%
32905	0	0.00%	29,242,057	0.23%	0	0.00%	47,435,149	0.33%	76,677,442	0.21%
32907	0	0.00%	51,453,718	0.41%	0	0.00%	95,994,281	0.66%	147,448,000	0.41%
32908	0	0.00%	12,247,607	0.10%	0	0.00%	20,195,096	0.14%	32,442,703	0.09%
32909	0	0.00%	46,411,960	0.37%	0	0.00%	68,144,664	0.47%	114,556,623	0.32%
32920	16,750,660	0.20%	28,744,735	0.23%	0	0.00%	34,679,185	0.24%	80,174,580	0.22%
32922	6,450,063	0.08%	13,574,681	0.11%	0	0.00%	18,773,710	0.13%	38,798,453	0.11%
32926	15,761,968	0.19%	25,579,529	0.20%	0	0.00%	42,329,142	0.29%	83,670,639	0.23%
32927	31,225,063	0.38%	31,442,791	0.25%	0	0.00%	51,585,786	0.36%	114,253,640	0.32%
32931	21,651,480	0.26%	69,890,882	0.55%	0	0.00%	85,422,231	0.59%	176,964,593	0.49%
32934	616,149	0.01%	41,297,527	0.33%	0	0.00%	57,306,557	0.40%	99,220,234	0.28%
32935	0	0.00%	80,045,683	0.63%	0	0.00%	99,781,048	0.69%	179,826,731	0.50%
32937	3,328,594	0.04%	107,075,585	0.85%	0	0.00%	114,699,326	0.79%	225,103,504	0.63%
32940	53,001,297	0.64%	108,656,423	0.86%	0	0.00%	140,976,148	0.98%	302,633,868	0.84%
32948	0	0.00%	3,752,153	0.03%	0	0.00%	5,548,710	0.04%	9,300,863	0.03%
32949	0	0.00%	8,100,584	0.06%	0	0.00%	10,414,192	0.07%	18,514,776	0.05%
32950	0	0.00%	14,096,207	0.11%	0	0.00%	16,949,906	0.12%	31,046,113	0.09%
32951	0	0.00%	54,651,643	0.43%	0	0.00%	98,685,228	0.68%	153,336,871	0.43%
32952	25,083,289	0.30%	77,258,540	0.61%	0	0.00%	89,904,480	0.62%	192,246,308	0.53%
32953	22,776,442	0.28%	49,931,086	0.39%	0	0.00%	69,368,681	0.48%	142,076,210	0.39%
32955	38,263,950	0.46%	72,239,024	0.57%	0	0.00%	99,404,945	0.69%	209,907,919	0.58%
32958	0	0.00%	74,575,486	0.59%	0	0.00%	91,553,447	0.63%	166,128,933	0.46%
32960	0	0.00%	46,208,856	0.37%	0	0.00%	54,327,504	0.38%	100,536,481	0.28%
32962	0	0.00%	55,341,728	0.44%	0	0.00%	62,881,083	0.44%	118,222,811	0.33%
32963	0	0.00%	177,307,368	1.40%	0	0.00%	401,666,020	2.78%	578,973,388	1.61%
32966	0	0.00%	35,924,735	0.28%	0	0.00%	48,390,582	0.34%	84,315,317	0.23%
32967	0	0.00%	46,254,338	0.37%	0	0.00%	59,339,143	0.41%	105,594,292	0.29%
32968	0	0.00%	37,722,529	0.30%	0	0.00%	40,948,801	0.28%	78,671,330	0.22%
32976	0	0.00%	17,234,958	0.14%	0	0.00%	45,918,930	0.32%	63,154,007	0.18%
33060	0	0.00%	2,863,764	0.02%	0	0.00%	0	0.00%	2,863,764	0.01%
33062	0	0.00%	22,085,389	0.17%	0	0.00%	0	0.00%	22,085,389	0.06%
33064	0	0.00%	6,424,337	0.05%	0	0.00%	0	0.00%	6,424,337	0.02%
33067	0	0.00%	2,856,960	0.02%	0	0.00%	0	0.00%	2,856,960	0.01%
33069	0	0.00%	18,625,899	0.15%	0	0.00%	0	0.00%	18,626,338	0.05%
33073	0	0.00%	2,824,235	0.02%	0	0.00%	0	0.00%	2,824,236	0.01%
33076	0	0.00%	1,865,784	0.01%	0	0.00%	0	0.00%	1,865,784	0.01%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
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33401	0	0.00%	46,249,722	0.37%	0	0.00%	34,405,207	0.24%	80,654,929	0.22%
33403	0	0.00%	14,828,791	0.12%	0	0.00%	10,637,841	0.07%	25,466,632	0.07%
33404	0	0.00%	52,605,259	0.42%	0	0.00%	38,691,200	0.27%	91,296,459	0.25%
33405	0	0.00%	33,022,728	0.26%	0	0.00%	17,268,182	0.12%	50,290,910	0.14%
33406	0	0.00%	38,698,300	0.31%	0	0.00%	23,463,843	0.16%	62,162,143	0.17%
33407	0	0.00%	35,912,160	0.28%	0	0.00%	26,267,692	0.18%	62,179,852	0.17%
33408	0	0.00%	96,161,361	0.76%	0	0.00%	77,409,990	0.54%	173,571,351	0.48%
33409	0	0.00%	35,143,052	0.28%	0	0.00%	22,996,231	0.16%	58,139,283	0.16%
33410	0	0.00%	120,446,316	0.95%	0	0.00%	106,083,693	0.73%	226,530,010	0.63%
33411	0	0.00%	146,113,421	1.15%	0	0.00%	98,145,930	0.68%	244,259,351	0.68%
33412	0	0.00%	60,676,555	0.48%	0	0.00%	53,813,139	0.37%	114,489,693	0.32%
33413	0	0.00%	23,024,111	0.18%	0	0.00%	15,343,640	0.11%	38,367,751	0.11%
33414	0	0.00%	145,056,444	1.15%	0	0.00%	113,079,992	0.78%	258,136,436	0.72%
33415	0	0.00%	46,006,697	0.36%	0	0.00%	35,280,533	0.24%	81,287,231	0.23%
33417	0	0.00%	55,644,522	0.44%	0	0.00%	36,794,418	0.25%	92,438,939	0.26%
33418	0	0.00%	222,564,655	1.76%	0	0.00%	181,599,556	1.26%	404,164,211	1.12%
33425	0	0.00%	546,471	0.00%	0	0.00%	0	0.00%	934,358	0.00%
33426	0	0.00%	31,051,966	0.25%	0	0.00%	16,122,370	0.11%	47,174,336	0.13%
33428	0	0.00%	38,384,659	0.30%	0	0.00%	0	0.00%	38,384,659	0.11%
33430	0	0.00%	4,902,945	0.04%	0	0.00%	4,917,308	0.03%	9,820,253	0.03%
33431	0	0.00%	21,689,955	0.17%	0	0.00%	0	0.00%	21,690,008	0.06%
33432	0	0.00%	46,323,194	0.37%	0	0.00%	0	0.00%	46,323,194	0.13%
33433	0	0.00%	58,541,917	0.46%	0	0.00%	0	0.00%	58,541,917	0.16%
33434	0	0.00%	40,605,068	0.32%	0	0.00%	0	0.00%	40,605,782	0.11%
33435	0	0.00%	50,976,433	0.40%	0	0.00%	27,839,360	0.19%	78,815,793	0.22%
33436	0	0.00%	70,929,929	0.56%	0	0.00%	49,767,630	0.34%	120,697,558	0.34%
33437	0	0.00%	87,059,423	0.69%	0	0.00%	62,408,519	0.43%	149,467,941	0.42%
33438	0	0.00%	692,113	0.01%	0	0.00%	620,858	0.00%	1,312,971	0.00%
33440	0	0.00%	8,673,536	0.07%	0	0.00%	8,703,921	0.06%	17,377,457	0.05%
33441	0	0.00%	11,052,630	0.09%	0	0.00%	0	0.00%	11,062,652	0.03%
33442	0	0.00%	13,850,042	0.11%	0	0.00%	0	0.00%	13,870,227	0.04%
33444	0	0.00%	19,496,530	0.15%	0	0.00%	1,846,391	0.01%	21,342,921	0.06%
33445	0	0.00%	50,173,397	0.40%	0	0.00%	11,849,666	0.08%	62,023,063	0.17%
33446	0	0.00%	79,576,341	0.63%	0	0.00%	62,541,796	0.43%	142,118,136	0.39%
33449	0	0.00%	25,525,290	0.20%	0	0.00%	21,337,889	0.15%	46,863,179	0.13%
33455	0	0.00%	100,215,674	0.79%	0	0.00%	92,222,120	0.64%	192,437,795	0.53%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
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33458	0	0.00%	164,509,536	1.30%	0	0.00%	134,091,733	0.93%	298,601,268	0.83%
33460	0	0.00%	31,817,845	0.25%	0	0.00%	19,138,460	0.13%	50,956,306	0.14%
33461	0	0.00%	35,451,547	0.28%	0	0.00%	18,152,836	0.13%	53,604,383	0.15%
33462	0	0.00%	53,783,648	0.43%	0	0.00%	28,259,784	0.20%	82,043,433	0.23%
33463	0	0.00%	70,523,358	0.56%	0	0.00%	40,110,326	0.28%	110,633,684	0.31%
33467	0	0.00%	113,029,101	0.89%	0	0.00%	88,844,513	0.62%	201,873,614	0.56%
33469	0	0.00%	80,157,912	0.63%	0	0.00%	73,740,936	0.51%	153,898,848	0.43%
33470	0	0.00%	56,016,813	0.44%	0	0.00%	47,161,145	0.33%	103,177,958	0.29%
33471	0	0.00%	4,075,418	0.03%	0	0.00%	4,089,764	0.03%	8,165,182	0.02%
33472	0	0.00%	45,837,393	0.36%	0	0.00%	23,987,069	0.17%	69,824,463	0.19%
33473	0	0.00%	20,936,365	0.17%	0	0.00%	19,002,447	0.13%	39,938,811	0.11%
33476	0	0.00%	3,436,029	0.03%	0	0.00%	2,776,294	0.02%	6,212,323	0.02%
33477	0	0.00%	89,356,373	0.71%	0	0.00%	81,961,844	0.57%	171,318,217	0.48%
33478	0	0.00%	53,899,054	0.43%	0	0.00%	50,132,478	0.35%	104,031,532	0.29%
33480	0	0.00%	230,294,573	1.82%	0	0.00%	155,463,947	1.08%	385,758,520	1.07%
33483	0	0.00%	40,410,333	0.32%	0	0.00%	8,669,557	0.06%	49,079,890	0.14%
33484	0	0.00%	50,915,523	0.40%	0	0.00%	15,313,767	0.11%	66,230,148	0.18%
33486	0	0.00%	22,455,108	0.18%	0	0.00%	0	0.00%	22,456,863	0.06%
33487	0	0.00%	33,537,224	0.27%	0	0.00%	577,175	0.00%	34,120,128	0.09%
33493	0	0.00%	876,583	0.01%	0	0.00%	879,643	0.01%	1,756,226	0.00%
33496	0	0.00%	57,924,550	0.46%	0	0.00%	1,100,358	0.01%	59,024,908	0.16%
33498	0	0.00%	22,598,769	0.18%	0	0.00%	0	0.00%	22,799,975	0.06%
33510	0	0.00%	1,008,902	0.01%	0	0.00%	19,486,327	0.13%	20,495,229	0.06%
33511	0	0.00%	2,236,795	0.02%	0	0.00%	36,906,362	0.26%	39,143,157	0.11%
33513	0	0.00%	7,685,555	0.06%	0	0.00%	7,712,667	0.05%	15,398,223	0.04%
33514	0	0.00%	1,058,226	0.01%	0	0.00%	1,407,877	0.01%	2,466,103	0.01%
33521	0	0.00%	0	0.00%	0	0.00%	0	0.00%	917,680	0.00%
33523	0	0.00%	13,454,650	0.11%	0	0.00%	13,502,041	0.09%	26,956,691	0.07%
33525	0	0.00%	13,048,324	0.10%	0	0.00%	18,763,830	0.13%	31,812,154	0.09%
33527	0	0.00%	8,961,625	0.07%	0	0.00%	12,726,660	0.09%	21,688,285	0.06%
33534	0	0.00%	0	0.00%	0	0.00%	6,776,424	0.05%	6,829,132	0.02%
33538	0	0.00%	5,106,490	0.04%	0	0.00%	5,124,266	0.04%	10,230,756	0.03%
33540	0	0.00%	3,725,529	0.03%	0	0.00%	5,856,900	0.04%	9,582,429	0.03%
33541	0	0.00%	9,278,607	0.07%	0	0.00%	13,619,108	0.09%	22,897,720	0.06%
33542	0	0.00%	9,522,497	0.08%	0	0.00%	15,824,160	0.11%	25,346,836	0.07%
33543	0	0.00%	26,799,226	0.21%	0	0.00%	34,931,918	0.24%	61,731,143	0.17%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33544	0	0.00%	22,477,717	0.18%	0	0.00%	28,059,793	0.19%	50,537,511	0.14%
33545	0	0.00%	12,967,938	0.10%	0	0.00%	15,019,978	0.10%	27,987,916	0.08%
33547	0	0.00%	0	0.00%	0	0.00%	27,188,804	0.19%	27,515,899	0.08%
33548	0	0.00%	9,128,748	0.07%	0	0.00%	9,161,163	0.06%	18,289,912	0.05%
33549	0	0.00%	17,105,976	0.14%	0	0.00%	17,164,682	0.12%	34,270,658	0.10%
33556	0	0.00%	36,793,017	0.29%	0	0.00%	36,920,170	0.26%	73,713,187	0.20%
33558	0	0.00%	25,290,056	0.20%	0	0.00%	25,376,255	0.18%	50,666,311	0.14%
33559	0	0.00%	11,827,184	0.09%	0	0.00%	11,863,965	0.08%	23,691,148	0.07%
33563	0	0.00%	0	0.00%	0	0.00%	16,318,599	0.11%	16,589,221	0.05%
33565	0	0.00%	9,485,777	0.08%	0	0.00%	19,793,426	0.14%	29,279,203	0.08%
33566	0	0.00%	13,970,895	0.11%	0	0.00%	22,679,590	0.16%	36,650,545	0.10%
33567	0	0.00%	5,906,661	0.05%	0	0.00%	8,396,400	0.06%	14,303,061	0.04%
33569	0	0.00%	0	0.00%	0	0.00%	24,281,053	0.17%	24,535,757	0.07%
33570	0	0.00%	747,209	0.01%	0	0.00%	16,250,090	0.11%	16,997,299	0.05%
33572	0	0.00%	1,228,151	0.01%	0	0.00%	26,296,705	0.18%	27,524,856	0.08%
33573	0	0.00%	12,674,753	0.10%	0	0.00%	38,863,791	0.27%	51,538,545	0.14%
33576	0	0.00%	7,082,401	0.06%	0	0.00%	7,106,155	0.05%	14,188,556	0.04%
33578	0	0.00%	4,785,976	0.04%	0	0.00%	31,369,935	0.22%	36,155,911	0.10%
33579	0	0.00%	786,635	0.01%	0	0.00%	23,809,991	0.16%	24,596,627	0.07%
33584	0	0.00%	0	0.00%	0	0.00%	16,957,224	0.12%	17,173,834	0.05%
33585	0	0.00%	1,035,306	0.01%	0	0.00%	1,038,946	0.01%	2,074,252	0.01%
33592	0	0.00%	6,730,236	0.05%	0	0.00%	6,753,572	0.05%	13,483,808	0.04%
33594	0	0.00%	785,391	0.01%	0	0.00%	28,948,583	0.20%	29,733,975	0.08%
33596	0	0.00%	581,872	0.00%	0	0.00%	30,919,419	0.21%	31,501,291	0.09%
33597	0	0.00%	4,683,278	0.04%	0	0.00%	4,699,781	0.03%	9,383,059	0.03%
33598	0	0.00%	684,844	0.01%	0	0.00%	12,043,660	0.08%	12,728,504	0.04%
33602	0	0.00%	15,970,529	0.13%	0	0.00%	7,318,168	0.05%	23,288,696	0.06%
33604	0	0.00%	0	0.00%	0	0.00%	0	0.00%	907,880	0.00%
33606	0	0.00%	23,582,287	0.19%	0	0.00%	3,320,644	0.02%	26,902,931	0.07%
33607	0	0.00%	935,057	0.01%	0	0.00%	933,118	0.01%	1,868,176	0.01%
33609	0	0.00%	2,916,676	0.02%	0	0.00%	2,910,870	0.02%	5,827,547	0.02%
33610	0	0.00%	0	0.00%	0	0.00%	11,739,488	0.08%	12,124,041	0.03%
33611	0	0.00%	30,553,625	0.24%	0	0.00%	4,360,362	0.03%	34,913,987	0.10%
33612	0	0.00%	957,131	0.01%	0	0.00%	15,255,002	0.11%	16,212,134	0.05%
33613	0	0.00%	18,486,494	0.15%	0	0.00%	18,533,807	0.13%	37,020,301	0.10%
33614	0	0.00%	2,525,978	0.02%	0	0.00%	2,520,383	0.02%	5,046,361	0.01%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33615	0	0.00%	26,434,684	0.21%	0	0.00%	2,887,672	0.02%	29,322,357	0.08%
33616	0	0.00%	10,413,028	0.08%	0	0.00%	2,077,563	0.01%	12,490,591	0.03%
33617	0	0.00%	3,424,242	0.03%	0	0.00%	22,768,290	0.16%	26,192,533	0.07%
33618	0	0.00%	29,799,040	0.24%	0	0.00%	29,873,461	0.21%	59,672,501	0.17%
33619	0	0.00%	803,469	0.01%	0	0.00%	11,458,872	0.08%	12,262,341	0.03%
33624	0	0.00%	29,427,324	0.23%	0	0.00%	29,528,001	0.20%	58,955,325	0.16%
33625	0	0.00%	17,949,919	0.14%	0	0.00%	18,009,832	0.12%	35,959,751	0.10%
33626	0	0.00%	33,157,970	0.26%	0	0.00%	1,959,881	0.01%	35,117,852	0.10%
33629	0	0.00%	43,114,361	0.34%	0	0.00%	2,813,373	0.02%	45,927,733	0.13%
33634	0	0.00%	11,019,491	0.09%	0	0.00%	750,356	0.01%	11,769,848	0.03%
33635	0	0.00%	9,338,783	0.07%	0	0.00%	0	0.00%	9,419,797	0.03%
33637	0	0.00%	658,895	0.01%	0	0.00%	6,432,625	0.04%	7,091,520	0.02%
33647	0	0.00%	63,790,885	0.50%	0	0.00%	88,568,400	0.61%	152,359,285	0.42%
33701	0	0.00%	13,985,380	0.11%	0	0.00%	0	0.00%	13,985,380	0.04%
33702	0	0.00%	4,570,330	0.04%	0	0.00%	0	0.00%	4,570,330	0.01%
33703	0	0.00%	24,741,972	0.20%	0	0.00%	0	0.00%	24,741,972	0.07%
33704	0	0.00%	20,105,263	0.16%	0	0.00%	0	0.00%	20,105,263	0.06%
33705	0	0.00%	15,075,795	0.12%	0	0.00%	0	0.00%	15,075,795	0.04%
33706	0	0.00%	61,121,200	0.48%	0	0.00%	0	0.00%	61,121,200	0.17%
33707	0	0.00%	43,806,649	0.35%	0	0.00%	0	0.00%	43,806,649	0.12%
33708	0	0.00%	60,612,543	0.48%	0	0.00%	0	0.00%	60,612,543	0.17%
33709	0	0.00%	17,324,327	0.14%	0	0.00%	0	0.00%	17,324,327	0.05%
33710	0	0.00%	25,539,707	0.20%	0	0.00%	0	0.00%	25,539,707	0.07%
33711	0	0.00%	12,800,456	0.10%	0	0.00%	0	0.00%	12,800,456	0.04%
33712	0	0.00%	11,272,128	0.09%	0	0.00%	0	0.00%	11,272,128	0.03%
33713	0	0.00%	16,705,548	0.13%	0	0.00%	0	0.00%	16,705,548	0.05%
33714	0	0.00%	6,504,716	0.05%	0	0.00%	0	0.00%	6,504,716	0.02%
33715	0	0.00%	35,090,543	0.28%	0	0.00%	14,239,541	0.10%	49,330,084	0.14%
33716	0	0.00%	5,143,089	0.04%	0	0.00%	0	0.00%	5,143,089	0.01%
33755	0	0.00%	15,760,682	0.12%	0	0.00%	2,543,674	0.02%	18,304,356	0.05%
33756	0	0.00%	28,064,806	0.22%	0	0.00%	5,953,842	0.04%	34,018,648	0.09%
33759	0	0.00%	11,371,605	0.09%	0	0.00%	0	0.00%	11,371,605	0.03%
33760	0	0.00%	9,367,002	0.07%	0	0.00%	0	0.00%	9,367,002	0.03%
33761	0	0.00%	21,405,638	0.17%	0	0.00%	6,590,172	0.05%	27,995,810	0.08%
33762	0	0.00%	7,741,778	0.06%	0	0.00%	0	0.00%	7,741,778	0.02%
33763	0	0.00%	1,613,818	0.01%	0	0.00%	0	0.00%	1,613,818	0.00%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33764	0	0.00%	21,381,724	0.17%	0	0.00%	0	0.00%	21,381,724	0.06%
33765	0	0.00%	7,647,348	0.06%	0	0.00%	0	0.00%	7,647,348	0.02%
33767	0	0.00%	39,360,827	0.31%	0	0.00%	22,928,340	0.16%	62,289,167	0.17%
33770	0	0.00%	18,698,390	0.15%	0	0.00%	1,821,052	0.01%	20,519,442	0.06%
33771	0	0.00%	13,873,483	0.11%	0	0.00%	0	0.00%	13,873,483	0.04%
33772	0	0.00%	35,498,554	0.28%	0	0.00%	0	0.00%	35,498,554	0.10%
33773	0	0.00%	11,164,202	0.09%	0	0.00%	0	0.00%	11,164,202	0.03%
33774	0	0.00%	28,213,011	0.22%	0	0.00%	3,433,795	0.02%	31,646,805	0.09%
33776	0	0.00%	35,067,766	0.28%	0	0.00%	624,783	0.00%	35,692,549	0.10%
33777	0	0.00%	28,124,435	0.22%	0	0.00%	0	0.00%	28,124,435	0.08%
33778	0	0.00%	15,992,821	0.13%	0	0.00%	0	0.00%	15,992,821	0.04%
33781	0	0.00%	12,532,646	0.10%	0	0.00%	0	0.00%	12,532,646	0.03%
33782	0	0.00%	15,584,802	0.12%	0	0.00%	0	0.00%	15,584,802	0.04%
33785	0	0.00%	30,326,070	0.24%	0	0.00%	19,944,619	0.14%	50,270,689	0.14%
33786	0	0.00%	8,376,555	0.07%	0	0.00%	6,307,511	0.04%	14,684,066	0.04%
33801	0	0.00%	1,086,050	0.01%	0	0.00%	29,445,989	0.20%	30,532,039	0.08%
33802	0	0.00%	0	0.00%	0	0.00%	0	0.00%	568,695	0.00%
33803	0	0.00%	1,894,344	0.02%	0	0.00%	54,275,638	0.38%	56,169,982	0.16%
33805	0	0.00%	932,306	0.01%	0	0.00%	19,170,104	0.13%	20,102,409	0.06%
33809	0	0.00%	20,783,768	0.16%	0	0.00%	46,573,640	0.32%	67,357,464	0.19%
33810	0	0.00%	30,445,006	0.24%	0	0.00%	57,275,003	0.40%	87,720,009	0.24%
33811	0	0.00%	723,666	0.01%	0	0.00%	34,153,892	0.24%	34,877,558	0.10%
33812	0	0.00%	851,052	0.01%	0	0.00%	22,549,568	0.16%	23,400,620	0.07%
33813	0	0.00%	871,773	0.01%	0	0.00%	83,740,129	0.58%	84,611,902	0.24%
33815	0	0.00%	0	0.00%	0	0.00%	4,950,199	0.03%	5,006,997	0.01%
33820	0	0.00%	0	0.00%	0	0.00%	0	0.00%	505,287	0.00%
33823	19,165,599	0.23%	0	0.00%	0	0.00%	38,372,750	0.27%	57,851,814	0.16%
33825	45,881,815	0.56%	13,395,987	0.11%	0	0.00%	35,794,467	0.25%	95,072,269	0.26%
33827	9,484,887	0.12%	4,168,090	0.03%	0	0.00%	6,886,355	0.05%	20,539,331	0.06%
33830	22,975,872	0.28%	0	0.00%	0	0.00%	31,248,252	0.22%	54,437,649	0.15%
33834	4,563,374	0.06%	0	0.00%	0	0.00%	2,963,847	0.02%	7,549,074	0.02%
33835	0	0.00%	0	0.00%	0	0.00%	0	0.00%	971,913	0.00%
33837	43,668,715	0.53%	24,279,628	0.19%	0	0.00%	37,151,502	0.26%	105,099,844	0.29%
33838	6,366,236	0.08%	2,267,966	0.02%	0	0.00%	5,054,373	0.04%	13,688,575	0.04%
33839	3,884,078	0.05%	2,022,491	0.02%	0	0.00%	3,924,017	0.03%	9,830,586	0.03%
33841	10,264,933	0.12%	0	0.00%	0	0.00%	7,375,251	0.05%	17,700,918	0.05%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33843	20,572,295	0.25%	4,491,444	0.04%	0	0.00%	11,981,833	0.08%	37,045,572	0.10%
33844	48,328,929	0.59%	21,135,916	0.17%	0	0.00%	48,837,139	0.34%	118,301,984	0.33%
33847	0	0.00%	0	0.00%	0	0.00%	0	0.00%	726,764	0.00%
33848	722,448	0.01%	0	0.00%	0	0.00%	635,019	0.00%	1,583,866	0.00%
33849	0	0.00%	0	0.00%	0	0.00%	0	0.00%	758,653	0.00%
33850	6,813,574	0.08%	0	0.00%	0	0.00%	9,159,683	0.06%	16,036,930	0.04%
33851	1,337,651	0.02%	0	0.00%	0	0.00%	1,115,386	0.01%	2,461,128	0.01%
33852	31,266,909	0.38%	31,486,538	0.25%	0	0.00%	51,540,599	0.36%	114,294,047	0.32%
33853	24,062,504	0.29%	6,175,099	0.05%	0	0.00%	17,330,264	0.12%	47,567,867	0.13%
33854	1,429,128	0.02%	621,517	0.00%	0	0.00%	955,369	0.01%	3,006,015	0.01%
33855	3,150,785	0.04%	1,921,666	0.02%	0	0.00%	3,636,939	0.03%	8,709,391	0.02%
33857	1,002,345	0.01%	2,255,030	0.02%	0	0.00%	3,234,623	0.02%	6,491,999	0.02%
33859	22,938,358	0.28%	6,553,247	0.05%	0	0.00%	13,533,225	0.09%	43,024,830	0.12%
33860	0	0.00%	0	0.00%	0	0.00%	17,409,037	0.12%	17,871,171	0.05%
33865	1,213,841	0.01%	0	0.00%	0	0.00%	606,450	0.00%	1,827,047	0.01%
33867	0	0.00%	0	0.00%	0	0.00%	0	0.00%	768,948	0.00%
33868	0	0.00%	5,248,497	0.04%	0	0.00%	9,866,080	0.07%	15,114,577	0.04%
33870	34,238,952	0.42%	13,148,681	0.10%	0	0.00%	34,577,928	0.24%	81,965,561	0.23%
33872	30,447,303	0.37%	12,728,101	0.10%	0	0.00%	30,763,221	0.21%	73,938,625	0.21%
33873	18,890,579	0.23%	0	0.00%	0	0.00%	11,575,118	0.08%	30,547,291	0.08%
33875	20,652,555	0.25%	10,192,121	0.08%	0	0.00%	25,312,807	0.18%	56,157,483	0.16%
33876	7,367,699	0.09%	7,417,929	0.06%	0	0.00%	14,070,759	0.10%	28,856,387	0.08%
33877	500,051	0.01%	0	0.00%	0	0.00%	0	0.00%	1,044,524	0.00%
33880	31,791,262	0.39%	1,121,320	0.01%	0	0.00%	43,172,985	0.30%	76,085,567	0.21%
33881	40,423,627	0.49%	19,665,650	0.16%	0	0.00%	49,703,246	0.34%	109,792,523	0.31%
33884	87,841,638	1.07%	32,407,028	0.26%	0	0.00%	77,373,784	0.54%	197,622,451	0.55%
33890	10,505,459	0.13%	0	0.00%	0	0.00%	3,890,735	0.03%	14,458,604	0.04%
33896	22,386,323	0.27%	3,590,005	0.03%	0	0.00%	22,565,284	0.16%	48,541,611	0.13%
33897	0	0.00%	0	0.00%	0	0.00%	27,945,239	0.19%	28,373,571	0.08%
33898	46,322,864	0.56%	11,107,761	0.09%	0	0.00%	29,670,416	0.21%	87,101,040	0.24%
33901	34,055,707	0.41%	0	0.00%	0	0.00%	0	0.00%	34,055,707	0.09%
33903	55,059,761	0.67%	0	0.00%	0	0.00%	0	0.00%	55,059,761	0.15%
33904	144,184,757	1.75%	0	0.00%	0	0.00%	0	0.00%	144,184,757	0.40%
33905	37,915,618	0.46%	0	0.00%	0	0.00%	0	0.00%	37,915,618	0.11%
33907	35,451,212	0.43%	0	0.00%	0	0.00%	0	0.00%	35,451,212	0.10%
33908	135,561,622	1.65%	0	0.00%	0	0.00%	0	0.00%	135,561,622	0.38%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
33909	51,109,981	0.62%	0	0.00%	0	0.00%	0	0.00%	51,109,981	0.14%
33912	62,226,926	0.76%	0	0.00%	0	0.00%	0	0.00%	62,226,926	0.17%
33913	53,273,425	0.65%	0	0.00%	0	0.00%	0	0.00%	53,273,425	0.15%
33914	158,250,698	1.92%	0	0.00%	0	0.00%	0	0.00%	158,250,698	0.44%
33916	17,767,325	0.22%	0	0.00%	0	0.00%	0	0.00%	17,767,325	0.05%
33917	59,273,612	0.72%	0	0.00%	0	0.00%	0	0.00%	59,273,715	0.16%
33919	110,753,989	1.34%	0	0.00%	0	0.00%	0	0.00%	110,753,989	0.31%
33920	8,262,450	0.10%	0	0.00%	0	0.00%	0	0.00%	8,474,386	0.02%
33921	51,808,978	0.63%	16,462,284	0.13%	0	0.00%	21,573,528	0.15%	89,844,789	0.25%
33922	25,917,584	0.31%	0	0.00%	0	0.00%	0	0.00%	25,917,584	0.07%
33924	48,703,187	0.59%	8,374,521	0.07%	0	1.46%	6,475,116	0.04%	63,552,825	0.18%
33928	51,447,603	0.62%	0	0.00%	0	0.00%	0	0.00%	51,447,603	0.14%
33931	55,038,236	0.67%	9,125,644	0.07%	0	0.00%	0	0.00%	64,163,881	0.18%
33935	0	0.00%	0	0.00%	0	0.00%	6,733,035	0.05%	6,843,373	0.02%
33936	15,182,974	0.18%	0	0.00%	0	0.00%	0	0.00%	15,182,974	0.04%
33946	18,463,491	0.22%	2,052,467	0.02%	0	0.54%	8,829,556	0.06%	29,345,514	0.08%
33947	30,258,399	0.37%	0	0.00%	0	0.00%	679,263	0.00%	30,937,662	0.09%
33948	59,741,804	0.73%	0	0.00%	0	0.00%	0	0.00%	59,741,804	0.17%
33950	162,344,890	1.97%	0	0.00%	0	0.00%	9,302,198	0.06%	171,647,089	0.48%
33952	101,600,926	1.23%	0	0.00%	0	0.00%	0	0.00%	101,600,926	0.28%
33953	17,190,097	0.21%	0	0.00%	0	0.00%	0	0.00%	17,190,097	0.05%
33954	34,737,764	0.42%	0	0.00%	0	0.00%	0	0.00%	34,828,029	0.10%
33955	68,901,890	0.84%	0	0.00%	0	6.43%	0	0.00%	68,901,890	0.19%
33956	28,727,763	0.35%	0	0.00%	0	0.00%	0	0.00%	28,828,348	0.08%
33957	106,857,662	1.30%	3,907,828	0.03%	0	0.00%	0	0.00%	110,765,490	0.31%
33960	0	0.00%	578,806	0.00%	0	4.90%	761,334	0.01%	1,727,907	0.00%
33966	24,603,906	0.30%	0	0.00%	0	0.00%	0	0.00%	24,603,906	0.07%
33967	31,672,907	0.38%	0	0.00%	0	0.00%	0	0.00%	31,672,907	0.09%
33971	18,652,417	0.23%	0	0.00%	0	0.00%	0	0.00%	18,652,417	0.05%
33972	9,465,713	0.11%	0	0.00%	0	0.00%	0	0.00%	9,648,538	0.03%
33973	4,685,111	0.06%	0	0.00%	0	0.00%	0	0.00%	4,685,111	0.01%
33974	9,300,504	0.11%	0	0.00%	0	0.00%	0	0.00%	9,300,504	0.03%
33976	8,367,056	0.10%	0	0.00%	0	2.34%	0	0.00%	8,367,056	0.02%
33980	42,700,958	0.52%	0	0.00%	0	0.00%	0	0.00%	42,700,958	0.12%
33981	29,678,396	0.36%	0	0.00%	0	0.00%	0	0.00%	29,678,396	0.08%
33982	37,478,053	0.46%	0	0.00%	0	0.00%	7,413,096	0.05%	44,891,309	0.12%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
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33983	84,669,411	1.03%	0	0.00%	0	5.54%	2,629,504	0.02%	87,298,915	0.24%
33990	86,500,589	1.05%	0	0.00%	0	0.00%	0	0.00%	86,500,589	0.24%
33991	58,868,020	0.71%	0	0.00%	0	0.00%	0	0.00%	58,868,020	0.16%
33993	52,071,920	0.63%	0	0.00%	0	0.00%	0	0.00%	52,071,920	0.14%
34102	0	0.00%	56,207,832	0.44%	0	0.00%	0	0.00%	56,207,832	0.16%
34103	0	0.00%	36,389,029	0.29%	0	8.09%	11,368,727	0.08%	47,757,763	0.13%
34105	0	0.00%	9,645,175	0.08%	0	0.00%	0	0.00%	9,645,175	0.03%
34108	0	0.00%	60,875,747	0.48%	0	0.00%	0	0.00%	60,875,748	0.17%
34109	0	0.00%	9,216,606	0.07%	0	0.00%	0	0.00%	9,216,606	0.03%
34110	16,860,536	0.20%	16,904,822	0.13%	0	0.00%	0	0.00%	33,765,357	0.09%
34134	53,465,726	0.65%	53,780,240	0.43%	0	0.00%	0	0.00%	107,245,967	0.30%
34135	13,879,271	0.17%	0	0.00%	0	0.00%	0	0.00%	13,881,466	0.04%
34145	0	0.00%	36,080,996	0.29%	0	0.00%	0	0.00%	36,124,049	0.10%
34202	0	0.00%	0	0.00%	0	0.00%	4,056,063	0.03%	4,056,063	0.01%
34205	0	0.00%	4,542,537	0.04%	0	0.00%	0	0.00%	4,542,720	0.01%
34207	0	0.00%	14,275,919	0.11%	0	0.00%	0	0.00%	14,275,919	0.04%
34208	0	0.00%	0	0.00%	0	0.00%	771,857	0.01%	771,857	0.00%
34209	0	0.00%	11,458,583	0.09%	0	0.00%	0	0.00%	11,458,583	0.03%
34210	0	0.00%	19,283,353	0.15%	0	0.00%	0	0.00%	19,283,353	0.05%
34212	0	0.00%	0	0.00%	0	0.00%	3,684,746	0.03%	3,684,746	0.01%
34215	0	0.00%	2,330,238	0.02%	0	0.00%	1,841,167	0.01%	4,171,405	0.01%
34216	0	0.00%	6,597,756	0.05%	0	0.00%	0	0.00%	6,634,553	0.02%
34217	0	0.00%	31,249,829	0.25%	0	0.00%	3,621,047	0.03%	34,870,876	0.10%
34219	0	0.00%	0	0.00%	0	0.00%	28,308,865	0.20%	28,619,669	0.08%
34221	0	0.00%	3,947,841	0.03%	0	0.00%	3,939,454	0.03%	7,887,294	0.02%
34223	37,247,717	0.45%	3,093,153	0.02%	0	0.00%	0	0.00%	40,340,870	0.11%
34224	36,255,784	0.44%	0	0.00%	0	0.00%	0	0.00%	36,593,293	0.10%
34228	0	0.00%	62,490,630	0.49%	0	0.00%	10,186,863	0.07%	72,677,493	0.20%
34229	0	0.00%	18,855,035	0.15%	0	0.00%	0	0.00%	18,855,035	0.05%
34231	0	0.00%	38,891,428	0.31%	0	0.00%	0	0.00%	38,891,428	0.11%
34234	0	0.00%	1,353,783	0.01%	0	0.00%	0	0.00%	1,353,783	0.00%
34236	0	0.00%	28,792,139	0.23%	0	0.00%	0	0.00%	28,792,139	0.08%
34238	0	0.00%	7,123,678	0.06%	0	0.00%	0	0.00%	7,123,678	0.02%
34239	0	0.00%	1,414,645	0.01%	0	0.00%	0	0.00%	1,414,645	0.00%
34242	0	0.00%	35,873,777	0.28%	0	5.67%	0	0.00%	35,873,777	0.10%
34250	0	0.00%	756,373	0.01%	0	0.00%	0	0.00%	765,552	0.00%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
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34251	0	0.00%	0	0.00%	0	0.00%	5,620,351	0.04%	5,620,351	0.02%
34266	55,572,858	0.67%	0	0.00%	0	0.00%	15,633,979	0.11%	71,206,851	0.20%
34269	24,585,808	0.30%	0	0.00%	0	0.00%	4,844,532	0.03%	29,430,340	0.08%
34275	0	0.00%	2,711,118	0.02%	0	0.00%	0	0.00%	2,711,118	0.01%
34285	6,318,033	0.08%	6,334,261	0.05%	0	0.00%	0	0.00%	12,652,294	0.04%
34286	32,784,187	0.40%	0	0.00%	0	0.00%	0	0.00%	32,940,809	0.09%
34287	30,549,469	0.37%	0	0.00%	0	0.00%	0	0.00%	30,549,469	0.08%
34288	23,710,421	0.29%	0	0.00%	0	0.00%	0	0.00%	24,210,105	0.07%
34289	4,631,286	0.06%	0	0.00%	0	0.00%	0	0.00%	5,066,310	0.01%
34291	7,892,406	0.10%	0	0.00%	0	0.00%	0	0.00%	7,892,406	0.02%
34293	52,213,454	0.63%	0	0.00%	0	0.00%	0	0.00%	52,219,144	0.15%
34420	0	0.00%	9,293,323	0.07%	0	0.00%	14,196,990	0.10%	23,490,313	0.07%
34428	0	0.00%	13,190,663	0.10%	0	0.00%	6,569,557	0.05%	19,760,220	0.05%
34429	0	0.00%	14,128,117	0.11%	0	0.00%	14,171,818	0.10%	28,299,935	0.08%
34431	0	0.00%	15,295,675	0.12%	0	0.00%	11,420,290	0.08%	26,715,965	0.07%
34432	0	0.00%	17,236,636	0.14%	0	0.00%	17,296,958	0.12%	34,533,594	0.10%
34433	0	0.00%	9,470,629	0.07%	0	0.00%	7,431,999	0.05%	16,902,628	0.05%
34434	0	0.00%	13,859,414	0.11%	0	0.00%	10,905,342	0.08%	24,764,756	0.07%
34436	0	0.00%	7,924,434	0.06%	0	0.00%	7,952,242	0.06%	15,876,676	0.04%
34442	0	0.00%	33,071,304	0.26%	0	0.00%	26,323,795	0.18%	59,395,099	0.17%
34446	0	0.00%	26,361,361	0.21%	0	0.00%	17,840,845	0.12%	44,202,206	0.12%
34448	0	0.00%	14,680,661	0.12%	0	0.00%	10,895,625	0.08%	25,576,286	0.07%
34449	0	0.00%	1,904,907	0.02%	0	0.00%	1,480,155	0.01%	3,385,062	0.01%
34450	0	0.00%	15,887,234	0.13%	0	0.00%	15,939,301	0.11%	31,826,534	0.09%
34452	0	0.00%	15,289,645	0.12%	0	0.00%	15,343,664	0.11%	30,633,309	0.09%
34453	0	0.00%	16,776,096	0.13%	0	0.00%	12,885,934	0.09%	29,662,030	0.08%
34461	0	0.00%	16,164,363	0.13%	0	0.00%	16,220,612	0.11%	32,384,975	0.09%
34465	0	0.00%	29,490,059	0.23%	0	0.00%	19,127,312	0.13%	48,617,371	0.14%
34470	0	0.00%	11,212,660	0.09%	0	0.00%	11,248,669	0.08%	22,461,328	0.06%
34471	0	0.00%	24,028,825	0.19%	0	0.00%	40,008,341	0.28%	64,037,166	0.18%
34472	0	0.00%	19,525,979	0.15%	0	0.00%	28,943,402	0.20%	48,469,381	0.13%
34473	0	0.00%	19,180,153	0.15%	0	0.00%	19,247,556	0.13%	38,427,709	0.11%
34474	0	0.00%	11,754,951	0.09%	0	0.00%	11,789,131	0.08%	23,544,082	0.07%
34475	0	0.00%	3,751,916	0.03%	0	0.00%	5,654,842	0.04%	9,406,759	0.03%
34476	0	0.00%	35,363,408	0.28%	0	0.00%	35,487,575	0.25%	70,850,983	0.20%
34479	0	0.00%	8,289,059	0.07%	0	0.00%	13,550,695	0.09%	21,839,754	0.06%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
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34480	0	0.00%	18,357,004	0.15%	0	0.00%	26,721,760	0.19%	45,078,764	0.13%
34481	0	0.00%	26,547,698	0.21%	0	0.00%	26,636,576	0.18%	53,184,274	0.15%
34482	0	0.00%	22,820,137	0.18%	0	0.00%	22,899,006	0.16%	45,719,143	0.13%
34484	0	0.00%	5,574,328	0.04%	0	0.00%	5,591,109	0.04%	11,165,438	0.03%
34488	0	0.00%	0	0.00%	0	0.00%	4,050,965	0.03%	4,160,731	0.01%
34491	0	0.00%	36,538,170	0.29%	0	7.04%	36,665,476	0.25%	73,203,647	0.20%
34498	0	0.00%	716,026	0.01%	0	0.00%	0	0.00%	725,290	0.00%
34601	0	0.00%	11,919,759	0.09%	0	0.00%	11,961,454	0.08%	23,881,213	0.07%
34602	0	0.00%	8,346,840	0.07%	0	0.00%	8,376,316	0.06%	16,723,155	0.05%
34604	0	0.00%	9,935,450	0.08%	0	0.00%	7,812,061	0.05%	17,747,511	0.05%
34606	0	0.00%	36,696,625	0.29%	0	0.00%	22,420,310	0.16%	59,116,935	0.16%
34607	0	0.00%	13,903,069	0.11%	0	0.00%	8,741,386	0.06%	22,644,455	0.06%
34608	0	0.00%	41,547,470	0.33%	0	0.00%	26,324,145	0.18%	67,871,615	0.19%
34609	0	0.00%	53,627,929	0.42%	0	0.00%	37,320,804	0.26%	90,948,732	0.25%
34610	0	0.00%	10,471,421	0.08%	0	0.00%	7,344,048	0.05%	17,815,468	0.05%
34613	0	0.00%	22,339,750	0.18%	0	0.00%	14,876,228	0.10%	37,215,978	0.10%
34614	0	0.00%	6,484,342	0.05%	0	0.00%	5,400,673	0.04%	11,885,015	0.03%
34637	0	0.00%	8,318,563	0.07%	0	0.00%	8,347,552	0.06%	16,666,115	0.05%
34638	0	0.00%	23,781,070	0.19%	0	0.00%	23,865,126	0.17%	47,646,196	0.13%
34639	0	0.00%	25,188,525	0.20%	0	0.00%	25,277,503	0.18%	50,466,028	0.14%
34652	0	0.00%	19,154,911	0.15%	0	0.00%	30,810,595	0.21%	49,965,505	0.14%
34653	0	0.00%	18,134,539	0.14%	0	0.00%	18,186,554	0.13%	36,321,093	0.10%
34654	0	0.00%	25,450,597	0.20%	0	0.00%	17,978,736	0.12%	43,429,332	0.12%
34655	0	0.00%	45,346,884	0.36%	0	0.00%	45,489,909	0.31%	90,836,793	0.25%
34667	0	0.00%	38,218,995	0.30%	0	0.00%	51,655,959	0.36%	89,874,954	0.25%
34668	0	0.00%	26,105,055	0.21%	0	0.00%	39,888,017	0.28%	65,993,072	0.18%
34669	0	0.00%	11,771,562	0.09%	0	0.00%	8,752,779	0.06%	20,524,341	0.06%
34677	0	0.00%	24,060,943	0.19%	0	0.53%	3,739,254	0.03%	27,800,197	0.08%
34681	0	0.00%	3,055,114	0.02%	0	0.00%	3,065,947	0.02%	6,121,061	0.02%
34683	0	0.00%	37,619,918	0.30%	0	0.00%	37,732,621	0.26%	75,352,539	0.21%
34684	0	0.00%	28,069,289	0.22%	0	0.00%	7,041,944	0.05%	35,111,233	0.10%
34685	0	0.00%	24,273,824	0.19%	0	0.00%	24,341,648	0.17%	48,615,471	0.14%
34688	0	0.00%	14,864,735	0.12%	0	0.00%	14,905,255	0.10%	29,769,990	0.08%
34689	0	0.00%	23,565,383	0.19%	0	0.00%	23,626,908	0.16%	47,192,291	0.13%
34690	0	0.00%	7,055,100	0.06%	0	0.00%	7,080,401	0.05%	14,135,501	0.04%
34691	0	0.00%	11,767,810	0.09%	0	0.00%	18,934,207	0.13%	30,702,017	0.09%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
34695	0	0.00%	17,682,803	0.14%	0	0.00%	0	0.00%	17,685,842	0.05%
34698	0	0.00%	29,269,889	0.23%	0	0.00%	782,932	0.01%	30,052,821	0.08%
34705	0	0.00%	1,347,486	0.01%	0	5.07%	2,018,651	0.01%	3,366,137	0.01%
34711	0	0.00%	62,643,076	0.50%	0	0.00%	103,437,270	0.72%	166,080,346	0.46%
34714	2,225,657	0.03%	2,231,839	0.02%	0	0.00%	23,625,027	0.16%	28,082,523	0.08%
34715	0	0.00%	14,560,726	0.12%	0	2.04%	23,680,413	0.16%	38,241,140	0.11%
34731	0	0.00%	13,235,991	0.10%	0	0.00%	18,034,923	0.12%	31,270,915	0.09%
34734	4,635,705	0.06%	4,668,787	0.04%	0	0.00%	9,148,367	0.06%	18,452,859	0.05%
34736	0	0.00%	15,350,221	0.12%	0	0.00%	23,044,941	0.16%	38,395,162	0.11%
34737	0	0.00%	5,402,451	0.04%	0	0.39%	8,162,147	0.06%	13,564,598	0.04%
34739	523,248	0.01%	1,102,590	0.01%	0	0.00%	1,872,193	0.01%	3,498,032	0.01%
34741	48,627,236	0.59%	20,277,171	0.16%	0	0.00%	35,884,227	0.25%	104,788,634	0.29%
34743	77,586,260	0.94%	24,146,658	0.19%	0	0.00%	63,430,649	0.44%	165,163,567	0.46%
34744	100,504,184	1.22%	36,899,221	0.29%	0	0.00%	81,986,350	0.57%	219,389,755	0.61%
34746	99,819,485	1.21%	41,861,380	0.33%	0	0.00%	80,426,189	0.56%	222,107,054	0.62%
34747	54,970,426	0.67%	43,543,824	0.34%	0	0.00%	66,875,546	0.46%	165,389,796	0.46%
34748	0	0.00%	34,491,573	0.27%	0	0.00%	50,630,563	0.35%	85,122,141	0.24%
34753	0	0.00%	2,772,676	0.02%	0	0.00%	4,481,533	0.03%	7,254,210	0.02%
34756	0	0.00%	4,724,263	0.04%	0	0.00%	8,102,562	0.06%	12,826,825	0.04%
34758	64,815,636	0.79%	27,098,252	0.21%	0	0.00%	52,800,843	0.37%	144,714,731	0.40%
34759	63,756,210	0.77%	30,797,432	0.24%	0	0.00%	50,301,642	0.35%	144,855,284	0.40%
34760	0	0.00%	0	0.00%	0	0.00%	1,978,588	0.01%	1,991,871	0.01%
34761	33,382,994	0.41%	944,850	0.01%	0	0.00%	62,054,550	0.43%	96,382,394	0.27%
34762	0	0.00%	0	0.00%	0	0.00%	1,015,011	0.01%	1,485,416	0.00%
34769	49,513,266	0.60%	15,953,840	0.13%	0	0.00%	39,941,285	0.28%	105,408,391	0.29%
34771	40,423,792	0.49%	18,155,478	0.14%	0	0.00%	35,647,857	0.25%	94,227,126	0.26%
34772	53,468,989	0.65%	23,063,030	0.18%	0	0.00%	43,445,514	0.30%	119,977,533	0.33%
34773	4,006,569	0.05%	3,075,022	0.02%	0	0.00%	4,645,822	0.03%	11,727,413	0.03%
34785	0	0.00%	8,911,471	0.07%	0	0.00%	11,849,623	0.08%	20,761,093	0.06%
34786	88,827,104	1.08%	89,461,437	0.71%	0	0.00%	139,932,147	0.97%	318,220,687	0.88%
34787	1,749,135	0.02%	1,756,691	0.01%	0	0.00%	92,308,486	0.64%	95,814,312	0.27%
34788	0	0.00%	11,993,515	0.09%	0	0.00%	20,108,791	0.14%	32,102,305	0.09%
34797	0	0.00%	1,869,517	0.01%	0	0.00%	4,779,145	0.03%	6,648,662	0.02%
34945	0	0.00%	7,688,202	0.06%	0	0.00%	9,440,636	0.07%	17,128,838	0.05%
34946	0	0.00%	8,288,226	0.07%	0	0.00%	10,222,278	0.07%	18,510,504	0.05%
34947	0	0.00%	8,852,634	0.07%	0	0.00%	9,889,287	0.07%	18,741,921	0.05%

	Hurricane Charley		Hurricane Frances		Hurricane Ivan		Hurricane Jeanne		Total	
ZIP Code	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)	Personal and Commercial Residential Monetary Contribution($)	Percent of Losses (%)
34949	0	0.00%	62,204,269	0.49%	0	0.00%	86,042,382	0.60%	148,246,651	0.41%
34950	0	0.00%	13,997,432	0.11%	0	0.00%	16,172,285	0.11%	30,169,717	0.08%
34951	0	0.00%	32,827,958	0.26%	0	0.00%	38,592,703	0.27%	71,420,661	0.20%
34952	0	0.00%	85,929,218	0.68%	0	4.33%	94,554,549	0.65%	180,483,767	0.50%
34953	0	0.00%	115,476,948	0.91%	0	0.00%	125,036,163	0.87%	240,513,111	0.67%
34956	0	0.00%	4,742,734	0.04%	0	0.00%	4,759,210	0.03%	9,501,944	0.03%
34957	0	0.00%	68,013,208	0.54%	0	0.00%	68,114,941	0.47%	136,128,148	0.38%
34972	0	0.00%	13,122,841	0.10%	0	0.00%	18,437,130	0.13%	31,559,971	0.09%
34974	703,900	0.01%	36,153,630	0.29%	0	0.00%	42,835,326	0.30%	79,692,857	0.22%
34981	0	0.00%	7,345,058	0.06%	0	0.00%	7,369,303	0.05%	14,714,361	0.04%
34982	0	0.00%	48,705,822	0.38%	0	0.00%	45,655,940	0.32%	94,361,762	0.26%
34983	0	0.00%	82,324,365	0.65%	0	0.00%	89,008,398	0.62%	171,332,763	0.48%
34984	0	0.00%	38,076,332	0.30%	0	0.00%	41,240,080	0.29%	79,316,412	0.22%
34986	0	0.00%	71,394,735	0.56%	0	0.00%	77,583,472	0.54%	148,979,186	0.41%
34987	0	0.00%	17,961,285	0.14%	0	0.00%	19,648,178	0.14%	37,609,766	0.10%
34990	0	0.00%	129,058,585	1.02%	0	0.00%	129,441,084	0.90%	258,499,669	0.72%
34994	0	0.00%	41,247,005	0.33%	0	0.00%	41,254,561	0.29%	82,501,566	0.23%
34996	0	0.00%	66,002,036	0.52%	0	0.00%	61,471,709	0.43%	127,473,745	0.35%
34997	0	0.00%	120,816,976	0.95%	0	0.00%	111,180,793	0.77%	231,998,180	0.64%
Total	8,231,489,676		12,638,088,473		665,560,417		14,430,120,801		35,984,143,630	

Appendix G – Form A-4A: Hurricane Output Ranges (2012 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
March 29, 2019

Form A-4A Output Ranges (2012 FHCF Exposure Data)
Loss Costs per $1000 for 0% Deductible
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Alachua	LOW	0.858	0.818	0.982	0.183	0.155	0.247	0.233	1.099
	AVERAGE	0.929	0.938	2.800	0.196	0.184	0.277	0.258	2.274
	HIGH	1.129	1.100	5.156	0.254	0.259	0.289	0.326	3.059
Baker	LOW	0.614	0.618	1.268	0.130	0.123	NA	NA	NA
	AVERAGE	0.666	0.664	1.552	0.135	0.127	NA	NA	NA
	HIGH	0.700	0.678	1.770	0.139	0.131	NA	NA	NA
Bay	LOW	1.236	1.251	2.606	0.331	0.264	0.475	0.457	3.679
	AVERAGE	2.289	2.127	7.143	0.544	0.489	1.378	0.863	7.587
	HIGH	3.261	3.195	18.635	0.976	0.856	1.736	1.078	8.805
Bradford	LOW	0.703	0.697	1.577	0.152	0.135	NA	NA	NA
	AVERAGE	0.837	0.832	2.101	0.183	0.162	NA	NA	NA
	HIGH	1.130	1.135	3.045	0.241	0.272	NA	NA	NA
Brevard	LOW	2.314	1.658	1.833	0.298	0.301	0.522	0.446	3.716
	AVERAGE	3.515	3.296	15.016	0.595	0.615	1.037	1.384	7.733
	HIGH	9.137	7.961	32.791	2.996	2.266	4.088	2.920	14.066
Broward	LOW	2.481	2.520	2.793	0.464	0.476	0.692	0.689	4.607
	AVERAGE	4.589	4.073	23.984	0.985	0.814	1.275	1.477	10.767
	HIGH	9.428	7.736	51.949	4.096	2.172	6.527	3.198	17.937
Calhoun	LOW	1.036	1.013	2.253	0.253	0.227	NA	NA	NA
	AVERAGE	1.104	1.076	2.823	0.261	0.262	NA	NA	NA
	HIGH	1.165	1.219	3.114	0.290	0.318	NA	NA	NA

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Charlotte	LOW	3.118	3.042	7.162	0.423	0.424	0.596	0.727	4.950
	AVERAGE	3.758	3.363	10.961	0.535	0.474	1.116	0.782	5.496
	HIGH	4.696	4.570	30.962	0.838	0.572	1.483	1.246	7.351
Citrus	LOW	1.962	1.218	4.629	0.243	0.248	0.321	0.324	3.011
	AVERAGE	2.145	1.942	5.580	0.284	0.266	0.506	0.488	3.423
	HIGH	2.465	2.407	8.001	0.333	0.302	0.541	0.553	3.957
Clay	LOW	0.700	0.682	1.915	0.139	0.134	0.188	0.176	1.621
	AVERAGE	0.772	0.765	2.231	0.162	0.151	0.215	0.196	1.775
	HIGH	0.944	1.027	4.095	0.198	0.184	0.233	0.239	2.147
Collier	LOW	2.616	2.381	2.479	0.497	0.433	0.585	0.578	5.193
	AVERAGE	4.405	3.982	18.677	0.732	0.657	1.127	1.091	6.987
	HIGH	7.555	6.355	42.734	1.038	1.422	1.991	1.540	11.004
Columbia	LOW	0.768	0.760	1.656	0.159	0.140	0.222	0.225	1.744
	AVERAGE	0.816	0.802	1.991	0.172	0.162	0.239	0.230	1.744
	HIGH	0.881	0.861	2.270	0.190	0.177	0.247	0.241	1.744
De Soto	LOW	2.201	2.694	2.130	0.415	0.430	0.792	0.826	5.261
	AVERAGE	3.266	3.233	8.223	0.457	0.444	0.803	0.828	5.796
	HIGH	3.642	3.413	13.533	0.515	0.495	0.807	0.828	5.808
Dixie	LOW	1.040	1.016	3.008	0.234	0.196	0.270	0.277	2.309
	AVERAGE	1.182	1.041	3.251	0.240	0.227	0.430	0.386	3.733
	HIGH	2.189	1.889	12.678	0.242	0.227	0.513	0.486	4.134

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Duval	LOW	0.571	0.587	0.732	0.139	0.125	0.174	0.145	1.388
	AVERAGE	0.832	0.797	2.164	0.180	0.168	0.232	0.252	2.241
	HIGH	1.695	1.577	5.966	0.463	0.360	0.529	0.439	4.707
Escambia	LOW	1.566	1.565	2.964	0.371	0.352	0.462	0.438	4.545
	AVERAGE	2.500	2.467	9.417	0.671	0.636	1.144	1.018	7.866
	HIGH	4.267	3.288	18.004	2.551	1.428	2.184	2.776	8.399
Flagler	LOW	1.480	1.415	3.532	0.216	0.207	0.472	0.262	2.272
	AVERAGE	2.123	1.717	6.968	0.366	0.270	0.628	0.456	3.520
	HIGH	3.543	3.902	10.292	0.896	0.668	1.319	1.017	6.823
Franklin	LOW	2.039	1.782	6.550	0.643	0.412	0.540	0.472	6.218
	AVERAGE	2.367	2.288	9.483	0.726	0.474	0.825	0.665	6.218
	HIGH	2.536	2.535	12.096	0.770	0.690	1.403	0.860	6.218
Gadsden	LOW	0.627	0.652	1.415	0.152	0.140	NA	0.167	1.737
	AVERAGE	0.751	0.754	2.006	0.167	0.158	NA	0.167	1.807
	HIGH	1.063	1.063	4.224	0.250	0.170	NA	0.167	2.161
Gilchrist	LOW	0.918	0.905	2.249	0.191	0.164	NA	0.298	NA
	AVERAGE	1.023	1.008	2.831	0.239	0.217	NA	0.298	NA
	HIGH	1.069	1.053	3.133	0.245	0.227	NA	0.298	NA
Glades	LOW	3.021	2.337	8.705	0.608	0.612	NA	NA	NA
	AVERAGE	4.363	3.815	13.030	0.608	0.612	NA	NA	NA
	HIGH	4.405	3.834	13.180	0.608	0.612	NA	NA	NA

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Gulf	LOW	1.309	1.353	1.879	0.295	0.289	0.540	0.450	4.517
	AVERAGE	1.766	1.796	5.626	0.468	0.442	0.540	0.452	4.517
	HIGH	1.862	1.938	8.919	0.496	0.465	0.540	0.612	4.517
Hamilton	LOW	0.562	0.555	1.313	0.124	0.087	NA	NA	NA
	AVERAGE	0.621	0.620	1.388	0.139	0.125	NA	NA	NA
	HIGH	0.666	0.661	1.494	0.142	0.128	NA	NA	NA
Hardee	LOW	2.885	2.872	6.978	0.395	0.389	NA	0.688	3.788
	AVERAGE	3.055	2.940	7.754	0.423	0.409	NA	0.688	3.819
	HIGH	3.472	3.186	8.182	0.560	0.468	NA	0.688	4.089
Hendry	LOW	3.334	3.109	7.187	0.398	0.494	0.902	0.843	6.787
	AVERAGE	3.841	3.624	12.042	0.680	0.572	1.083	0.930	6.787
	HIGH	4.510	4.203	13.847	0.790	0.635	1.148	0.946	6.787
Hernando	LOW	1.959	1.561	4.961	0.266	0.249	0.483	0.379	3.103
	AVERAGE	2.189	2.017	6.670	0.288	0.274	0.563	0.526	3.464
	HIGH	4.350	2.569	8.747	0.328	0.326	0.607	0.854	3.662
Highlands	LOW	2.726	2.716	6.857	0.377	0.365	0.602	0.663	4.732
	AVERAGE	3.139	3.009	9.845	0.433	0.399	0.700	0.708	5.103
	HIGH	3.969	3.629	15.823	0.808	0.531	0.898	0.753	6.201
Hillsborough	LOW	1.617	1.466	1.712	0.298	0.271	0.415	0.396	3.451
	AVERAGE	2.629	2.638	8.418	0.356	0.348	0.585	0.596	4.171
	HIGH	3.587	3.782	14.142	0.566	0.442	0.988	0.924	6.355

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Holmes	LOW	1.025	1.115	3.576	0.282	0.273	0.402	NA	2.831
	AVERAGE	1.245	1.232	3.611	0.283	0.273	0.402	NA	2.831
	HIGH	1.262	1.254	4.269	0.285	0.273	0.402	NA	2.831
Indian River	LOW	2.195	2.235	8.475	0.352	0.403	0.855	0.651	5.227
	AVERAGE	4.849	4.153	15.471	1.625	1.206	1.884	2.018	10.570
	HIGH	8.759	6.852	51.145	2.928	2.046	3.940	2.877	13.974
Jackson	LOW	0.846	0.831	1.888	0.202	0.153	NA	0.250	2.069
	AVERAGE	0.997	0.996	2.691	0.221	0.213	NA	0.304	2.456
	HIGH	1.205	1.209	3.633	0.276	0.270	NA	0.434	2.612
Jefferson	LOW	0.680	0.657	1.556	0.128	0.138	0.208	NA	NA
	AVERAGE	0.687	0.680	1.741	0.148	0.140	0.208	NA	NA
	HIGH	0.803	0.761	2.102	0.148	0.163	0.208	NA	NA
Lafayette	LOW	0.820	0.832	0.816	0.197	0.159	0.320	NA	NA
	AVERAGE	0.841	0.832	2.240	0.197	0.159	0.320	NA	NA
	HIGH	0.841	0.855	2.246	0.197	0.159	0.320	NA	NA
Lake	LOW	1.487	1.435	3.942	0.197	0.192	0.366	0.338	2.662
	AVERAGE	1.969	1.883	6.105	0.272	0.257	0.468	0.453	3.193
	HIGH	2.484	2.393	8.732	0.364	0.379	0.566	0.513	3.758
Lee	LOW	2.079	2.042	2.325	0.389	0.371	0.606	0.543	4.411
	AVERAGE	4.345	3.195	16.663	0.618	0.500	1.082	0.873	6.817
	HIGH	6.882	6.152	28.553	1.712	1.697	2.349	1.959	13.780

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Leon	LOW	0.743	0.686	0.827	0.143	0.134	0.191	0.187	1.586
	AVERAGE	0.777	0.766	2.385	0.165	0.153	0.214	0.210	1.771
	HIGH	0.891	0.848	3.455	0.194	0.177	0.242	0.261	2.110
Levy	LOW	0.955	0.788	2.644	0.234	0.171	0.770	0.671	2.954
	AVERAGE	1.333	1.197	3.715	0.354	0.260	0.770	0.671	4.842
	HIGH	2.230	2.117	8.045	0.843	1.173	0.770	0.671	4.979
Liberty	LOW	0.900	0.778	2.333	0.223	0.219	NA	NA	NA
	AVERAGE	1.012	1.010	2.633	0.234	0.219	NA	NA	NA
	HIGH	1.015	1.015	2.867	0.235	0.219	NA	NA	NA
Madison	LOW	0.568	0.562	1.476	0.124	0.103	NA	NA	NA
	AVERAGE	0.668	0.656	1.658	0.143	0.133	NA	NA	NA
	HIGH	0.686	0.667	1.793	0.149	0.144	NA	NA	NA
Manatee	LOW	2.405	1.884	1.929	0.389	0.315	0.488	0.504	4.228
	AVERAGE	3.377	2.861	12.559	0.521	0.509	1.060	1.130	7.263
	HIGH	6.918	5.344	32.074	1.380	1.180	2.090	1.684	10.271
Marion	LOW	1.151	1.081	1.183	0.184	0.173	0.265	0.279	2.455
	AVERAGE	1.488	1.428	4.612	0.224	0.214	0.337	0.363	2.700
	HIGH	2.070	1.894	6.533	0.264	0.245	0.416	0.442	4.162
Martin	LOW	3.972	3.490	16.535	0.653	0.493	0.829	1.307	7.256
	AVERAGE	6.725	5.490	31.338	2.255	1.356	3.098	2.228	11.784
	HIGH	8.980	7.560	41.375	3.561	4.373	3.852	3.438	14.390

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Miami-Dade	LOW	2.595	2.423	3.007	0.448	0.487	0.666	0.634	2.225
	AVERAGE	4.876	4.400	19.225	1.872	1.260	2.584	2.059	13.043
	HIGH	10.083	9.048	41.089	5.467	3.266	4.782	4.221	24.446
Monroe	LOW	6.339	5.660	47.263	1.577	1.168	3.141	1.875	19.442
	AVERAGE	7.679	7.187	61.503	2.980	1.725	3.261	2.635	22.804
	HIGH	11.902	9.303	80.183	6.387	3.141	7.614	3.813	31.000
Nassau	LOW	0.529	0.524	1.224	0.112	0.102	0.311	0.132	1.499
	AVERAGE	0.875	0.822	1.992	0.220	0.195	0.311	0.303	2.658
	HIGH	1.011	0.992	3.950	0.236	0.208	0.311	0.304	2.666
Okaloosa	LOW	1.383	1.389	2.389	0.357	0.320	0.401	0.690	3.541
	AVERAGE	2.810	2.701	7.120	0.830	0.762	1.470	1.384	9.082
	HIGH	4.347	4.206	22.793	2.263	1.662	2.077	1.985	9.981
Okeechobee	LOW	3.482	3.211	10.621	0.509	0.500	0.775	0.764	4.975
	AVERAGE	3.871	3.562	14.566	0.595	0.542	0.775	0.903	5.619
	HIGH	4.633	3.776	18.499	0.695	0.570	0.775	0.923	5.627
Orange	LOW	1.289	1.269	1.343	0.239	0.207	0.317	0.334	2.512
	AVERAGE	1.989	1.999	5.838	0.281	0.269	0.447	0.433	3.094
	HIGH	2.346	2.739	10.239	0.327	0.308	0.588	0.497	3.538
Osceola	LOW	1.701	1.371	5.641	0.283	0.245	0.412	0.400	3.009
	AVERAGE	1.870	1.863	7.117	0.294	0.281	0.461	0.425	3.079
	HIGH	2.378	2.507	10.321	0.478	0.323	0.492	0.507	4.061

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Palm Beach	LOW	2.897	2.695	2.773	0.613	0.612	0.713	0.661	5.663
	AVERAGE	6.854	5.545	23.089	4.020	1.825	2.426	2.243	12.234
	HIGH	12.979	10.577	49.616	5.408	3.485	6.340	6.376	22.073
Pasco	LOW	1.699	1.665	2.715	0.269	0.252	0.412	0.425	3.030
	AVERAGE	2.224	2.249	7.088	0.320	0.316	0.551	0.558	3.987
	HIGH	2.975	3.186	11.075	0.394	0.359	0.794	0.602	4.781
Pinellas	LOW	1.516	1.475	1.656	0.329	0.285	0.433	0.399	3.789
	AVERAGE	3.484	3.365	10.667	0.436	0.448	0.906	0.898	5.814
	HIGH	5.460	8.253	19.334	1.221	0.865	1.590	1.386	8.417
Polk	LOW	1.450	1.669	1.760	0.267	0.246	0.352	0.338	2.617
	AVERAGE	2.598	2.483	8.067	0.351	0.346	0.531	0.565	3.826
	HIGH	3.671	5.411	18.069	0.524	0.691	1.053	0.931	5.350
Putnam	LOW	0.890	0.860	2.265	0.193	0.186	0.245	0.235	2.391
	AVERAGE	1.015	0.990	3.622	0.226	0.206	0.310	0.266	2.502
	HIGH	1.203	1.165	5.381	0.289	0.245	0.499	0.353	2.541
St. Johns	LOW	0.715	0.719	1.609	0.152	0.146	0.191	0.180	1.439
	AVERAGE	1.111	1.220	3.963	0.301	0.291	0.479	0.486	4.073
	HIGH	1.873	1.715	10.610	0.554	0.435	0.713	0.635	5.209
St. Lucie	LOW	3.755	2.241	10.065	0.518	0.426	0.592	0.581	4.716
	AVERAGE	4.907	3.376	20.873	0.881	0.690	2.051	2.338	10.256
	HIGH	10.442	8.936	37.705	3.858	2.213	4.454	3.296	13.215

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Santa Rosa	LOW	1.702	1.663	1.823	0.402	0.384	0.541	1.045	4.156
	AVERAGE	2.786	2.709	9.549	0.983	0.850	2.377	1.410	9.963
	HIGH	5.285	4.639	33.832	2.322	1.394	2.851	1.526	11.684
Sarasota	LOW	1.898	1.855	2.027	0.420	0.369	0.516	0.485	3.924
	AVERAGE	3.511	3.166	15.853	0.542	0.483	0.909	0.849	5.801
	HIGH	4.725	4.310	22.620	1.002	0.850	1.409	1.212	7.424
Seminole	LOW	1.859	1.724	4.508	0.258	0.218	0.341	0.332	2.706
	AVERAGE	2.094	2.056	6.203	0.274	0.262	0.456	0.443	2.969
	HIGH	3.461	2.869	7.625	0.290	0.277	0.498	0.491	3.247
Sumter	LOW	1.367	1.289	4.272	0.229	0.222	0.373	0.360	2.946
	AVERAGE	1.448	1.451	6.296	0.248	0.248	0.473	0.383	3.309
	HIGH	2.611	2.451	7.969	0.323	0.358	0.636	0.469	3.875
Suwannee	LOW	0.673	0.664	1.638	0.149	0.133	0.220	0.208	1.364
	AVERAGE	0.743	0.733	1.840	0.161	0.146	0.220	0.208	1.708
	HIGH	0.889	0.859	2.416	0.193	0.170	0.220	0.208	2.361
Taylor	LOW	0.757	0.660	2.011	0.173	0.164	0.213	0.320	2.497
	AVERAGE	0.912	0.871	2.550	0.200	0.172	0.325	0.320	2.497
	HIGH	1.311	1.399	4.567	0.258	0.254	0.331	0.320	2.497
Union	LOW	0.829	0.819	0.916	0.180	0.167	0.209	0.198	1.667
	AVERAGE	0.832	0.822	2.055	0.183	0.168	0.209	0.198	1.667
	HIGH	0.917	0.868	3.639	0.192	0.186	0.209	0.198	1.667

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Volusia	LOW	1.172	1.072	1.251	0.185	0.189	0.309	0.332	1.730
	AVERAGE	2.121	1.965	7.222	0.327	0.439	0.692	0.876	5.961
	HIGH	4.587	3.657	22.874	0.893	0.762	1.679	1.258	7.341
Wakulla	LOW	0.829	0.841	2.601	0.178	0.159	0.279	0.593	2.133
	AVERAGE	0.977	0.962	2.873	0.192	0.186	0.401	0.593	4.082
	HIGH	1.787	1.775	8.872	0.390	0.408	0.486	0.593	4.471
Walton	LOW	1.288	1.412	3.677	0.315	0.310	0.485	0.320	3.277
	AVERAGE	2.610	2.360	5.960	0.773	0.781	1.603	1.151	8.271
	HIGH	3.734	3.214	29.653	1.317	1.099	1.925	1.296	9.577
Washington	LOW	1.201	1.200	3.063	0.272	0.226	0.335	NA	2.629
	AVERAGE	1.220	1.227	3.202	0.280	0.259	0.335	NA	2.629
	HIGH	1.436	1.430	4.792	0.324	0.271	0.335	NA	2.629
Statewide	LOW	0.529	0.524	0.732	0.112	0.087	0.174	0.132	1.099
	AVERAGE	2.324	3.206	9.165	0.781	0.764	0.890	1.377	9.200
	HIGH	12.979	10.577	80.183	6.387	4.373	7.614	6.376	31.000

Form A-4A Output Ranges (2012 FHCF Exposure Data)
Loss Costs per $1000 with Specified Deductible
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Alachua	LOW	0.123	0.099	0.216	0.036	0.027	0.034	0.031	0.168
	AVERAGE	0.183	0.189	1.817	0.040	0.037	0.043	0.039	0.520
	HIGH	0.278	0.310	3.877	0.054	0.077	0.047	0.049	0.905
Baker	LOW	0.099	0.102	0.652	0.025	0.023	NA	NA	NA
	AVERAGE	0.111	0.109	0.874	0.026	0.024	NA	NA	NA
	HIGH	0.135	0.121	1.054	0.027	0.025	NA	NA	NA
Bay	LOW	0.250	0.280	1.496	0.072	0.055	0.087	0.070	0.843
	AVERAGE	0.847	0.728	5.530	0.209	0.168	0.756	0.325	3.756
	HIGH	1.554	1.477	16.299	0.553	0.434	1.069	0.482	4.738
Bradford	LOW	0.138	0.135	0.890	0.032	0.027	NA	NA	NA
	AVERAGE	0.174	0.171	1.282	0.039	0.033	NA	NA	NA
	HIGH	0.259	0.263	1.972	0.051	0.074	NA	NA	NA
Brevard	LOW	1.016	0.363	0.509	0.069	0.072	0.098	0.066	1.071
	AVERAGE	1.837	1.639	12.945	0.275	0.289	0.428	0.667	3.868
	HIGH	6.444	5.314	29.773	2.386	1.667	3.016	1.909	8.894
Broward	LOW	0.645	0.673	0.819	0.100	0.105	0.108	0.109	1.092
	AVERAGE	2.239	1.801	21.170	0.527	0.353	0.469	0.600	5.990
	HIGH	6.266	4.630	48.219	3.417	1.559	5.243	2.117	12.423
Calhoun	LOW	0.219	0.204	1.200	0.056	0.048	NA	NA	NA
	AVERAGE	0.246	0.228	1.770	0.058	0.068	NA	NA	NA
	HIGH	0.264	0.272	2.009	0.062	0.100	NA	NA	NA

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Charlotte	LOW	1.330	1.229	5.196	0.095	0.099	0.087	0.120	1.441
	AVERAGE	1.772	1.484	8.822	0.159	0.120	0.347	0.148	1.743
	HIGH	2.398	2.273	27.909	0.366	0.160	0.589	0.402	2.898
Citrus	LOW	0.795	0.244	3.302	0.048	0.051	0.043	0.044	0.657
	AVERAGE	0.900	0.761	4.165	0.062	0.057	0.079	0.073	0.867
	HIGH	1.091	1.101	6.404	0.082	0.066	0.089	0.082	1.098
Clay	LOW	0.110	0.081	1.139	0.026	0.025	0.026	0.023	0.289
	AVERAGE	0.135	0.134	1.396	0.032	0.030	0.031	0.027	0.349
	HIGH	0.271	0.255	2.969	0.042	0.036	0.036	0.034	0.496
Collier	LOW	0.769	0.591	0.689	0.115	0.093	0.084	0.083	1.623
	AVERAGE	2.156	1.818	16.032	0.272	0.220	0.318	0.290	2.604
	HIGH	4.844	3.642	39.301	0.496	0.838	0.991	0.628	5.661
Columbia	LOW	0.137	0.132	0.859	0.032	0.026	0.033	0.033	0.277
	AVERAGE	0.154	0.146	1.169	0.035	0.032	0.035	0.034	0.277
	HIGH	0.187	0.164	1.404	0.038	0.039	0.037	0.036	0.277
De Soto	LOW	0.638	0.983	0.591	0.088	0.094	0.125	0.133	1.554
	AVERAGE	1.445	1.408	6.247	0.113	0.109	0.140	0.157	1.817
	HIGH	1.758	1.506	11.197	0.135	0.130	0.147	0.158	1.823
Dixie	LOW	0.231	0.199	1.965	0.049	0.036	0.038	0.038	0.397
	AVERAGE	0.289	0.217	2.188	0.054	0.054	0.076	0.065	0.882
	HIGH	0.768	0.516	10.699	0.056	0.054	0.097	0.089	1.018

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Duval	LOW	0.082	0.069	0.155	0.027	0.023	0.024	0.019	0.235
	AVERAGE	0.200	0.185	1.408	0.045	0.039	0.042	0.049	0.623
	HIGH	0.682	0.578	4.725	0.220	0.132	0.195	0.123	2.348
Escambia	LOW	0.461	0.461	1.199	0.101	0.092	0.071	0.065	1.556
	AVERAGE	0.965	0.927	7.631	0.281	0.256	0.514	0.411	3.897
	HIGH	2.335	1.504	15.750	1.893	0.926	1.393	1.931	4.289
Flagler	LOW	0.518	0.474	2.491	0.046	0.044	0.093	0.035	0.453
	AVERAGE	0.965	0.666	5.608	0.151	0.080	0.213	0.119	1.220
	HIGH	1.988	2.279	8.621	0.575	0.359	0.745	0.470	3.626
Franklin	LOW	0.705	0.471	4.923	0.293	0.121	0.130	0.081	2.500
	AVERAGE	0.915	0.866	7.705	0.357	0.156	0.345	0.204	2.500
	HIGH	1.026	1.025	10.233	0.387	0.337	0.782	0.314	2.500
Gadsden	LOW	0.083	0.100	0.748	0.030	0.027	NA	0.022	0.312
	AVERAGE	0.144	0.144	1.229	0.034	0.031	NA	0.022	0.337
	HIGH	0.243	0.242	3.068	0.053	0.034	NA	0.022	0.453
Gilchrist	LOW	0.183	0.175	1.356	0.037	0.031	NA	0.045	NA
	AVERAGE	0.212	0.202	1.824	0.051	0.046	NA	0.045	NA
	HIGH	0.224	0.214	2.068	0.053	0.049	NA	0.045	NA
Glades	LOW	1.226	0.753	6.684	0.173	0.167	NA	NA	NA
	AVERAGE	2.118	1.686	10.611	0.173	0.167	NA	NA	NA
	HIGH	2.145	1.697	10.747	0.173	0.167	NA	NA	NA

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Gulf	LOW	0.293	0.326	0.513	0.063	0.075	0.121	0.071	1.440
	AVERAGE	0.491	0.528	4.185	0.154	0.149	0.121	0.072	1.440
	HIGH	0.533	0.594	7.127	0.169	0.161	0.121	0.136	1.440
Hamilton	LOW	0.094	0.090	0.715	0.025	0.015	NA	NA	NA
	AVERAGE	0.113	0.111	0.768	0.029	0.024	NA	NA	NA
	HIGH	0.127	0.124	0.836	0.030	0.025	NA	NA	NA
Hardee	LOW	1.206	1.202	5.101	0.086	0.091	NA	0.090	0.717
	AVERAGE	1.330	1.247	5.853	0.100	0.101	NA	0.090	0.726
	HIGH	1.614	1.392	6.214	0.179	0.116	NA	0.090	0.807
Hendry	LOW	1.433	1.256	5.218	0.077	0.127	0.158	0.155	2.313
	AVERAGE	1.786	1.604	9.734	0.258	0.170	0.289	0.217	2.313
	HIGH	2.240	1.993	11.416	0.335	0.204	0.336	0.228	2.313
Hernando	LOW	0.734	0.424	3.561	0.055	0.048	0.062	0.052	0.635
	AVERAGE	0.888	0.768	5.113	0.062	0.056	0.091	0.078	0.881
	HIGH	2.662	1.083	6.962	0.081	0.070	0.099	0.230	0.991
Highlands	LOW	1.110	1.058	5.043	0.074	0.079	0.086	0.100	1.284
	AVERAGE	1.374	1.274	7.783	0.104	0.091	0.117	0.115	1.469
	HIGH	1.871	1.645	13.280	0.361	0.135	0.191	0.130	1.906
Hillsborough	LOW	0.379	0.320	0.466	0.061	0.052	0.058	0.055	0.789
	AVERAGE	1.158	1.160	6.634	0.087	0.083	0.098	0.100	1.200
	HIGH	1.769	1.959	11.977	0.193	0.128	0.274	0.169	2.637

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Holmes	LOW	0.206	0.268	2.419	0.062	0.063	0.068	NA	0.610
	AVERAGE	0.303	0.295	2.452	0.066	0.063	0.068	NA	0.610
	HIGH	0.312	0.308	3.102	0.067	0.063	0.068	NA	0.610
Indian River	LOW	0.622	0.798	6.680	0.078	0.118	0.232	0.142	1.824
	AVERAGE	2.787	2.184	13.262	1.149	0.757	1.110	1.166	6.033
	HIGH	6.094	4.329	47.702	2.306	1.461	2.910	1.867	8.837
Jackson	LOW	0.178	0.169	1.089	0.040	0.029	NA	0.036	0.367
	AVERAGE	0.218	0.215	1.714	0.047	0.046	NA	0.059	0.507
	HIGH	0.305	0.298	2.495	0.067	0.066	NA	0.117	0.567
Jefferson	LOW	0.123	0.108	0.880	0.023	0.026	0.030	NA	NA
	AVERAGE	0.128	0.124	1.042	0.030	0.028	0.030	NA	NA
	HIGH	0.175	0.150	1.319	0.030	0.032	0.030	NA	NA
Lafayette	LOW	0.170	0.165	0.175	0.044	0.031	0.073	NA	NA
	AVERAGE	0.171	0.165	1.403	0.044	0.031	0.073	NA	NA
	HIGH	0.177	0.199	1.408	0.044	0.031	0.073	NA	NA
Lake	LOW	0.563	0.527	2.785	0.039	0.038	0.050	0.046	0.470
	AVERAGE	0.762	0.684	4.602	0.056	0.052	0.065	0.062	0.706
	HIGH	1.045	1.039	6.921	0.104	0.113	0.084	0.079	0.944
Lee	LOW	0.477	0.456	0.620	0.080	0.074	0.088	0.077	0.964
	AVERAGE	2.140	1.281	14.118	0.212	0.129	0.331	0.193	2.496
	HIGH	4.041	3.537	25.550	1.070	1.051	1.262	0.895	7.906

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Leon	LOW	0.131	0.083	0.178	0.026	0.024	0.026	0.025	0.241
	AVERAGE	0.154	0.146	1.546	0.033	0.030	0.031	0.030	0.361
	HIGH	0.221	0.183	2.487	0.042	0.036	0.039	0.039	0.477
Levy	LOW	0.214	0.096	1.702	0.047	0.031	0.284	0.202	0.685
	AVERAGE	0.344	0.263	2.537	0.123	0.061	0.284	0.202	1.600
	HIGH	0.810	0.710	6.305	0.462	0.756	0.284	0.202	1.666
Liberty	LOW	0.186	0.104	1.375	0.045	0.044	NA	NA	NA
	AVERAGE	0.210	0.210	1.644	0.051	0.044	NA	NA	NA
	HIGH	0.210	0.212	1.917	0.051	0.044	NA	NA	NA
Madison	LOW	0.100	0.097	0.833	0.024	0.018	NA	NA	NA
	AVERAGE	0.128	0.120	0.985	0.029	0.026	NA	NA	NA
	HIGH	0.134	0.124	1.096	0.030	0.028	NA	NA	NA
Manatee	LOW	0.906	0.524	0.514	0.088	0.061	0.071	0.075	1.057
	AVERAGE	1.623	1.231	10.518	0.186	0.179	0.401	0.422	3.272
	HIGH	4.327	2.985	29.104	0.863	0.672	1.141	0.780	5.406
Marion	LOW	0.285	0.199	0.272	0.034	0.032	0.035	0.037	0.453
	AVERAGE	0.473	0.426	3.321	0.044	0.041	0.045	0.049	0.567
	HIGH	0.885	0.754	5.048	0.057	0.049	0.062	0.062	1.410
Martin	LOW	1.960	1.575	14.084	0.259	0.130	0.219	0.464	3.001
	AVERAGE	4.197	3.119	28.409	1.677	0.840	2.060	1.233	6.767
	HIGH	6.144	4.811	38.134	2.864	3.552	2.729	2.161	9.023

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Miami-Dade	LOW	0.730	0.635	1.063	0.095	0.109	0.109	0.100	0.851
	AVERAGE	2.539	2.119	16.752	1.343	0.749	1.676	1.138	8.177
	HIGH	7.087	5.956	37.786	4.681	2.535	3.694	2.998	17.931
Monroe	LOW	3.927	3.223	44.202	1.064	0.640	2.083	0.904	14.329
	AVERAGE	5.064	4.411	58.104	2.344	1.102	2.224	1.527	17.238
	HIGH	8.905	6.210	76.511	5.556	2.394	6.306	2.567	24.907
Nassau	LOW	0.091	0.088	0.685	0.021	0.019	0.070	0.017	0.305
	AVERAGE	0.196	0.176	1.296	0.062	0.049	0.070	0.067	0.789
	HIGH	0.266	0.237	2.967	0.069	0.054	0.070	0.067	0.792
Okaloosa	LOW	0.298	0.344	0.795	0.086	0.070	0.061	0.196	0.906
	AVERAGE	1.245	1.147	5.572	0.430	0.364	0.809	0.718	4.873
	HIGH	2.484	2.321	20.255	1.706	1.120	1.312	1.241	5.467
Okeechobee	LOW	1.556	1.331	8.463	0.140	0.137	0.134	0.132	1.222
	AVERAGE	1.800	1.546	12.100	0.195	0.155	0.134	0.180	1.491
	HIGH	2.260	1.674	15.799	0.259	0.167	0.134	0.186	1.494
Orange	LOW	0.267	0.247	0.322	0.048	0.038	0.043	0.045	0.528
	AVERAGE	0.742	0.756	4.348	0.059	0.054	0.061	0.058	0.717
	HIGH	1.035	1.262	8.311	0.071	0.069	0.080	0.070	0.975
Osceola	LOW	0.511	0.271	4.055	0.055	0.045	0.057	0.053	0.600
	AVERAGE	0.600	0.597	5.423	0.060	0.056	0.064	0.058	0.666
	HIGH	0.804	0.901	8.296	0.144	0.065	0.069	0.071	1.021

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Palm Beach	LOW	0.837	0.683	0.802	0.192	0.176	0.121	0.106	1.649
	AVERAGE	4.151	3.027	20.233	3.265	1.219	1.386	1.190	6.915
	HIGH	9.450	7.320	45.830	4.541	2.677	4.894	4.720	15.458
Pasco	LOW	0.401	0.407	1.361	0.051	0.047	0.057	0.060	0.574
	AVERAGE	0.861	0.884	5.428	0.070	0.070	0.088	0.093	1.103
	HIGH	1.424	1.618	9.149	0.119	0.094	0.195	0.107	1.469
Pinellas	LOW	0.341	0.309	0.414	0.075	0.055	0.063	0.056	0.905
	AVERAGE	1.790	1.692	8.782	0.138	0.142	0.269	0.245	2.435
	HIGH	3.201	5.812	16.915	0.729	0.416	0.709	0.523	4.258
Polk	LOW	0.308	0.359	0.464	0.054	0.048	0.048	0.045	0.443
	AVERAGE	1.091	1.007	6.256	0.078	0.077	0.081	0.086	0.922
	HIGH	1.791	3.035	15.560	0.185	0.243	0.282	0.224	1.780
Putnam	LOW	0.187	0.167	1.401	0.036	0.037	0.034	0.032	0.507
	AVERAGE	0.234	0.219	2.573	0.052	0.045	0.053	0.041	0.577
	HIGH	0.310	0.285	4.134	0.078	0.066	0.152	0.057	0.591
St. Johns	LOW	0.106	0.097	0.820	0.031	0.028	0.026	0.024	0.248
	AVERAGE	0.301	0.337	2.933	0.111	0.100	0.164	0.160	1.679
	HIGH	0.726	0.591	9.017	0.274	0.183	0.310	0.245	2.397
St. Lucie	LOW	1.775	0.584	7.957	0.154	0.100	0.093	0.092	1.144
	AVERAGE	2.704	1.488	18.307	0.455	0.306	1.175	1.407	5.663
	HIGH	7.549	6.064	34.548	3.191	1.599	3.362	2.222	8.065

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Santa Rosa	LOW	0.460	0.431	0.526	0.104	0.089	0.117	0.473	1.392
	AVERAGE	1.204	1.119	7.741	0.557	0.439	1.583	0.732	5.507
	HIGH	3.219	2.604	30.951	1.715	0.869	1.994	0.820	6.907
Sarasota	LOW	0.459	0.436	0.537	0.091	0.077	0.074	0.071	0.828
	AVERAGE	1.680	1.405	13.542	0.188	0.145	0.253	0.211	2.137
	HIGH	2.578	2.218	19.919	0.555	0.416	0.616	0.439	3.271
Seminole	LOW	0.688	0.589	3.177	0.053	0.040	0.047	0.045	0.588
	AVERAGE	0.867	0.840	4.704	0.059	0.055	0.064	0.061	0.730
	HIGH	1.988	1.465	5.989	0.066	0.059	0.072	0.067	0.864
Sumter	LOW	0.333	0.293	2.877	0.044	0.042	0.051	0.049	0.545
	AVERAGE	0.401	0.396	4.747	0.049	0.050	0.071	0.053	0.778
	HIGH	1.139	1.026	6.285	0.070	0.077	0.095	0.066	0.989
Suwannee	LOW	0.119	0.113	0.946	0.030	0.024	0.032	0.028	0.197
	AVERAGE	0.137	0.130	1.090	0.033	0.028	0.032	0.028	0.316
	HIGH	0.180	0.160	1.570	0.041	0.033	0.032	0.028	0.600
Taylor	LOW	0.144	0.078	1.209	0.035	0.033	0.029	0.052	0.451
	AVERAGE	0.194	0.182	1.653	0.043	0.035	0.051	0.052	0.451
	HIGH	0.361	0.429	3.328	0.056	0.061	0.052	0.052	0.451
Union	LOW	0.155	0.140	0.196	0.037	0.034	0.028	0.026	0.248
	AVERAGE	0.156	0.150	1.218	0.037	0.034	0.028	0.026	0.248
	HIGH	0.208	0.167	2.592	0.040	0.037	0.028	0.026	0.248

County	Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masonry Condo Unit	Commercial Residential
Volusia	LOW	0.242	0.205	0.300	0.034	0.035	0.041	0.043	0.414
	AVERAGE	0.896	0.784	5.762	0.106	0.189	0.232	0.338	2.804
	HIGH	2.702	1.886	20.471	0.541	0.422	0.952	0.586	3.751
Wakulla	LOW	0.140	0.150	1.690	0.035	0.029	0.043	0.175	0.438
	AVERAGE	0.205	0.200	1.926	0.040	0.038	0.083	0.175	1.278
	HIGH	0.569	0.555	7.222	0.113	0.129	0.111	0.175	1.450
Walton	LOW	0.249	0.353	2.435	0.071	0.076	0.078	0.046	0.753
	AVERAGE	1.022	0.823	4.456	0.380	0.384	0.917	0.537	4.133
	HIGH	1.870	1.394	26.899	0.821	0.633	1.189	0.649	5.216
Washington	LOW	0.273	0.278	1.957	0.060	0.041	0.048	NA	0.523
	AVERAGE	0.279	0.285	2.064	0.063	0.059	0.048	NA	0.523
	HIGH	0.370	0.379	3.454	0.084	0.060	0.048	NA	0.523
Statewide	LOW	0.082	0.069	0.155	0.021	0.015	0.024	0.017	0.168
	AVERAGE	1.027	1.472	7.447	0.478	0.394	0.362	0.600	4.917
	HIGH	9.450	7.320	76.511	5.556	3.552	6.306	4.720	24.907

Appendix H – Form A-4B: Hurricane Output Ranges (2017 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
March 29, 2019

Form A-4B Output Ranges (2017 FHCF Exposure Data)
Loss Cost per $1000 for 0% Deductible
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Alachua	LOW	0.777	0.838	0.917	0.183	0.169	0.219	0.230	0.384
	AVERAGE	0.952	0.996	2.590	0.199	0.188	0.284	0.267	2.299
	HIGH	1.250	1.225	5.490	0.274	0.235	0.301	0.285	2.826
Baker	LOW	0.633	0.643	1.187	0.145	0.127	NA	NA	1.421
	AVERAGE	0.685	0.688	1.609	0.151	0.140	NA	NA	1.421
	HIGH	0.743	0.696	1.880	0.159	0.144	NA	NA	1.421
Bay	LOW	1.230	1.334	3.140	0.336	0.272	0.451	0.448	4.168
	AVERAGE	2.346	2.403	8.010	0.591	0.523	1.323	0.847	7.330
	HIGH	3.236	3.586	20.828	0.962	0.793	1.714	0.920	9.581
Bradford	LOW	0.709	0.705	1.613	0.160	0.131	NA	NA	NA
	AVERAGE	0.854	0.860	2.083	0.198	0.169	NA	NA	NA
	HIGH	1.136	1.162	2.751	0.297	0.305	NA	NA	NA
Brevard	LOW	2.448	1.927	2.307	0.317	0.245	0.478	0.422	3.455
	AVERAGE	4.011	3.808	13.469	0.680	0.731	1.088	1.374	7.621
	HIGH	10.232	8.273	30.871	3.994	2.326	3.922	3.744	15.318
Broward	LOW	2.463	2.447	2.557	0.578	0.546	0.689	0.698	0.865
	AVERAGE	6.354	5.213	20.745	1.012	1.049	1.719	1.861	9.897
	HIGH	16.088	12.581	39.663	3.451	2.768	4.967	3.781	19.172
Calhoun	LOW	1.044	1.026	2.825	0.187	0.233	NA	NA	NA
	AVERAGE	1.149	1.143	2.994	0.219	0.234	NA	NA	NA
	HIGH	1.252	1.351	3.095	0.291	0.255	NA	NA	NA

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Charlotte	LOW	3.660	3.281	2.087	0.441	0.474	0.599	0.721	2.129
	AVERAGE	4.348	3.905	8.360	0.576	0.539	1.195	0.850	5.479
	HIGH	5.564	5.288	30.476	0.953	0.939	1.673	1.619	7.549
Citrus	LOW	2.183	2.029	3.883	0.262	0.271	0.470	0.342	2.816
	AVERAGE	2.550	2.244	4.871	0.304	0.291	0.577	0.541	3.540
	HIGH	3.060	2.788	6.502	0.466	0.344	0.647	0.661	4.380
Clay	LOW	0.712	0.686	0.813	0.141	0.131	0.190	0.175	1.605
	AVERAGE	0.797	0.818	2.048	0.167	0.159	0.219	0.202	1.775
	HIGH	0.999	1.007	3.928	0.218	0.212	0.259	0.251	2.780
Collier	LOW	2.579	2.193	5.556	0.540	0.503	0.586	0.577	1.194
	AVERAGE	5.213	4.367	13.915	0.724	0.706	1.328	1.283	6.547
	HIGH	10.712	9.531	45.710	2.414	2.244	3.596	2.779	13.619
Columbia	LOW	0.643	0.608	0.922	0.105	0.145	0.252	0.237	1.711
	AVERAGE	0.834	0.831	1.841	0.182	0.168	0.259	0.242	1.711
	HIGH	0.916	0.888	2.003	0.250	0.191	0.270	0.257	1.711
De Soto	LOW	3.747	3.706	7.536	0.512	0.494	0.675	0.751	5.158
	AVERAGE	4.043	3.899	7.732	0.558	0.513	0.858	0.939	5.410
	HIGH	6.209	6.456	16.536	0.635	0.736	0.889	0.942	5.427
Dixie	LOW	1.111	1.045	3.053	0.235	0.244	0.270	0.255	2.536
	AVERAGE	1.260	1.087	3.425	0.250	0.256	0.412	0.361	3.098
	HIGH	2.426	2.078	11.970	0.256	0.367	0.515	0.488	4.030

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Duval	LOW	0.607	0.602	0.712	0.131	0.126	0.172	0.161	1.403
	AVERAGE	0.815	0.807	2.002	0.180	0.169	0.229	0.253	1.907
	HIGH	1.648	1.653	10.568	0.481	0.547	0.539	0.441	3.265
Escambia	LOW	1.635	1.686	4.703	0.408	0.381	0.500	0.438	3.951
	AVERAGE	2.624	2.692	9.533	0.721	0.686	1.092	0.988	8.134
	HIGH	3.985	4.150	31.436	1.239	0.961	1.455	1.422	10.674
Flagler	LOW	1.723	1.511	3.183	0.231	0.223	0.270	0.263	2.233
	AVERAGE	2.415	1.866	5.917	0.360	0.301	0.713	0.475	3.115
	HIGH	6.377	3.804	8.988	1.202	0.903	1.608	0.991	4.745
Franklin	LOW	2.096	2.482	9.319	0.732	0.579	0.499	0.472	6.476
	AVERAGE	2.438	2.610	11.675	0.833	0.677	0.606	0.652	6.476
	HIGH	2.613	2.848	15.438	0.959	0.755	1.113	0.867	6.476
Gadsden	LOW	0.631	0.655	1.544	0.163	0.146	NA	NA	1.470
	AVERAGE	0.779	0.788	1.991	0.183	0.166	NA	NA	1.737
	HIGH	1.161	1.134	4.036	0.258	0.182	NA	NA	2.654
Gilchrist	LOW	0.937	0.915	2.345	0.179	0.192	NA	NA	NA
	AVERAGE	1.044	1.039	2.869	0.234	0.228	NA	NA	NA
	HIGH	1.085	1.095	3.152	0.242	0.243	NA	NA	NA
Glades	LOW	4.011	2.414	8.374	0.731	0.584	NA	NA	5.985
	AVERAGE	5.360	4.414	11.858	0.731	0.584	NA	NA	5.985
	HIGH	5.390	4.462	11.986	0.731	0.584	NA	NA	5.985

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Gulf	LOW	1.356	1.442	3.969	0.315	0.385	0.530	0.461	4.472
	AVERAGE	1.801	1.981	6.275	0.586	0.516	0.530	0.461	4.472
	HIGH	1.878	2.109	10.528	0.623	0.551	0.530	0.461	4.472
Hamilton	LOW	0.580	0.573	1.148	0.125	0.103	NA	NA	NA
	AVERAGE	0.642	0.645	1.270	0.147	0.138	NA	NA	NA
	HIGH	0.695	0.691	1.346	0.155	0.145	NA	NA	NA
Hardee	LOW	3.661	3.413	6.751	0.432	0.455	1.248	NA	5.360
	AVERAGE	3.738	3.586	7.185	0.482	0.491	1.248	NA	5.360
	HIGH	4.148	3.648	7.759	0.687	0.579	1.248	NA	5.360
Hendry	LOW	4.097	2.889	4.929	0.521	0.501	0.858	0.891	5.840
	AVERAGE	4.600	4.372	11.327	0.747	0.687	1.209	1.410	6.967
	HIGH	5.565	5.323	13.351	0.910	0.952	1.258	1.548	7.461
Hernando	LOW	2.083	1.639	1.333	0.278	0.265	0.559	0.339	2.930
	AVERAGE	2.551	2.356	6.313	0.305	0.297	0.651	0.626	3.588
	HIGH	2.962	3.249	8.453	0.486	0.381	0.665	0.788	4.476
Highlands	LOW	3.149	1.799	2.000	0.417	0.410	0.743	0.721	4.531
	AVERAGE	3.746	3.606	9.184	0.494	0.473	0.826	0.834	5.029
	HIGH	5.114	4.911	13.017	0.883	0.711	0.972	0.962	6.865
Hillsborough	LOW	1.919	1.614	1.570	0.312	0.316	0.411	0.403	2.988
	AVERAGE	2.649	2.919	7.478	0.373	0.369	0.612	0.620	4.426
	HIGH	4.586	6.045	16.288	0.676	0.690	0.949	0.792	5.098

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Holmes	LOW	1.135	0.990	3.403	0.286	0.287	NA	NA	2.844
	AVERAGE	1.307	1.323	3.458	0.295	0.292	NA	NA	2.844
	HIGH	1.320	1.332	3.579	0.300	0.313	NA	NA	2.844
Indian River	LOW	3.113	2.362	2.860	0.352	0.345	1.002	0.732	4.376
	AVERAGE	6.149	4.704	13.408	1.783	1.195	2.463	2.322	9.283
	HIGH	11.478	7.873	27.704	3.560	2.624	5.195	3.335	15.487
Jackson	LOW	0.876	0.884	1.910	0.211	0.184	NA	NA	1.894
	AVERAGE	1.055	1.057	2.729	0.243	0.224	NA	NA	2.629
	HIGH	1.295	1.311	3.425	0.306	0.342	NA	NA	2.721
Jefferson	LOW	0.705	0.610	1.442	0.156	0.131	NA	NA	NA
	AVERAGE	0.708	0.701	1.667	0.162	0.151	NA	NA	NA
	HIGH	0.797	0.780	2.248	0.165	0.155	NA	NA	NA
Lafayette	LOW	0.851	0.864	0.807	0.207	0.172	NA	NA	NA
	AVERAGE	0.872	0.864	2.079	0.207	0.172	NA	NA	NA
	HIGH	0.872	0.882	2.080	0.207	0.172	NA	NA	NA
Lake	LOW	1.740	1.764	3.257	0.204	0.193	0.368	0.355	2.129
	AVERAGE	2.279	2.097	5.602	0.283	0.272	0.545	0.491	3.132
	HIGH	3.573	4.089	9.226	0.385	0.360	0.724	0.555	4.923
Lee	LOW	2.234	2.167	2.246	0.401	0.387	0.604	0.588	5.080
	AVERAGE	5.115	3.716	13.834	0.583	0.549	1.183	0.956	6.591
	HIGH	8.393	7.548	38.662	2.487	1.642	2.877	2.134	17.505

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Leon	LOW	0.757	0.745	0.837	0.152	0.137	0.191	0.181	0.318
	AVERAGE	0.804	0.803	2.315	0.172	0.159	0.218	0.217	1.872
	HIGH	1.080	0.927	4.336	0.203	0.225	0.269	0.251	2.223
Levy	LOW	1.044	1.006	2.871	0.255	0.228	0.843	0.777	2.560
	AVERAGE	1.376	1.242	3.494	0.306	0.279	0.843	0.777	4.475
	HIGH	2.411	2.372	10.093	0.746	0.772	0.843	0.777	5.447
Liberty	LOW	0.957	0.937	2.485	0.227	0.240	NA	NA	NA
	AVERAGE	1.044	1.049	2.780	0.228	0.240	NA	NA	NA
	HIGH	1.044	1.051	3.079	0.231	0.240	NA	NA	NA
Madison	LOW	0.583	0.572	1.312	0.109	0.113	NA	NA	NA
	AVERAGE	0.694	0.685	1.611	0.149	0.137	NA	NA	NA
	HIGH	0.725	0.705	1.891	0.159	0.159	NA	NA	NA
Manatee	LOW	2.561	2.169	1.817	0.376	0.380	0.489	0.512	3.283
	AVERAGE	3.770	3.103	10.063	0.498	0.521	1.208	1.303	6.225
	HIGH	9.673	8.389	34.326	1.692	1.589	2.892	2.688	19.023
Marion	LOW	1.762	0.998	1.085	0.229	0.199	0.295	0.363	1.651
	AVERAGE	2.216	1.870	4.121	0.262	0.247	0.430	0.468	2.651
	HIGH	3.487	3.341	6.244	0.382	0.397	0.774	0.537	4.194
Martin	LOW	4.262	3.540	13.103	0.635	0.600	1.694	1.323	7.422
	AVERAGE	7.292	6.011	27.969	1.600	1.557	3.223	2.338	11.536
	HIGH	9.674	10.550	41.808	3.115	3.027	3.904	3.190	17.654

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Miami-Dade	LOW	2.603	2.514	2.770	0.467	0.500	0.689	0.665	1.489
	AVERAGE	6.309	5.459	21.085	1.536	1.487	2.896	2.740	12.973
	HIGH	14.590	10.534	42.449	10.203	6.353	8.178	8.296	25.179
Monroe	LOW	7.959	7.233	58.248	2.697	1.399	4.957	2.112	8.427
	AVERAGE	9.096	8.897	68.667	3.703	2.195	5.153	3.193	21.487
	HIGH	14.592	11.592	85.688	7.394	3.374	7.345	4.793	30.896
Nassau	LOW	0.541	0.537	1.046	0.113	0.104	0.309	0.299	2.319
	AVERAGE	0.881	0.862	1.871	0.211	0.194	0.309	0.299	2.319
	HIGH	1.011	1.040	3.366	0.240	0.219	0.309	0.299	2.319
Okaloosa	LOW	1.427	1.469	1.669	0.370	0.341	0.402	0.733	3.250
	AVERAGE	3.058	3.076	6.849	0.953	0.901	1.450	1.306	8.138
	HIGH	5.263	5.479	30.425	2.116	1.889	1.889	1.428	11.721
Okeechobee	LOW	4.182	2.982	9.835	0.662	0.562	0.582	0.869	4.993
	AVERAGE	4.756	4.307	13.675	0.715	0.639	0.670	0.946	6.198
	HIGH	5.698	4.634	19.119	0.744	0.699	0.898	0.948	6.199
Orange	LOW	1.357	1.317	1.348	0.216	0.242	0.340	0.335	1.105
	AVERAGE	2.202	2.403	5.353	0.294	0.289	0.486	0.486	3.233
	HIGH	3.798	3.069	8.704	0.388	0.335	0.727	0.733	4.477
Osceola	LOW	1.876	1.835	1.564	0.284	0.292	0.421	0.406	3.171
	AVERAGE	2.171	2.411	6.515	0.306	0.310	0.535	0.477	3.412
	HIGH	4.285	3.634	9.969	0.849	0.483	0.614	0.634	4.428

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Palm Beach	LOW	2.925	2.701	2.858	0.642	0.605	0.712	0.698	4.053
	AVERAGE	7.453	6.059	22.160	1.715	1.380	2.731	2.420	10.612
	HIGH	13.598	11.552	49.053	5.781	4.114	7.395	5.324	25.287
Pasco	LOW	1.729	1.670	1.670	0.292	0.303	0.416	0.422	2.006
	AVERAGE	2.290	2.523	6.288	0.326	0.343	0.559	0.604	4.042
	HIGH	4.593	3.578	11.298	0.452	0.468	0.657	0.736	4.884
Pinellas	LOW	1.574	1.558	5.521	0.337	0.346	0.434	0.524	1.003
	AVERAGE	3.384	3.589	10.077	0.436	0.461	0.886	0.870	5.097
	HIGH	5.410	5.791	19.255	1.323	1.034	1.805	1.340	8.499
Polk	LOW	1.530	1.577	1.734	0.262	0.249	0.352	0.339	2.629
	AVERAGE	2.936	2.825	7.218	0.366	0.377	0.552	0.603	3.804
	HIGH	5.087	5.434	22.915	0.667	0.885	0.921	0.995	5.679
Putnam	LOW	0.921	0.899	2.139	0.214	0.187	0.249	0.236	2.334
	AVERAGE	1.073	1.058	3.335	0.245	0.225	0.323	0.291	2.578
	HIGH	1.392	1.273	4.937	0.294	0.273	0.380	0.355	3.004
St. Johns	LOW	0.713	0.722	1.534	0.149	0.139	0.191	0.180	1.531
	AVERAGE	1.099	1.252	3.574	0.331	0.288	0.485	0.470	3.190
	HIGH	1.964	1.828	11.168	0.608	0.469	0.711	0.591	4.189
St. Lucie	LOW	4.353	2.214	2.474	0.529	0.413	0.599	0.584	3.394
	AVERAGE	5.562	3.491	17.852	0.775	0.713	2.276	2.306	9.720
	HIGH	10.944	8.910	45.701	3.304	2.555	4.444	3.218	13.082

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Santa Rosa	LOW	1.780	1.753	6.670	0.472	0.428	0.590	0.605	3.668
	AVERAGE	2.932	2.777	11.136	1.045	0.993	1.955	1.428	8.068
	HIGH	5.835	5.362	28.373	2.740	2.132	2.880	1.578	10.666
Sarasota	LOW	1.901	1.850	1.941	0.387	0.411	0.517	0.502	3.996
	AVERAGE	4.100	3.666	13.631	0.567	0.539	1.009	0.987	5.480
	HIGH	5.951	6.234	21.582	1.178	0.962	1.672	1.604	7.525
Seminole	LOW	1.267	1.559	3.863	0.259	0.222	0.337	0.327	2.408
	AVERAGE	2.370	2.345	5.604	0.286	0.278	0.478	0.477	3.106
	HIGH	2.694	2.783	7.664	0.348	0.361	0.737	0.572	3.871
Sumter	LOW	1.376	1.295	3.301	0.230	0.219	0.373	0.361	2.732
	AVERAGE	1.489	1.486	5.552	0.258	0.256	0.451	0.385	2.924
	HIGH	3.137	2.882	6.782	0.400	0.348	0.540	0.540	3.889
Suwannee	LOW	0.688	0.679	1.505	0.149	0.119	NA	NA	1.445
	AVERAGE	0.760	0.752	1.679	0.166	0.150	NA	NA	1.924
	HIGH	0.902	0.883	2.075	0.216	0.217	NA	NA	2.408
Taylor	LOW	0.867	0.878	1.988	0.199	0.173	0.213	0.305	2.614
	AVERAGE	0.951	0.911	2.884	0.205	0.181	0.315	0.305	2.614
	HIGH	1.242	1.324	5.138	0.229	0.278	0.323	0.305	2.614
Union	LOW	0.845	0.845	0.918	0.185	0.177	NA	NA	NA
	AVERAGE	0.850	0.850	1.844	0.189	0.183	NA	NA	NA
	HIGH	0.985	0.930	3.343	0.241	0.197	NA	NA	NA

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Volusia	LOW	1.085	1.372	1.213	0.223	0.218	0.329	0.321	0.810
	AVERAGE	2.868	2.572	6.141	0.426	0.417	0.946	1.168	5.313
	HIGH	5.664	5.451	25.580	1.309	1.141	1.836	1.481	8.819
Wakulla	LOW	0.833	0.854	1.543	0.185	0.173	0.266	0.700	1.763
	AVERAGE	0.977	0.994	2.696	0.212	0.262	0.469	0.700	2.709
	HIGH	1.853	2.231	10.011	0.471	0.532	0.583	0.700	4.873
Walton	LOW	1.512	1.452	1.600	0.331	0.304	0.485	0.816	3.828
	AVERAGE	2.577	2.400	7.019	0.749	0.649	1.527	1.106	9.315
	HIGH	3.690	3.381	27.423	1.423	1.176	1.892	1.229	12.562
Washington	LOW	1.251	1.280	2.996	0.309	0.286	0.335	NA	2.596
	AVERAGE	1.268	1.300	3.156	0.313	0.294	0.335	NA	2.596
	HIGH	1.651	1.563	5.843	0.398	0.400	0.335	NA	2.596
Statewide	LOW	0.541	0.537	0.712	0.105	0.103	0.172	0.161	0.318
	AVERAGE	2.475	3.713	7.684	0.483	0.718	0.911	1.600	8.440
	HIGH	16.088	12.581	85.688	10.203	6.353	8.178	8.296	30.896

Form A-4B Output Ranges (2017 FHCF Exposure Data)
Loss Costs per $1000 with Specified Deductible
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Alachua	LOW	0.097	0.172	0.196	0.037	0.032	0.031	0.032	0.065
	AVERAGE	0.198	0.230	1.629	0.042	0.039	0.045	0.040	0.487
	HIGH	0.362	0.370	4.182	0.071	0.059	0.053	0.044	0.754
Baker	LOW	0.112	0.119	0.560	0.030	0.024	NA	NA	0.207
	AVERAGE	0.123	0.126	0.923	0.032	0.029	NA	NA	0.207
	HIGH	0.170	0.128	1.147	0.034	0.031	NA	NA	0.207
Bay	LOW	0.265	0.340	1.978	0.089	0.057	0.075	0.070	1.170
	AVERAGE	0.895	0.956	6.349	0.241	0.191	0.707	0.308	3.521
	HIGH	1.531	1.833	18.407	0.540	0.399	1.046	0.371	5.322
Bradford	LOW	0.143	0.142	0.921	0.035	0.025	NA	NA	NA
	AVERAGE	0.185	0.190	1.265	0.047	0.036	NA	NA	NA
	HIGH	0.263	0.283	1.816	0.083	0.100	NA	NA	NA
Brevard	LOW	1.112	0.491	0.781	0.081	0.046	0.073	0.064	0.869
	AVERAGE	2.238	2.070	11.483	0.342	0.383	0.457	0.639	3.758
	HIGH	7.394	5.572	28.059	3.290	1.718	2.859	2.514	9.939
Broward	LOW	0.628	0.617	0.706	0.158	0.160	0.109	0.116	0.168
	AVERAGE	3.810	2.812	18.062	0.536	0.558	0.801	0.889	5.168
	HIGH	12.516	9.373	36.352	2.778	2.105	3.689	2.611	13.097
Calhoun	LOW	0.230	0.218	1.802	0.034	0.052	NA	NA	NA
	AVERAGE	0.279	0.278	1.922	0.046	0.052	NA	NA	NA
	HIGH	0.307	0.382	1.968	0.077	0.052	NA	NA	NA

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Charlotte	LOW	1.765	1.432	0.549	0.104	0.129	0.088	0.108	0.704
	AVERAGE	2.248	1.926	6.356	0.188	0.166	0.378	0.177	1.712
	HIGH	3.132	2.952	27.436	0.466	0.460	0.702	0.629	3.294
Citrus	LOW	0.920	0.819	2.611	0.054	0.058	0.062	0.046	0.515
	AVERAGE	1.216	0.999	3.514	0.074	0.070	0.101	0.084	0.916
	HIGH	1.564	1.365	4.960	0.173	0.094	0.128	0.147	1.508
Clay	LOW	0.116	0.130	0.171	0.027	0.027	0.026	0.023	0.260
	AVERAGE	0.153	0.170	1.232	0.035	0.034	0.032	0.029	0.343
	HIGH	0.226	0.242	2.823	0.050	0.049	0.041	0.037	0.772
Collier	LOW	0.735	0.522	3.535	0.145	0.137	0.085	0.085	0.257
	AVERAGE	2.828	2.148	11.497	0.271	0.262	0.440	0.405	2.389
	HIGH	7.500	6.601	42.361	1.736	1.559	2.195	1.459	8.587
Columbia	LOW	0.127	0.104	0.366	0.019	0.028	0.038	0.035	0.283
	AVERAGE	0.168	0.168	1.037	0.040	0.035	0.039	0.036	0.283
	HIGH	0.230	0.197	1.172	0.071	0.044	0.041	0.039	0.283
De Soto	LOW	1.779	1.830	5.611	0.126	0.143	0.099	0.109	1.529
	AVERAGE	2.052	1.941	5.787	0.172	0.155	0.179	0.207	1.532
	HIGH	3.936	4.052	14.047	0.212	0.307	0.192	0.208	1.578
Dixie	LOW	0.261	0.215	2.041	0.049	0.063	0.038	0.035	0.542
	AVERAGE	0.347	0.250	2.341	0.060	0.065	0.072	0.059	0.690

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
	HIGH	0.977	0.678	10.023	0.064	0.089	0.097	0.089	0.936
Duval	LOW	0.074	0.070	0.148	0.025	0.025	0.023	0.021	0.207
	AVERAGE	0.189	0.195	1.263	0.046	0.044	0.041	0.050	0.432
	HIGH	0.657	0.661	9.048	0.236	0.311	0.213	0.138	1.058
Escambia	LOW	0.520	0.325	3.393	0.128	0.119	0.079	0.065	1.223
	AVERAGE	1.078	1.119	7.756	0.324	0.300	0.464	0.381	4.138
	HIGH	2.254	2.406	28.698	0.749	0.504	0.752	0.766	6.295
Flagler	LOW	0.717	0.550	2.169	0.056	0.053	0.037	0.036	0.424
	AVERAGE	1.207	0.782	4.596	0.149	0.104	0.264	0.126	0.905
	HIGH	4.467	2.172	7.531	0.842	0.562	0.959	0.421	1.681
Franklin	LOW	0.757	1.069	7.554	0.363	0.234	0.089	0.081	2.687
	AVERAGE	0.980	1.157	9.797	0.454	0.320	0.174	0.186	2.687
	HIGH	1.097	1.309	13.331	0.555	0.393	0.533	0.304	2.687
Gadsden	LOW	0.085	0.103	0.857	0.034	0.030	NA	NA	0.222
	AVERAGE	0.163	0.169	1.214	0.040	0.035	NA	NA	0.306
	HIGH	0.311	0.299	2.898	0.056	0.039	NA	NA	0.769
Gilchrist	LOW	0.197	0.182	1.439	0.034	0.038	NA	NA	NA
	AVERAGE	0.225	0.224	1.857	0.050	0.054	NA	NA	NA
	HIGH	0.235	0.243	2.082	0.052	0.061	NA	NA	NA
Glades	LOW	2.006	0.815	6.375	0.255	0.149	NA	NA	1.656

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
	AVERAGE	2.923	2.182	9.496	0.255	0.149	NA	NA	1.656
	HIGH	2.943	2.215	9.610	0.255	0.149	NA	NA	1.656
Gulf	LOW	0.331	0.398	2.704	0.076	0.128	0.109	0.080	1.319
	AVERAGE	0.517	0.676	4.790	0.246	0.197	0.109	0.080	1.319
	HIGH	0.549	0.741	8.637	0.269	0.216	0.109	0.080	1.319
Hamilton	LOW	0.109	0.104	0.586	0.026	0.019	NA	NA	NA
	AVERAGE	0.128	0.130	0.665	0.032	0.031	NA	NA	NA
	HIGH	0.148	0.147	0.708	0.035	0.033	NA	NA	NA
Hardee	LOW	1.809	1.620	4.945	0.103	0.101	0.362	NA	1.583
	AVERAGE	1.854	1.757	5.320	0.131	0.147	0.362	NA	1.583
	HIGH	2.176	1.790	5.815	0.267	0.198	0.362	NA	1.583
Hendry	LOW	2.015	1.100	3.081	0.137	0.139	0.128	0.153	1.756
	AVERAGE	2.379	2.222	9.052	0.299	0.270	0.345	0.525	2.466
	HIGH	3.083	2.932	10.937	0.418	0.456	0.375	0.624	2.776
Hernando	LOW	0.852	0.485	0.322	0.062	0.054	0.079	0.045	0.527
	AVERAGE	1.170	1.035	4.784	0.072	0.068	0.119	0.114	0.915
	HIGH	1.409	1.623	6.685	0.186	0.102	0.128	0.178	1.593
Highlands	LOW	1.435	0.385	0.531	0.097	0.087	0.107	0.101	1.102
	AVERAGE	1.845	1.744	7.169	0.145	0.135	0.161	0.168	1.409
	HIGH	2.826	2.642	10.627	0.402	0.279	0.256	0.244	2.607

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Hillsborough	LOW	0.561	0.351	0.411	0.066	0.063	0.058	0.057	0.582
	AVERAGE	1.164	1.383	5.753	0.099	0.097	0.113	0.111	1.366
	HIGH	2.754	3.938	14.029	0.311	0.321	0.279	0.176	1.890
Holmes	LOW	0.278	0.181	2.260	0.062	0.071	NA	NA	0.615
	AVERAGE	0.350	0.365	2.312	0.070	0.073	NA	NA	0.615
	HIGH	0.358	0.369	2.423	0.074	0.085	NA	NA	0.615
Indian River	LOW	1.480	0.901	1.110	0.082	0.073	0.319	0.145	1.835
	AVERAGE	3.898	2.668	11.289	1.293	0.757	1.561	1.380	5.015
	HIGH	8.529	5.256	24.976	2.895	1.983	3.973	2.213	10.067
Jackson	LOW	0.199	0.208	1.108	0.048	0.035	NA	NA	0.291
	AVERAGE	0.258	0.261	1.746	0.058	0.053	NA	NA	0.593
	HIGH	0.360	0.379	2.279	0.082	0.121	NA	NA	0.625
Jefferson	LOW	0.136	0.083	0.774	0.031	0.026	NA	NA	NA
	AVERAGE	0.142	0.138	0.975	0.036	0.033	NA	NA	NA
	HIGH	0.183	0.159	1.458	0.036	0.034	NA	NA	NA
Lafayette	LOW	0.192	0.188	0.172	0.049	0.034	NA	NA	NA
	AVERAGE	0.192	0.188	1.259	0.049	0.034	NA	NA	NA
	HIGH	0.200	0.227	1.260	0.049	0.034	NA	NA	NA
Lake	LOW	0.568	0.670	2.051	0.043	0.038	0.050	0.048	0.470
	AVERAGE	1.001	0.848	4.144	0.063	0.060	0.086	0.071	0.638
	HIGH	2.062	2.397	7.368	0.113	0.104	0.158	0.085	1.704

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Lee	LOW	0.531	0.625	0.581	0.085	0.083	0.088	0.085	1.233
	AVERAGE	2.780	1.699	11.450	0.190	0.163	0.372	0.225	2.317
	HIGH	5.327	4.751	35.335	1.754	1.012	1.652	1.012	11.426
Leon	LOW	0.141	0.133	0.181	0.028	0.026	0.026	0.024	0.060
	AVERAGE	0.173	0.173	1.484	0.037	0.033	0.032	0.033	0.374
	HIGH	0.299	0.222	3.245	0.046	0.058	0.053	0.049	0.571
Levy	LOW	0.234	0.230	1.775	0.056	0.043	0.339	0.299	0.550
	AVERAGE	0.380	0.298	2.335	0.085	0.075	0.339	0.299	1.481
	HIGH	0.962	0.941	8.245	0.370	0.408	0.339	0.299	1.964
Liberty	LOW	0.231	0.223	1.514	0.046	0.056	NA	NA	NA
	AVERAGE	0.232	0.239	1.773	0.046	0.056	NA	NA	NA
	HIGH	0.235	0.239	2.105	0.047	0.056	NA	NA	NA
Madison	LOW	0.112	0.096	0.733	0.020	0.021	NA	NA	NA
	AVERAGE	0.147	0.141	0.944	0.032	0.028	NA	NA	NA
	HIGH	0.159	0.151	1.176	0.035	0.040	NA	NA	NA
Manatee	LOW	1.027	0.689	0.469	0.080	0.088	0.072	0.078	0.801
	AVERAGE	1.926	1.434	8.162	0.169	0.190	0.496	0.537	2.641
	HIGH	6.655	5.632	31.276	1.137	1.020	1.738	1.528	13.123
Marion	LOW	0.648	0.178	0.242	0.048	0.036	0.040	0.047	0.352
	AVERAGE	1.022	0.756	2.876	0.061	0.055	0.061	0.078	0.533

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
	HIGH	1.987	1.861	4.765	0.118	0.134	0.196	0.089	1.435
Martin	LOW	2.195	1.571	10.786	0.238	0.212	0.772	0.449	2.855
	AVERAGE	4.674	3.594	25.147	1.083	1.020	2.157	1.318	6.491
	HIGH	6.865	7.630	38.550	2.461	2.315	2.765	2.026	11.968
Miami-Dade	LOW	0.733	0.667	0.920	0.103	0.117	0.121	0.108	0.460
	AVERAGE	3.792	3.053	18.560	1.025	0.955	1.930	1.731	8.068
	HIGH	11.215	7.276	39.157	9.036	5.375	6.664	6.686	18.897
Monroe	LOW	5.368	4.493	55.080	2.076	0.838	3.612	1.032	5.866
	AVERAGE	6.370	5.993	65.135	3.008	1.535	3.855	1.997	16.008
	HIGH	11.415	8.353	81.773	6.447	2.643	6.011	3.427	24.801
Nassau	LOW	0.097	0.097	0.280	0.022	0.019	0.067	0.060	0.568
	AVERAGE	0.203	0.206	1.187	0.059	0.053	0.067	0.060	0.568
	HIGH	0.255	0.278	2.417	0.072	0.063	0.067	0.060	0.568
Okaloosa	LOW	0.360	0.390	0.468	0.094	0.086	0.061	0.229	0.674
	AVERAGE	1.475	1.507	5.332	0.536	0.494	0.786	0.640	3.966
	HIGH	3.284	3.535	27.638	1.550	1.334	1.153	0.744	6.962
Okeechobee	LOW	2.128	1.171	7.717	0.256	0.190	0.086	0.132	1.228
	AVERAGE	2.519	2.160	11.250	0.278	0.229	0.115	0.153	1.889
	HIGH	3.363	2.381	16.455	0.289	0.259	0.192	0.153	1.889
Orange	LOW	0.285	0.264	0.323	0.040	0.048	0.046	0.045	0.227

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
	AVERAGE	0.907	1.068	3.906	0.066	0.065	0.074	0.074	0.738
	HIGH	2.225	1.577	6.908	0.120	0.086	0.153	0.161	1.380
Osceola	LOW	0.557	0.462	0.390	0.057	0.062	0.059	0.056	0.627
	AVERAGE	0.829	1.016	4.866	0.068	0.071	0.088	0.073	0.751
	HIGH	2.545	1.818	8.063	0.419	0.176	0.121	0.119	1.533
Palm Beach	LOW	0.847	0.683	0.849	0.217	0.171	0.121	0.120	1.429
	AVERAGE	4.645	3.486	19.334	1.152	0.831	1.633	1.324	5.511
	HIGH	10.008	8.360	45.481	4.901	3.247	5.798	3.779	18.318
Pasco	LOW	0.448	0.408	0.453	0.058	0.062	0.058	0.059	0.635
	AVERAGE	0.906	1.093	4.689	0.073	0.086	0.090	0.101	1.160
	HIGH	2.757	1.977	9.339	0.153	0.167	0.133	0.170	1.721
Pinellas	LOW	0.359	0.332	3.989	0.078	0.080	0.063	0.074	0.292
	AVERAGE	1.693	1.884	8.231	0.139	0.155	0.261	0.234	1.788
	HIGH	3.184	3.496	16.836	0.830	0.567	0.864	0.494	4.482
Polk	LOW	0.435	0.334	0.453	0.054	0.049	0.048	0.046	0.447
	AVERAGE	1.355	1.277	5.469	0.088	0.096	0.086	0.099	0.911
	HIGH	2.693	3.127	20.192	0.281	0.402	0.244	0.288	2.133
Putnam	LOW	0.209	0.195	1.287	0.048	0.037	0.035	0.032	0.508
	AVERAGE	0.275	0.267	2.312	0.061	0.055	0.058	0.049	0.650
	HIGH	0.455	0.366	3.726	0.083	0.074	0.067	0.057	0.906

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
St. Johns	LOW	0.101	0.096	0.748	0.030	0.027	0.026	0.024	0.287
	AVERAGE	0.304	0.361	2.573	0.134	0.101	0.168	0.141	0.959
	HIGH	0.807	0.686	9.545	0.337	0.207	0.302	0.196	1.469
St. Lucie	LOW	2.290	0.562	0.799	0.166	0.090	0.096	0.093	1.023
	AVERAGE	3.251	1.593	15.395	0.365	0.327	1.358	1.376	5.056
	HIGH	7.951	6.057	42.350	2.665	1.911	3.352	2.147	7.564
Santa Rosa	LOW	0.525	0.506	5.092	0.147	0.116	0.121	0.116	0.835
	AVERAGE	1.335	1.205	9.269	0.608	0.572	1.220	0.740	3.833
	HIGH	3.730	3.267	25.637	2.093	1.529	2.017	0.857	5.775
Sarasota	LOW	0.462	0.428	0.521	0.083	0.097	0.074	0.071	0.808
	AVERAGE	2.134	1.813	11.445	0.206	0.187	0.296	0.286	1.839
	HIGH	3.587	3.961	18.926	0.702	0.505	0.780	0.695	3.277
Seminole	LOW	0.263	0.478	2.590	0.055	0.041	0.046	0.044	0.615
	AVERAGE	1.086	1.063	4.159	0.066	0.064	0.072	0.070	0.730
	HIGH	1.329	1.402	6.009	0.102	0.117	0.171	0.099	1.150
Sumter	LOW	0.339	0.295	2.090	0.044	0.041	0.051	0.049	0.502
	AVERAGE	0.419	0.397	4.066	0.053	0.052	0.063	0.053	0.580
	HIGH	1.549	1.413	5.190	0.115	0.091	0.075	0.076	0.993
Suwannee	LOW	0.129	0.124	0.830	0.029	0.021	NA	NA	0.210
	AVERAGE	0.149	0.144	0.950	0.035	0.031	NA	NA	0.370
	HIGH	0.189	0.178	1.250	0.056	0.059	NA	NA	0.626

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Taylor	LOW	0.199	0.202	1.213	0.044	0.037	0.029	0.045	0.511
	AVERAGE	0.221	0.213	1.952	0.046	0.039	0.047	0.045	0.511
	HIGH	0.301	0.358	3.851	0.054	0.059	0.049	0.045	0.511
Union	LOW	0.166	0.159	0.196	0.039	0.038	NA	NA	NA
	AVERAGE	0.168	0.170	1.032	0.041	0.040	NA	NA	NA
	HIGH	0.252	0.211	2.329	0.065	0.044	NA	NA	NA
Volusia	LOW	0.220	0.396	0.287	0.046	0.044	0.047	0.044	0.168
	AVERAGE	1.485	1.267	4.754	0.181	0.174	0.396	0.535	2.305
	HIGH	3.599	3.439	23.130	0.923	0.748	1.036	0.764	4.906
Wakulla	LOW	0.141	0.158	0.746	0.037	0.035	0.040	0.254	0.270
	AVERAGE	0.208	0.234	1.768	0.049	0.081	0.117	0.254	0.730
	HIGH	0.624	0.948	8.291	0.175	0.237	0.160	0.254	1.791
Walton	LOW	0.424	0.387	0.440	0.077	0.066	0.078	0.275	0.859
	AVERAGE	0.982	0.843	5.490	0.357	0.289	0.852	0.492	5.017
	HIGH	1.831	1.552	24.709	0.912	0.701	1.155	0.584	7.910
Washington	LOW	0.310	0.333	1.889	0.075	0.073	0.048	NA	0.518
	AVERAGE	0.316	0.341	2.023	0.079	0.077	0.048	NA	0.518
	HIGH	0.548	0.484	4.416	0.128	0.144	0.048	NA	0.518
Statewide	LOW	0.074	0.070	0.148	0.019	0.019	0.023	0.021	0.060
	AVERAGE	1.160	1.900	6.065	0.209	0.357	0.372	0.770	4.253

County	Hurricane Loss Costs	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
	HIGH	12.516	9.373	81.773	9.036	5.375	6.664	6.686	24.801

Appendix I – Form A-5: Percentage Change in Hurricane Output Ranges (2012 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
March 29, 2019

Form A-5 Percentage Change in Hurricane Output Ranges (2012 FHCF Exposure Data)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Percentage Change in $0 Deductible Output Ranges

Region	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Coastal	1.77%	2.50%	2.00%	4.91%	4.37%	2.11%	3.56%	3.11%
Inland	1.89%	1.43%	0.23%	2.04%	1.68%	1.89%	1.60%	1.30%
North	1.55%	1.71%	2.20%	1.00%	1.23%	0.51%	0.75%	1.38%
Central	1.54%	1.32%	0.74%	1.80%	2.26%	1.93%	3.24%	1.92%
South	2.47%	3.05%	2.56%	6.37%	4.84%	2.90%	3.69%	3.34%
Statewide	1.79%	2.35%	1.45%	4.59%	4.16%	2.09%	3.53%	3.07%

Percentage Change in Specified Deductible Output Ranges

Region	Frame Owners	Masonry Owners	Manufactured Homes	Frame Renters	Masonry Renters	Frame Condo Unit	Masrony Condo Unit	Commercial Residential
Coastal	1.72%	2.84%	2.02%	6.33%	5.93%	2.35%	4.74%	3.61%
Inland	1.85%	1.82%	-0.08%	1.35%	1.22%	1.05%	0.91%	1.45%
North	0.61%	0.78%	1.73%	-0.32%	0.06%	-0.80%	-0.52%	0.70%
Central	1.74%	1.50%	0.63%	2.43%	3.83%	2.87%	6.00%	2.42%
South	2.48%	3.48%	2.63%	7.40%	6.24%	3.33%	4.65%	3.83%
Statewide	1.74%	2.73%	1.41%	6.13%	5.78%	2.30%	4.72%	3.59%

Relationship to Hurricane Risk (Trade Secret Item)

Florida International University
Florida Public Hurricane Loss Model 7.0
March 29, 2019

Exposure Exceptions:

Notional Set 1- Deductible Sensitivity

Unknown number of Stories assigned “1” for Owners, Renters, and Condo (both frame and masonry)
Unknown opening protection for Commercial Residential assigned a value based on the county and year built.
Layout was set to “Closed” for all Commercial Residential policies.

Notional Set 2 - Construction Sensitivity

Unknown number of Stories assigned “1” for Owners, Renters, and Condo (both frame and masonry)
Unknown opening protection for Commercial Residential assigned a value based on the county and year built.
Layout was set to “Closed” for all Commercial Residential policies.

Notional Set 3 - Policy Form Sensitivity

Unknown number of Stories assigned “1” for Owners (both frame and masonry).

Notional Set 4 - Coverage Sensitivity

Unknown number of Stories assigned “1” for Owners, Renters, and Condo (both frame and masonry)
Unknown opening protection for Commercial Residential assigned a value based on the county and year built.
Layout was set to “Closed” for all Commercial Residential policies.

Notional Set 5 - Building Code / Enforcement (Year Built) Sensitivity

Unknown number of Stories assigned “1” for Owners, Renters, and Condo (both frame and masonry)
Unknown opening protection for Commercial Residential assigned a value based on the county and year built.
Layout was set to “Closed” for all Commercial Residential policies.

Notional Set 6 - Building Strength Sensitivity

For policies with only deck attachment and roof-to-wall unknown:
Roof-to-wall was assigned based on statistics

Deck attachment was assigned based on the year built, location and strength.
Number of stories 3 was changed to 2 for Condo Frame and Masonry.

Notional Set 8 - Number of Stories Sensitivity

For all personal residential policies:
Year built was assigned “1993”
Roof shape was assigned “gable”
Roof cover was assigned “shingle/unrated”
Roof to deck connection was assigned “8d12”
Opening protection was assigned “none”.

Form A-6: Logical Relationship to Hurricane Risk - Deductible (Trade Secret Item)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
Frame Owners	1	BAY	4.080	3.431	2.784	2.239	1.546	1.237	1.000	0.841	0.682	0.549	0.379	0.303
	2	BREVARD	4.567	3.992	3.418	2.716	1.311	0.668	1.000	0.874	0.748	0.595	0.287	0.146
	3	BREVARD	4.399	3.832	3.267	2.574	1.187	0.567	1.000	0.871	0.743	0.585	0.270	0.129
	4	BROWARD	7.419	6.643	5.869	4.915	2.910	1.698	1.000	0.895	0.791	0.662	0.392	0.229
	5	BROWARD	12.368	11.420	10.475	9.267	6.668	4.823	1.000	0.923	0.847	0.749	0.539	0.390
	6	CITRUS	3.417	2.949	2.484	1.927	0.816	0.323	1.000	0.863	0.727	0.564	0.239	0.095
	7	CLAY	0.894	0.630	0.368	0.216	0.088	0.065	1.000	0.705	0.412	0.242	0.099	0.072
	8	COLLIER	5.844	5.085	4.329	3.469	1.763	0.923	1.000	0.870	0.741	0.594	0.302	0.158
	9	COLUMBIA	0.963	0.681	0.401	0.235	0.084	0.063	1.000	0.707	0.416	0.244	0.087	0.065
	10	DIXIE	2.883	2.318	1.755	1.327	0.851	0.669	1.000	0.804	0.609	0.460	0.295	0.232
	11	DUVAL	1.861	1.475	1.091	0.807	0.451	0.364	1.000	0.793	0.586	0.434	0.243	0.196
	12	FRANKLIN	6.033	5.290	4.549	3.912	3.048	2.538	1.000	0.877	0.754	0.648	0.505	0.421
	13	GLADES	5.672	4.967	4.264	3.394	1.606	0.726	1.000	0.876	0.752	0.598	0.283	0.128
	14	HAMILTON	0.876	0.619	0.364	0.217	0.084	0.062	1.000	0.707	0.416	0.248	0.096	0.071
	15	HERNANDO	4.483	3.900	3.320	2.618	1.211	0.575	1.000	0.870	0.741	0.584	0.270	0.128
	16	HILLSBOROUGH	3.990	3.453	2.919	2.250	0.920	0.366	1.000	0.866	0.732	0.564	0.231	0.092
	17	HOLMES	1.509	1.121	0.735	0.466	0.161	0.119	1.000	0.743	0.487	0.309	0.107	0.079
	18	INDIAN RIVER	13.458	12.580	11.704	10.501	7.897	6.148	1.000	0.935	0.870	0.780	0.587	0.457
	19	JACKSON	1.188	0.865	0.543	0.332	0.108	0.080	1.000	0.728	0.457	0.280	0.091	0.068
	20	LEE	5.460	4.733	4.008	3.197	1.574	0.751	1.000	0.867	0.734	0.585	0.288	0.138
	21	LEON	1.167	0.848	0.530	0.331	0.134	0.099	1.000	0.726	0.454	0.283	0.115	0.085
	22	MARION	1.656	1.253	0.852	0.598	0.234	0.104	1.000	0.757	0.515	0.361	0.141	0.063
	23	MARTIN	5.980	5.305	4.632	3.736	1.885	0.914	1.000	0.887	0.775	0.625	0.315	0.153

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	24	MARTIN	13.192	12.308	11.425	10.162	7.404	5.466	1.000	0.933	0.866	0.770	0.561	0.414
	25	MIAMI-DADE	6.677	5.971	5.267	4.396	2.559	1.451	1.000	0.894	0.789	0.658	0.383	0.217
	26	MIAMI-DADE	9.716	8.878	8.042	6.987	4.737	3.212	1.000	0.914	0.828	0.719	0.488	0.331
	27	MONROE	12.407	11.599	10.792	9.539	6.782	4.882	1.000	0.935	0.870	0.769	0.547	0.393
	28	MONROE	19.284	18.306	17.330	15.815	12.440	9.838	1.000	0.949	0.899	0.820	0.645	0.510
	29	OKALOOSA	3.039	2.457	1.877	1.432	0.916	0.698	1.000	0.808	0.617	0.471	0.301	0.230
	30	OSCEOLA	3.158	2.663	2.170	1.639	0.637	0.242	1.000	0.843	0.687	0.519	0.202	0.077
	31	OSCEOLA	4.082	3.498	2.915	2.263	0.999	0.448	1.000	0.857	0.714	0.554	0.245	0.110
	32	PALM BEACH	7.621	6.830	6.042	4.935	2.593	1.407	1.000	0.896	0.793	0.648	0.340	0.185
	33	PALM BEACH	11.071	10.154	9.238	7.915	5.047	3.375	1.000	0.917	0.834	0.715	0.456	0.305
	34	PINELLAS	4.549	4.011	3.475	2.712	1.149	0.513	1.000	0.882	0.764	0.596	0.253	0.113
	35	SAINT JOHNS	1.389	1.039	0.691	0.463	0.201	0.152	1.000	0.748	0.497	0.333	0.145	0.110
	36	SANTA ROSA	2.242	1.765	1.288	0.920	0.499	0.365	1.000	0.787	0.575	0.410	0.222	0.163
	37	SEMINOLE	3.276	2.834	2.394	1.848	0.758	0.296	1.000	0.865	0.731	0.564	0.231	0.090
	38	TAYLOR	1.123	0.813	0.504	0.304	0.130	0.096	1.000	0.724	0.448	0.271	0.116	0.085
	39	VOLUSIA	3.059	2.581	2.105	1.654	0.821	0.441	1.000	0.844	0.688	0.541	0.268	0.144
	40	WAKULLA	2.628	2.101	1.575	1.173	0.698	0.544	1.000	0.799	0.599	0.446	0.266	0.207
Masonry Owners	1	BAY	3.776	3.129	2.483	1.969	1.341	1.049	1.000	0.829	0.658	0.522	0.355	0.278
	2	BREVARD	4.504	3.928	3.354	2.659	1.270	0.634	1.000	0.872	0.745	0.590	0.282	0.141
	3	BREVARD	4.347	3.780	3.215	2.529	1.158	0.544	1.000	0.870	0.740	0.582	0.266	0.125
	4	BROWARD	7.253	6.477	5.704	4.758	2.786	1.614	1.000	0.893	0.786	0.656	0.384	0.223
	5	BROWARD	11.806	10.859	9.914	8.716	6.156	4.363	1.000	0.920	0.840	0.738	0.521	0.370
	6	CITRUS	3.367	2.900	2.434	1.886	0.795	0.314	1.000	0.861	0.723	0.560	0.236	0.093
	7	CLAY	0.861	0.597	0.335	0.194	0.083	0.061	1.000	0.694	0.389	0.225	0.096	0.070
	8	COLLIER	5.731	4.973	4.217	3.370	1.701	0.886	1.000	0.868	0.736	0.588	0.297	0.155
	9	COLUMBIA	0.925	0.644	0.363	0.209	0.079	0.059	1.000	0.696	0.393	0.226	0.085	0.063

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	10	DIXIE	2.720	2.156	1.594	1.191	0.763	0.591	1.000	0.793	0.586	0.438	0.281	0.217
	11	DUVAL	1.685	1.299	0.915	0.653	0.336	0.255	1.000	0.771	0.543	0.388	0.199	0.152
	12	FRANKLIN	5.473	4.732	3.992	3.389	2.596	2.111	1.000	0.865	0.729	0.619	0.474	0.386
	13	GLADES	5.569	4.864	4.161	3.303	1.553	0.702	1.000	0.873	0.747	0.593	0.279	0.126
	14	HAMILTON	0.844	0.587	0.332	0.196	0.080	0.059	1.000	0.696	0.394	0.232	0.094	0.070
	15	HERNANDO	4.423	3.840	3.260	2.566	1.181	0.555	1.000	0.868	0.737	0.580	0.267	0.126
	16	HILLSBOROUGH	3.930	3.394	2.859	2.199	0.893	0.353	1.000	0.864	0.728	0.560	0.227	0.090
	17	HOLMES	1.440	1.052	0.666	0.417	0.149	0.109	1.000	0.731	0.463	0.290	0.103	0.076
	18	INDIAN RIVER	12.493	11.615	10.739	9.546	6.970	5.247	1.000	0.930	0.860	0.764	0.558	0.420
	19	JACKSON	1.135	0.813	0.491	0.296	0.100	0.075	1.000	0.716	0.433	0.261	0.088	0.066
	20	LEE	5.340	4.613	3.889	3.092	1.513	0.724	1.000	0.864	0.728	0.579	0.283	0.136
	21	LEON	1.119	0.800	0.483	0.298	0.125	0.092	1.000	0.715	0.431	0.266	0.112	0.082
	22	MARION	1.619	1.217	0.816	0.572	0.227	0.102	1.000	0.751	0.504	0.353	0.140	0.063
	23	MARTIN	5.766	5.093	4.421	3.543	1.764	0.870	1.000	0.883	0.767	0.614	0.306	0.151
	24	MARTIN	12.415	11.532	10.651	9.406	6.726	4.886	1.000	0.929	0.858	0.758	0.542	0.394
	25	MIAMI-DADE	6.538	5.832	5.129	4.265	2.459	1.386	1.000	0.892	0.784	0.652	0.376	0.212
	26	MIAMI-DADE	9.393	8.555	7.719	6.672	4.457	2.975	1.000	0.911	0.822	0.710	0.475	0.317
	27	MONROE	11.748	10.941	10.135	8.895	6.193	4.369	1.000	0.931	0.863	0.757	0.527	0.372
	28	MONROE	17.735	16.758	15.783	14.282	10.972	8.462	1.000	0.945	0.890	0.805	0.619	0.477
	29	OKALOOSA	2.881	2.300	1.721	1.301	0.834	0.628	1.000	0.798	0.597	0.451	0.289	0.218
	30	OSCEOLA	3.108	2.613	2.119	1.598	0.619	0.235	1.000	0.841	0.682	0.514	0.199	0.076
	31	OSCEOLA	4.010	3.426	2.844	2.203	0.966	0.429	1.000	0.854	0.709	0.549	0.241	0.107
	32	PALM BEACH	7.320	6.531	5.744	4.662	2.410	1.316	1.000	0.892	0.785	0.637	0.329	0.180
	33	PALM BEACH	10.503	9.587	8.672	7.375	4.606	3.043	1.000	0.913	0.826	0.702	0.439	0.290
	34	PINELLAS	4.458	3.920	3.384	2.631	1.098	0.486	1.000	0.879	0.759	0.590	0.246	0.109
	35	SAINT JOHNS	1.312	0.962	0.614	0.403	0.173	0.127	1.000	0.733	0.468	0.308	0.132	0.097
	36	SANTA ROSA	2.135	1.658	1.183	0.836	0.459	0.334	1.000	0.777	0.554	0.391	0.215	0.156

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	37	SEMINOLE	3.216	2.775	2.335	1.798	0.732	0.287	1.000	0.863	0.726	0.559	0.227	0.089
	38	TAYLOR	1.079	0.768	0.460	0.273	0.121	0.089	1.000	0.713	0.426	0.253	0.112	0.083
	39	VOLUSIA	3.006	2.528	2.052	1.609	0.792	0.418	1.000	0.841	0.683	0.535	0.264	0.139
	40	WAKULLA	2.457	1.930	1.405	1.028	0.603	0.459	1.000	0.786	0.572	0.419	0.246	0.187
Manufactured Homes	1	BAY	16.560	15.167	15.167	14.273	12.207	10.244	1.000	0.916	0.916	0.862	0.737	0.619
	2	BREVARD	13.468	12.279	12.279	11.383	9.240	7.345	1.000	0.912	0.912	0.845	0.686	0.545
	3	BREVARD	12.697	11.527	11.527	10.643	8.526	6.669	1.000	0.908	0.908	0.838	0.671	0.525
	4	BROWARD	25.558	23.945	23.945	22.633	19.362	16.110	1.000	0.937	0.937	0.886	0.758	0.630
	5	BROWARD	45.801	43.829	43.829	42.191	38.045	33.604	1.000	0.957	0.957	0.921	0.831	0.734
	6	CITRUS	8.161	7.193	7.193	6.471	4.763	3.370	1.000	0.881	0.881	0.793	0.584	0.413
	7	CLAY	2.734	2.168	2.168	1.854	1.184	0.716	1.000	0.793	0.793	0.678	0.433	0.262
	8	COLLIER	23.662	22.073	22.073	20.777	17.540	14.341	1.000	0.933	0.933	0.878	0.741	0.606
	9	COLUMBIA	2.746	2.143	2.143	1.812	1.108	0.634	1.000	0.780	0.780	0.660	0.404	0.231
	10	DIXIE	12.169	10.950	10.950	10.191	8.460	6.899	1.000	0.900	0.900	0.837	0.695	0.567
	11	DUVAL	7.028	6.213	6.213	5.722	4.621	3.685	1.000	0.884	0.884	0.814	0.657	0.524
	12	FRANKLIN	22.582	20.990	20.990	19.972	17.626	15.306	1.000	0.930	0.930	0.884	0.781	0.678
	13	GLADES	16.770	15.315	15.315	14.190	11.447	8.924	1.000	0.913	0.913	0.846	0.683	0.532
	14	HAMILTON	2.482	1.933	1.933	1.634	0.999	0.577	1.000	0.779	0.779	0.658	0.402	0.232
	15	HERNANDO	13.537	12.326	12.326	11.396	9.138	7.109	1.000	0.911	0.911	0.842	0.675	0.525
	16	HILLSBOROUGH	10.734	9.630	9.630	8.783	6.723	4.905	1.000	0.897	0.897	0.818	0.626	0.457
	17	HOLMES	4.926	4.099	4.099	3.615	2.540	1.695	1.000	0.832	0.832	0.734	0.516	0.344
	18	INDIAN RIVER	44.960	43.138	43.138	41.676	38.014	34.106	1.000	0.959	0.959	0.927	0.846	0.759
	19	JACKSON	3.553	2.864	2.864	2.471	1.608	0.975	1.000	0.806	0.806	0.695	0.453	0.275
	20	LEE	19.431	17.921	17.921	16.703	13.689	10.830	1.000	0.922	0.922	0.860	0.704	0.557
	21	LEON	3.812	3.128	3.128	2.736	1.875	1.230	1.000	0.821	0.821	0.718	0.492	0.323
	22	MARION	6.197	5.356	5.356	4.740	3.305	2.208	1.000	0.864	0.864	0.765	0.533	0.356

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	23	MARTIN	17.549	16.131	16.131	15.007	12.259	9.732	1.000	0.919	0.919	0.855	0.699	0.555
	24	MARTIN	46.094	44.240	44.240	42.701	38.809	34.637	1.000	0.960	0.960	0.926	0.842	0.751
	25	MIAMI-DADE	23.000	21.534	21.534	20.339	17.356	14.368	1.000	0.936	0.936	0.884	0.755	0.625
	26	MIAMI-DADE	36.218	34.473	34.473	33.036	29.423	25.627	1.000	0.952	0.952	0.912	0.812	0.708
	27	MONROE	51.920	50.212	50.212	48.763	45.039	40.758	1.000	0.967	0.967	0.939	0.867	0.785
	28	MONROE	74.324	72.277	72.277	70.537	66.046	60.751	1.000	0.972	0.972	0.949	0.889	0.817
	29	OKALOOSA	13.506	12.252	12.252	11.453	9.620	7.910	1.000	0.907	0.907	0.848	0.712	0.586
	30	OSCEOLA	8.228	7.205	7.205	6.446	4.650	3.196	1.000	0.876	0.876	0.783	0.565	0.388
	31	OSCEOLA	12.562	11.355	11.355	10.441	8.247	6.326	1.000	0.904	0.904	0.831	0.657	0.504
	32	PALM BEACH	25.041	23.393	23.393	22.059	18.755	15.548	1.000	0.934	0.934	0.881	0.749	0.621
	33	PALM BEACH	39.452	37.539	37.539	35.964	32.003	27.879	1.000	0.952	0.952	0.912	0.811	0.707
	34	PINELLAS	12.121	11.002	11.002	10.115	7.949	6.020	1.000	0.908	0.908	0.834	0.656	0.497
	35	SAINT JOHNS	5.326	4.584	4.584	4.148	3.183	2.403	1.000	0.861	0.861	0.779	0.598	0.451
	36	SANTA ROSA	9.623	8.595	8.595	7.947	6.463	5.108	1.000	0.893	0.893	0.826	0.672	0.531
	37	SEMINOLE	7.190	6.272	6.272	5.591	3.982	2.707	1.000	0.872	0.872	0.778	0.554	0.377
	38	TAYLOR	3.812	3.141	3.141	2.756	1.912	1.281	1.000	0.824	0.824	0.723	0.501	0.336
	39	VOLUSIA	11.776	10.794	10.794	10.050	8.267	6.681	1.000	0.917	0.917	0.853	0.702	0.567
	40	WAKULLA	10.680	9.548	9.548	8.845	7.247	5.830	1.000	0.894	0.894	0.828	0.679	0.546
Frame Renters	1	BAY	1.646	0.998	1.067	0.998	0.876	0.790	1.000	0.606	0.648	0.606	0.532	0.480
	2	BREVARD	0.954	0.481	0.552	0.481	0.342	0.294	1.000	0.504	0.579	0.504	0.359	0.308
	3	BREVARD	0.873	0.409	0.479	0.409	0.277	0.236	1.000	0.469	0.548	0.469	0.318	0.270
	4	BROWARD	1.980	1.238	1.378	1.238	0.944	0.784	1.000	0.626	0.696	0.626	0.477	0.396
	5	BROWARD	4.628	3.616	3.834	3.616	3.123	2.743	1.000	0.781	0.828	0.781	0.675	0.593
	6	CITRUS	0.666	0.267	0.335	0.267	0.138	0.108	1.000	0.400	0.503	0.400	0.206	0.162
	7	CLAY	0.239	0.054	0.062	0.054	0.043	0.041	1.000	0.224	0.258	0.224	0.180	0.172
	8	COLLIER	1.398	0.703	0.828	0.703	0.452	0.368	1.000	0.503	0.592	0.503	0.323	0.263

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	9	COLUMBIA	0.250	0.053	0.060	0.053	0.043	0.041	1.000	0.210	0.241	0.210	0.170	0.164
	10	DIXIE	1.059	0.536	0.583	0.536	0.460	0.414	1.000	0.506	0.550	0.506	0.434	0.391
	11	DUVAL	0.550	0.284	0.297	0.284	0.262	0.247	1.000	0.517	0.540	0.517	0.477	0.449
	12	FRANKLIN	2.789	2.025	2.121	2.025	1.833	1.662	1.000	0.726	0.761	0.726	0.657	0.596
	13	GLADES	1.125	0.519	0.616	0.519	0.329	0.269	1.000	0.462	0.548	0.462	0.292	0.239
	14	HAMILTON	0.226	0.051	0.058	0.051	0.043	0.041	1.000	0.228	0.258	0.228	0.189	0.181
	15	HERNANDO	0.982	0.458	0.552	0.458	0.276	0.224	1.000	0.466	0.562	0.466	0.281	0.228
	16	HILLSBOROUGH	0.679	0.265	0.318	0.265	0.165	0.138	1.000	0.391	0.468	0.391	0.243	0.203
	17	HOLMES	0.377	0.094	0.107	0.094	0.077	0.073	1.000	0.250	0.285	0.250	0.204	0.194
	18	INDIAN RIVER	5.690	4.680	4.915	4.680	4.150	3.737	1.000	0.822	0.864	0.822	0.729	0.657
	19	JACKSON	0.293	0.066	0.075	0.066	0.054	0.052	1.000	0.224	0.256	0.224	0.184	0.178
	20	LEE	1.128	0.526	0.618	0.526	0.344	0.284	1.000	0.467	0.548	0.467	0.305	0.252
	21	LEON	0.311	0.079	0.090	0.079	0.065	0.061	1.000	0.254	0.288	0.254	0.208	0.197
	22	MARION	0.263	0.063	0.070	0.063	0.051	0.048	1.000	0.238	0.265	0.238	0.192	0.183
	23	MARTIN	1.625	0.842	1.033	0.842	0.462	0.348	1.000	0.518	0.636	0.518	0.284	0.214
	24	MARTIN	5.664	4.454	4.790	4.454	3.713	3.239	1.000	0.786	0.846	0.786	0.656	0.572
	25	MIAMI-DADE	1.730	1.055	1.181	1.055	0.789	0.649	1.000	0.610	0.683	0.610	0.456	0.375
	26	MIAMI-DADE	3.223	2.361	2.538	2.361	1.971	1.699	1.000	0.733	0.787	0.733	0.611	0.527
	27	MONROE	5.442	4.220	4.589	4.220	3.396	2.874	1.000	0.775	0.843	0.775	0.624	0.528
	28	MONROE	9.838	8.279	8.767	8.279	7.152	6.276	1.000	0.842	0.891	0.842	0.727	0.638
	29	OKALOOSA	1.070	0.534	0.582	0.534	0.454	0.407	1.000	0.499	0.544	0.499	0.424	0.381
	30	OSCEOLA	0.530	0.183	0.224	0.183	0.106	0.089	1.000	0.344	0.423	0.344	0.200	0.168
	31	OSCEOLA	0.747	0.314	0.369	0.314	0.209	0.177	1.000	0.420	0.493	0.420	0.279	0.237
	32	PALM BEACH	2.016	1.155	1.346	1.155	0.767	0.625	1.000	0.573	0.668	0.573	0.380	0.310
	33	PALM BEACH	3.789	2.708	2.966	2.708	2.159	1.866	1.000	0.715	0.783	0.715	0.570	0.492
	34	PINELLAS	1.024	0.464	0.579	0.464	0.243	0.188	1.000	0.453	0.566	0.453	0.237	0.184
	35	SAINT JOHNS	0.333	0.110	0.118	0.110	0.097	0.092	1.000	0.329	0.353	0.329	0.291	0.276

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	36	SANTA ROSA	0.731	0.291	0.327	0.291	0.237	0.214	1.000	0.398	0.447	0.398	0.325	0.293
	37	SEMINOLE	0.663	0.264	0.339	0.264	0.126	0.096	1.000	0.399	0.511	0.399	0.190	0.145
	38	TAYLOR	0.333	0.081	0.095	0.081	0.064	0.060	1.000	0.244	0.285	0.244	0.192	0.180
	39	VOLUSIA	0.559	0.270	0.289	0.270	0.234	0.213	1.000	0.483	0.516	0.483	0.418	0.381
	40	WAKULLA	0.893	0.430	0.467	0.430	0.371	0.337	1.000	0.482	0.523	0.482	0.415	0.377
Masonry Renters	1	BAY	1.444	0.830	0.890	0.830	0.722	0.644	1.000	0.575	0.617	0.575	0.500	0.446
	2	BREVARD	0.922	0.456	0.527	0.456	0.320	0.273	1.000	0.495	0.572	0.495	0.347	0.297
	3	BREVARD	0.849	0.393	0.462	0.393	0.263	0.223	1.000	0.464	0.544	0.464	0.310	0.263
	4	BROWARD	1.913	1.183	1.320	1.183	0.894	0.740	1.000	0.618	0.690	0.618	0.467	0.387
	5	BROWARD	4.249	3.252	3.466	3.252	2.773	2.412	1.000	0.765	0.816	0.765	0.653	0.568
	6	CITRUS	0.652	0.259	0.327	0.259	0.132	0.104	1.000	0.397	0.501	0.397	0.203	0.159
	7	CLAY	0.220	0.047	0.054	0.047	0.039	0.037	1.000	0.214	0.244	0.214	0.176	0.168
	8	COLLIER	1.360	0.676	0.800	0.676	0.431	0.351	1.000	0.497	0.588	0.497	0.317	0.258
	9	COLUMBIA	0.230	0.046	0.052	0.046	0.038	0.037	1.000	0.199	0.226	0.199	0.165	0.159
	10	DIXIE	0.961	0.467	0.507	0.467	0.399	0.356	1.000	0.486	0.527	0.486	0.415	0.371
	11	DUVAL	0.423	0.174	0.184	0.174	0.157	0.147	1.000	0.411	0.435	0.411	0.371	0.348
	12	FRANKLIN	2.368	1.644	1.729	1.644	1.470	1.318	1.000	0.694	0.730	0.694	0.621	0.557
	13	GLADES	1.097	0.501	0.597	0.501	0.315	0.259	1.000	0.457	0.545	0.457	0.287	0.236
	14	HAMILTON	0.208	0.046	0.051	0.046	0.039	0.037	1.000	0.221	0.246	0.221	0.186	0.178
	15	HERNANDO	0.960	0.444	0.537	0.444	0.264	0.214	1.000	0.462	0.559	0.462	0.275	0.223
	16	HILLSBOROUGH	0.660	0.255	0.307	0.255	0.156	0.130	1.000	0.386	0.464	0.386	0.236	0.197
	17	HOLMES	0.349	0.083	0.094	0.083	0.069	0.066	1.000	0.239	0.269	0.239	0.198	0.189
	18	INDIAN RIVER	4.924	3.930	4.160	3.930	3.418	3.037	1.000	0.798	0.845	0.798	0.694	0.617
	19	JACKSON	0.270	0.058	0.065	0.058	0.048	0.047	1.000	0.214	0.241	0.214	0.179	0.173
	20	LEE	1.098	0.507	0.597	0.507	0.330	0.273	1.000	0.462	0.544	0.462	0.301	0.249
	21	LEON	0.286	0.070	0.079	0.070	0.058	0.055	1.000	0.245	0.275	0.245	0.204	0.193

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	22	MARION	0.255	0.060	0.067	0.060	0.049	0.046	1.000	0.236	0.263	0.236	0.191	0.181
	23	MARTIN	1.573	0.801	0.989	0.801	0.436	0.334	1.000	0.509	0.629	0.509	0.277	0.212
	24	MARTIN	5.058	3.864	4.193	3.864	3.150	2.712	1.000	0.764	0.829	0.764	0.623	0.536
	25	MIAMI-DADE	1.679	1.014	1.138	1.014	0.753	0.617	1.000	0.604	0.678	0.604	0.448	0.368
	26	MIAMI-DADE	3.036	2.186	2.360	2.186	1.804	1.543	1.000	0.720	0.777	0.720	0.594	0.508
	27	MONROE	4.984	3.777	4.140	3.777	2.975	2.483	1.000	0.758	0.831	0.758	0.597	0.498
	28	MONROE	8.617	7.080	7.558	7.080	5.988	5.168	1.000	0.822	0.877	0.822	0.695	0.600
	29	OKALOOSA	0.988	0.481	0.523	0.481	0.410	0.365	1.000	0.488	0.530	0.488	0.415	0.370
	30	OSCEOLA	0.517	0.177	0.217	0.177	0.102	0.086	1.000	0.342	0.421	0.342	0.197	0.165
	31	OSCEOLA	0.724	0.300	0.354	0.300	0.197	0.166	1.000	0.414	0.488	0.414	0.271	0.229
	32	PALM BEACH	1.914	1.067	1.254	1.067	0.696	0.569	1.000	0.557	0.655	0.557	0.364	0.297
	33	PALM BEACH	3.440	2.377	2.628	2.377	1.852	1.587	1.000	0.691	0.764	0.691	0.539	0.461
	34	PINELLAS	0.991	0.439	0.553	0.439	0.223	0.172	1.000	0.443	0.558	0.443	0.225	0.174
	35	SAINT JOHNS	0.295	0.086	0.093	0.086	0.075	0.072	1.000	0.291	0.314	0.291	0.256	0.242
	36	SANTA ROSA	0.678	0.263	0.293	0.263	0.216	0.194	1.000	0.388	0.433	0.388	0.319	0.287
	37	SEMINOLE	0.650	0.257	0.330	0.257	0.121	0.093	1.000	0.396	0.509	0.396	0.187	0.144
	38	TAYLOR	0.308	0.071	0.082	0.071	0.058	0.054	1.000	0.232	0.267	0.232	0.187	0.175
	39	VOLUSIA	0.540	0.258	0.277	0.258	0.222	0.202	1.000	0.478	0.512	0.478	0.412	0.374
	40	WAKULLA	0.788	0.351	0.382	0.351	0.300	0.270	1.000	0.446	0.485	0.446	0.381	0.343
Frame Condo Unit	1	BAY	1.967	1.336	1.336	1.127	0.971	0.859	1.000	0.679	0.679	0.573	0.493	0.437
	2	BREVARD	1.356	0.820	0.820	0.583	0.421	0.325	1.000	0.605	0.605	0.430	0.311	0.240
	3	BREVARD	1.261	0.733	0.733	0.501	0.347	0.261	1.000	0.582	0.582	0.397	0.276	0.207
	4	BROWARD	2.611	1.846	1.846	1.479	1.125	0.878	1.000	0.707	0.707	0.566	0.431	0.336
	5	BROWARD	5.644	4.661	4.661	4.166	3.574	3.051	1.000	0.826	0.826	0.738	0.633	0.540
	6	CITRUS	0.967	0.531	0.531	0.336	0.192	0.121	1.000	0.549	0.549	0.347	0.199	0.125
	7	CLAY	0.312	0.114	0.114	0.059	0.045	0.042	1.000	0.366	0.366	0.190	0.145	0.135

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	8	COLLIER	1.898	1.178	1.178	0.857	0.572	0.407	1.000	0.621	0.621	0.451	0.301	0.214
	9	COLUMBIA	0.330	0.117	0.117	0.058	0.044	0.042	1.000	0.355	0.355	0.176	0.135	0.127
	10	DIXIE	1.286	0.767	0.767	0.607	0.508	0.448	1.000	0.596	0.596	0.471	0.395	0.348
	11	DUVAL	0.704	0.406	0.406	0.316	0.285	0.263	1.000	0.576	0.576	0.449	0.405	0.374
	12	FRANKLIN	3.258	2.530	2.530	2.275	2.035	1.821	1.000	0.777	0.777	0.698	0.624	0.559
	13	GLADES	1.624	0.952	0.952	0.643	0.424	0.301	1.000	0.586	0.586	0.396	0.261	0.185
	14	HAMILTON	0.298	0.110	0.110	0.057	0.045	0.042	1.000	0.368	0.368	0.190	0.150	0.140
	15	HERNANDO	1.372	0.814	0.814	0.563	0.360	0.249	1.000	0.593	0.593	0.411	0.262	0.182
	16	HILLSBOROUGH	1.035	0.540	0.540	0.327	0.215	0.154	1.000	0.522	0.522	0.316	0.208	0.149
	17	HOLMES	0.502	0.194	0.194	0.105	0.081	0.075	1.000	0.386	0.386	0.209	0.162	0.150
	18	INDIAN RIVER	6.791	5.831	5.831	5.339	4.721	4.148	1.000	0.859	0.859	0.786	0.695	0.611
	19	JACKSON	0.391	0.143	0.143	0.072	0.056	0.053	1.000	0.365	0.365	0.185	0.144	0.135
	20	LEE	1.604	0.944	0.944	0.646	0.437	0.316	1.000	0.589	0.589	0.403	0.272	0.197
	21	LEON	0.406	0.159	0.159	0.088	0.069	0.063	1.000	0.391	0.391	0.217	0.169	0.155
	22	MARION	0.409	0.161	0.161	0.071	0.056	0.050	1.000	0.393	0.393	0.173	0.136	0.122
	23	MARTIN	2.131	1.408	1.408	1.038	0.611	0.389	1.000	0.660	0.660	0.487	0.287	0.182
	24	MARTIN	6.732	5.698	5.698	5.122	4.278	3.602	1.000	0.846	0.846	0.761	0.635	0.535
	25	MIAMI-DADE	2.300	1.602	1.602	1.266	0.946	0.727	1.000	0.697	0.697	0.551	0.412	0.316
	26	MIAMI-DADE	4.033	3.178	3.178	2.755	2.281	1.894	1.000	0.788	0.788	0.683	0.566	0.470
	27	MONROE	6.453	5.457	5.457	4.867	3.947	3.220	1.000	0.846	0.846	0.754	0.612	0.499
	28	MONROE	11.374	10.142	10.142	9.398	8.138	6.996	1.000	0.892	0.892	0.826	0.715	0.615
	29	OKALOOSA	1.311	0.777	0.777	0.609	0.503	0.440	1.000	0.593	0.593	0.465	0.384	0.336
	30	OSCEOLA	0.811	0.397	0.397	0.226	0.141	0.098	1.000	0.489	0.489	0.278	0.174	0.121
	31	OSCEOLA	1.108	0.600	0.600	0.383	0.263	0.196	1.000	0.542	0.542	0.346	0.237	0.177
	32	PALM BEACH	2.670	1.814	1.814	1.399	0.959	0.694	1.000	0.679	0.679	0.524	0.359	0.260
	33	PALM BEACH	4.717	3.686	3.686	3.162	2.531	2.070	1.000	0.781	0.781	0.670	0.537	0.439
	34	PINELLAS	1.420	0.841	0.841	0.577	0.334	0.209	1.000	0.592	0.592	0.406	0.235	0.147

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	35	SAINT JOHNS	0.450	0.195	0.195	0.122	0.104	0.096	1.000	0.434	0.434	0.270	0.231	0.213
	36	SANTA ROSA	0.910	0.468	0.468	0.333	0.260	0.228	1.000	0.515	0.515	0.365	0.286	0.251
	37	SEMINOLE	0.951	0.525	0.525	0.335	0.181	0.107	1.000	0.552	0.552	0.352	0.191	0.113
	38	TAYLOR	0.423	0.163	0.163	0.091	0.068	0.062	1.000	0.385	0.385	0.215	0.160	0.147
	39	VOLUSIA	0.829	0.465	0.465	0.314	0.266	0.231	1.000	0.562	0.562	0.379	0.321	0.279
	40	WAKULLA	1.104	0.633	0.633	0.487	0.408	0.362	1.000	0.573	0.573	0.441	0.370	0.328
Masonry Condo Unit	1	BAY	1.742	1.137	1.137	0.941	0.802	0.700	1.000	0.653	0.653	0.540	0.460	0.402
	2	BREVARD	1.317	0.788	0.788	0.555	0.395	0.302	1.000	0.599	0.599	0.421	0.300	0.229
	3	BREVARD	1.232	0.711	0.711	0.482	0.331	0.246	1.000	0.577	0.577	0.391	0.268	0.200
	4	BROWARD	2.530	1.773	1.773	1.413	1.066	0.827	1.000	0.701	0.701	0.559	0.422	0.327
	5	BROWARD	5.222	4.249	4.249	3.764	3.186	2.683	1.000	0.814	0.814	0.721	0.610	0.514
	6	CITRUS	0.948	0.518	0.518	0.326	0.185	0.116	1.000	0.547	0.547	0.344	0.196	0.122
	7	CLAY	0.291	0.104	0.104	0.052	0.041	0.038	1.000	0.357	0.357	0.179	0.140	0.130
	8	COLLIER	1.849	1.140	1.140	0.825	0.545	0.387	1.000	0.617	0.617	0.446	0.295	0.209
	9	COLUMBIA	0.307	0.106	0.106	0.050	0.040	0.037	1.000	0.345	0.345	0.164	0.129	0.122
	10	DIXIE	1.176	0.679	0.679	0.528	0.441	0.385	1.000	0.577	0.577	0.449	0.375	0.328
	11	DUVAL	0.565	0.282	0.282	0.197	0.171	0.156	1.000	0.498	0.498	0.348	0.303	0.277
	12	FRANKLIN	2.797	2.099	2.099	1.858	1.640	1.446	1.000	0.750	0.750	0.664	0.586	0.517
	13	GLADES	1.585	0.923	0.923	0.621	0.407	0.288	1.000	0.582	0.582	0.392	0.257	0.182
	14	HAMILTON	0.278	0.100	0.100	0.050	0.041	0.038	1.000	0.360	0.360	0.181	0.146	0.136
	15	HERNANDO	1.344	0.793	0.793	0.547	0.346	0.237	1.000	0.590	0.590	0.407	0.257	0.176
	16	HILLSBOROUGH	1.010	0.523	0.523	0.314	0.204	0.145	1.000	0.518	0.518	0.311	0.202	0.144
	17	HOLMES	0.468	0.176	0.176	0.092	0.073	0.067	1.000	0.376	0.376	0.197	0.155	0.144
	18	INDIAN RIVER	5.958	5.008	5.008	4.523	3.921	3.378	1.000	0.841	0.841	0.759	0.658	0.567
	19	JACKSON	0.365	0.130	0.130	0.063	0.050	0.047	1.000	0.355	0.355	0.173	0.138	0.130
	20	LEE	1.562	0.913	0.913	0.623	0.418	0.302	1.000	0.585	0.585	0.399	0.268	0.194

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	21	LEON	0.378	0.144	0.144	0.078	0.062	0.057	1.000	0.381	0.381	0.205	0.163	0.150
	22	MARION	0.397	0.155	0.155	0.068	0.053	0.048	1.000	0.391	0.391	0.173	0.135	0.120
	23	MARTIN	2.059	1.346	1.346	0.987	0.577	0.371	1.000	0.654	0.654	0.479	0.280	0.180
	24	MARTIN	6.072	5.049	5.049	4.486	3.669	3.033	1.000	0.832	0.832	0.739	0.604	0.499
	25	MIAMI-DADE	2.236	1.546	1.546	1.217	0.903	0.690	1.000	0.691	0.691	0.544	0.404	0.309
	26	MIAMI-DADE	3.818	2.972	2.972	2.557	2.093	1.719	1.000	0.778	0.778	0.670	0.548	0.450
	27	MONROE	5.943	4.957	4.957	4.378	3.480	2.787	1.000	0.834	0.834	0.737	0.586	0.469
	28	MONROE	10.046	8.825	8.825	8.095	6.869	5.784	1.000	0.879	0.879	0.806	0.684	0.576
	29	OKALOOSA	1.215	0.705	0.705	0.547	0.453	0.394	1.000	0.581	0.581	0.450	0.372	0.324
	30	OSCEOLA	0.793	0.386	0.386	0.218	0.136	0.094	1.000	0.487	0.487	0.275	0.171	0.119
	31	OSCEOLA	1.079	0.579	0.579	0.367	0.249	0.184	1.000	0.537	0.537	0.340	0.231	0.170
	32	PALM BEACH	2.540	1.697	1.697	1.296	0.873	0.630	1.000	0.668	0.668	0.510	0.344	0.248
	33	PALM BEACH	4.323	3.306	3.306	2.799	2.192	1.765	1.000	0.765	0.765	0.647	0.507	0.408
	34	PINELLAS	1.378	0.806	0.806	0.548	0.310	0.191	1.000	0.585	0.585	0.398	0.225	0.138
	35	SAINT JOHNS	0.405	0.165	0.165	0.095	0.080	0.074	1.000	0.407	0.407	0.235	0.198	0.183
	36	SANTA ROSA	0.848	0.426	0.426	0.299	0.236	0.206	1.000	0.503	0.503	0.353	0.279	0.243
	37	SEMINOLE	0.931	0.512	0.512	0.326	0.175	0.104	1.000	0.549	0.549	0.350	0.188	0.111
	38	TAYLOR	0.395	0.147	0.147	0.080	0.061	0.056	1.000	0.372	0.372	0.202	0.154	0.141
	39	VOLUSIA	0.806	0.448	0.448	0.300	0.253	0.219	1.000	0.557	0.557	0.373	0.314	0.271
	40	WAKULLA	0.985	0.536	0.536	0.399	0.330	0.290	1.000	0.544	0.544	0.405	0.335	0.294
			Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	2%	3%	5%	10%		$0	2%	3%	5%	10%	
Commercial Residential	1	BAY	14.129	12.016	11.232	9.878	7.263							
	2	BREVARD	8.702	7.038	6.471	5.528	3.819		1.000	0.809	0.744	0.635	0.439	
	3	BREVARD	8.011	6.387	5.833	4.918	3.276		1.000	0.797	0.728	0.614	0.409	

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	4	BROWARD	15.970	13.513	12.572	10.939	7.775		1.000	0.846	0.787	0.685	0.487	
	5	BROWARD	27.625	24.514	23.278	21.086	16.628		1.000	0.887	0.843	0.763	0.602	
	6	CITRUS	4.591	3.337	2.939	2.317	1.311		1.000	0.727	0.640	0.505	0.285	
	7	CLAY	1.780	1.129	0.954	0.698	0.328		1.000	0.634	0.536	0.392	0.184	
	8	COLLIER	14.831	12.378	11.447	9.837	6.720		1.000	0.835	0.772	0.663	0.453	
	9	COLUMBIA	1.642	0.976	0.806	0.573	0.261		1.000	0.594	0.491	0.349	0.159	
	10	DIXIE	7.980	6.440	5.915	5.041	3.482		1.000	0.807	0.741	0.632	0.436	
	11	DUVAL	5.386	4.303	3.950	3.373	2.355		1.000	0.799	0.733	0.626	0.437	
	12	FRANKLIN	16.786	14.548	13.705	12.237	9.343		1.000	0.867	0.816	0.729	0.557	
	13	GLADES	10.584	8.468	7.711	6.438	4.113		1.000	0.800	0.729	0.608	0.389	
	14	HAMILTON	1.410	0.826	0.689	0.494	0.231		1.000	0.586	0.489	0.350	0.164	
	15	HERNANDO	7.568	5.945	5.382	4.446	2.815		1.000	0.785	0.711	0.587	0.372	
	16	HILLSBOROUGH	6.915	5.305	4.739	3.813	2.208		1.000	0.767	0.685	0.551	0.319	
	17	HOLMES	4.050	2.917	2.556	1.983	1.051		1.000	0.720	0.631	0.490	0.260	
	18	INDIAN RIVER	25.362	22.699	21.672	19.856	16.165		1.000	0.895	0.855	0.783	0.637	
	19	JACKSON	2.711	1.796	1.526	1.123	0.537		1.000	0.663	0.563	0.414	0.198	
	20	LEE	11.433	9.231	8.421	7.056	4.548		1.000	0.807	0.737	0.617	0.398	
	21	LEON	2.514	1.690	1.454	1.109	0.585		1.000	0.672	0.578	0.441	0.233	
	22	MARION	3.419	2.363	2.052	1.573	0.824		1.000	0.691	0.600	0.460	0.241	
	23	MARTIN	11.252	9.152	8.398	7.135	4.818		1.000	0.813	0.746	0.634	0.428	
	24	MARTIN	27.528	24.626	23.482	21.464	17.332		1.000	0.895	0.853	0.780	0.630	
	25	MIAMI-DADE	15.713	13.372	12.464	10.866	7.721		1.000	0.851	0.793	0.692	0.491	
	26	MIAMI-DADE	23.160	20.396	19.304	17.362	13.398		1.000	0.881	0.833	0.750	0.579	
	27	MONROE	32.696	29.834	28.644	26.465	21.761		1.000	0.912	0.876	0.809	0.666	
	28	MONROE	39.472	36.388	35.096	32.732	27.576		1.000	0.922	0.889	0.829	0.699	
	29	OKALOOSA	12.168	10.239	9.528	8.309	5.931		1.000	0.841	0.783	0.683	0.487	
	30	OSCEOLA	4.861	3.506	3.076	2.389	1.284		1.000	0.721	0.633	0.491	0.264	

Construction / Policy	Location	County	Hurricane Loss Cost at different Deductibles						Ratios relative $0					
			$0	$500	1%	2%	5%	10%	$0	$500	1%	2%	5%	10%
	31	OSCEOLA	7.220	5.598	5.050	4.156	2.598		1.000	0.775	0.699	0.576	0.360	
	32	PALM BEACH	15.415	12.953	12.043	10.472	7.469		1.000	0.840	0.781	0.679	0.484	
	33	PALM BEACH	24.602	21.612	20.442	18.376	14.243		1.000	0.878	0.831	0.747	0.579	
	34	PINELLAS	7.922	6.258	5.670	4.695	2.969		1.000	0.790	0.716	0.593	0.375	
	35	SAINT JOHNS	4.260	3.267	2.954	2.457	1.594		1.000	0.767	0.694	0.577	0.374	
	36	SANTA ROSA	8.035	6.524	5.975	5.040	3.263		1.000	0.812	0.744	0.627	0.406	
	37	SEMINOLE	4.107	2.903	2.531	1.963	1.075		1.000	0.707	0.616	0.478	0.262	
	38	TAYLOR	2.681	1.850	1.614	1.260	0.707		1.000	0.690	0.602	0.470	0.264	
	39	VOLUSIA	7.374	6.009	5.541	4.765	3.345		1.000	0.815	0.751	0.646	0.454	
	40	WAKULLA	7.723	6.240	5.737	4.895	3.376		1.000	0.808	0.743	0.634	0.437	

Form A-6: Logical Relationship to Hurricane Risk - Construction
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Policy Form	Location	County	Hurricane Loss Cost per Construction Type		Frame / Masonry
			Masonry	Frame	Masonry
Owners	1	BAY	3.776	4.080	1.081
	2	BREVARD	4.504	4.567	1.014
	3	BREVARD	4.347	4.399	1.012
	4	BROWARD	7.253	7.419	1.023
	5	BROWARD	11.806	12.368	1.048
	6	CITRUS	3.367	3.417	1.015
	7	CLAY	0.861	0.894	1.038
	8	COLLIER	5.731	5.844	1.020
	9	COLUMBIA	0.925	0.963	1.040
	10	DIXIE	2.720	2.883	1.060
	11	DUVAL	1.685	1.861	1.105
	12	FRANKLIN	5.473	6.033	1.102
	13	GLADES	5.569	5.672	1.019
	14	HAMILTON	0.844	0.876	1.038
	15	HERNANDO	4.423	4.483	1.014
	16	HILLSBOROUGH	3.930	3.990	1.015
	17	HOLMES	1.440	1.509	1.048
	18	INDIAN RIVER	12.493	13.458	1.077
	19	JACKSON	1.135	1.188	1.046
	20	LEE	5.340	5.460	1.023
	21	LEON	1.119	1.167	1.042
	22	MARION	1.619	1.656	1.023
	23	MARTIN	5.766	5.980	1.037
	24	MARTIN	12.415	13.192	1.063
	25	MIAMI-DADE	6.538	6.677	1.021
	26	MIAMI-DADE	9.393	9.716	1.034
	27	MONROE	11.748	12.407	1.056
	28	MONROE	17.735	19.284	1.087
	29	OKALOOSA	2.881	3.039	1.055
	30	OSCEOLA	3.108	3.158	1.016
	31	OSCEOLA	4.010	4.082	1.018
	32	PALM BEACH	7.320	7.621	1.041
	33	PALM BEACH	10.503	11.071	1.054
	34	PINELLAS	4.458	4.549	1.021
	35	SAINT JOHNS	1.312	1.389	1.059
	36	SANTA ROSA	2.135	2.242	1.050
	37	SEMINOLE	3.216	3.276	1.019
	38	TAYLOR	1.079	1.123	1.041
	39	VOLUSIA	3.006	3.059	1.018

Policy Form	Location	County	Hurricane Loss Cost per Construction Type		Frame / Masonry
			Masonry	Frame	Masonry
	40	WAKULLA	2.457	2.628	1.070
Renters	1	BAY	1.444	1.646	1.140
	2	BREVARD	0.922	0.954	1.035
	3	BREVARD	0.849	0.873	1.028
	4	BROWARD	1.913	1.980	1.035
	5	BROWARD	4.249	4.628	1.089
	6	CITRUS	0.652	0.666	1.022
	7	CLAY	0.220	0.239	1.089
	8	COLLIER	1.360	1.398	1.028
	9	COLUMBIA	0.230	0.250	1.087
	10	DIXIE	0.961	1.059	1.102
	11	DUVAL	0.423	0.550	1.300
	12	FRANKLIN	2.368	2.789	1.178
	13	GLADES	1.097	1.125	1.026
	14	HAMILTON	0.208	0.226	1.082
	15	HERNANDO	0.960	0.982	1.023
	16	HILLSBOROUGH	0.660	0.679	1.028
	17	HOLMES	0.349	0.377	1.082
	18	INDIAN RIVER	4.924	5.690	1.155
	19	JACKSON	0.270	0.293	1.082
	20	LEE	1.098	1.128	1.028
	21	LEON	0.286	0.311	1.085
	22	MARION	0.255	0.263	1.033
	23	MARTIN	1.573	1.625	1.033
	24	MARTIN	5.058	5.664	1.120
	25	MIAMI-DADE	1.679	1.730	1.030
	26	MIAMI-DADE	3.036	3.223	1.062
	27	MONROE	4.984	5.442	1.092
	28	MONROE	8.617	9.838	1.142
	29	OKALOOSA	0.988	1.070	1.084
	30	OSCEOLA	0.517	0.530	1.026
	31	OSCEOLA	0.724	0.747	1.031
	32	PALM BEACH	1.914	2.016	1.053
	33	PALM BEACH	3.440	3.789	1.101
	34	PINELLAS	0.991	1.024	1.034
	35	SAINT JOHNS	0.295	0.333	1.129
	36	SANTA ROSA	0.678	0.731	1.078
	37	SEMINOLE	0.650	0.663	1.021
	38	TAYLOR	0.308	0.333	1.081

Policy Form	Location	County	Hurricane Loss Cost per Construction Type		Frame / Masonry
			Masonry	Frame	Masonry
	39	VOLUSIA	0.540	0.559	1.034
	40	WAKULLA	0.788	0.893	1.134
Condo Unit	1	BAY	1.742	1.967	1.129
	2	BREVARD	1.317	1.356	1.029
	3	BREVARD	1.232	1.261	1.024
	4	BROWARD	2.530	2.611	1.032
	5	BROWARD	5.222	5.644	1.081
	6	CITRUS	0.948	0.967	1.020
	7	CLAY	0.291	0.312	1.075
	8	COLLIER	1.849	1.898	1.026
	9	COLUMBIA	0.307	0.330	1.074
	10	DIXIE	1.176	1.286	1.094
	11	DUVAL	0.565	0.704	1.247
	12	FRANKLIN	2.797	3.258	1.165
	13	GLADES	1.585	1.624	1.024
	14	HAMILTON	0.278	0.298	1.070
	15	HERNANDO	1.344	1.372	1.021
	16	HILLSBOROUGH	1.010	1.035	1.024
	17	HOLMES	0.468	0.502	1.073
	18	INDIAN RIVER	5.958	6.791	1.140
	19	JACKSON	0.365	0.391	1.073
	20	LEE	1.562	1.604	1.027
	21	LEON	0.378	0.406	1.074
	22	MARION	0.397	0.409	1.030
	23	MARTIN	2.059	2.131	1.035
	24	MARTIN	6.072	6.732	1.109
	25	MIAMI-DADE	2.236	2.300	1.028
	26	MIAMI-DADE	3.818	4.033	1.056
	27	MONROE	5.943	6.453	1.086
	28	MONROE	10.046	11.374	1.132
	29	OKALOOSA	1.215	1.311	1.079
	30	OSCEOLA	0.793	0.811	1.023
	31	OSCEOLA	1.079	1.108	1.027
	32	PALM BEACH	2.540	2.670	1.051
	33	PALM BEACH	4.323	4.717	1.091
	34	PINELLAS	1.378	1.420	1.030
	35	SAINT JOHNS	0.405	0.450	1.109
	36	SANTA ROSA	0.848	0.910	1.073
	37	SEMINOLE	0.931	0.951	1.021

Policy Form	Location	County	Hurricane Loss Cost per Construction Type		Frame / Masonry
			Masonry	Frame	Masonry
	38	TAYLOR	0.395	0.423	1.071
	39	VOLUSIA	0.806	0.829	1.029
	40	WAKULLA	0.985	1.104	1.120
Policy Form	**Location**	**County**	**Hurricane Loss Cost per Construction**		
			Concrete		
Commercial Residential	1	BAY	14.129		
	2	BREVARD	8.702		
	3	BREVARD	8.011		
	4	BROWARD	15.970		
	5	BROWARD	27.625		
	6	CITRUS	4.591		
	7	CLAY	1.780		
	8	COLLIER	14.831		
	9	COLUMBIA	1.642		
	10	DIXIE	7.980		
	11	DUVAL	5.386		
	12	FRANKLIN	16.786		
	13	GLADES	10.584		
	14	HAMILTON	1.410		
	15	HERNANDO	7.568		
	16	HILLSBOROUGH	6.915		
	17	HOLMES	4.050		
	18	INDIAN RIVER	25.362		
	19	JACKSON	2.711		
	20	LEE	11.433		
	21	LEON	2.514		
	22	MARION	3.419		
	23	MARTIN	11.252		
	24	MARTIN	27.528		
	25	MIAMI-DADE	15.713		
	26	MIAMI-DADE	23.160		
	27	MONROE	32.696		
	28	MONROE	39.472		
	29	OKALOOSA	12.168		
	30	OSCEOLA	4.861		
	31	OSCEOLA	7.220		
	32	PALM BEACH	15.415		
	33	PALM BEACH	24.602		

Policy Form	Location	County	Hurricane Loss Cost per Construction Type		Frame / Masonry
			Masonry	Frame	Masonry
	34	PINELLAS	7.922		
	35	SAINT JOHNS	4.260		
	36	SANTA ROSA	8.035		
	37	SEMINOLE	4.107		
	38	TAYLOR	2.681		
	39	VOLUSIA	7.374		
	40	WAKULLA	7.723		

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
Frame Owners	1	BAY	3.085	0.172	0.656	0.167	1.000	0.056	0.213	0.054
	2	BREVARD	3.967	0.123	0.396	0.081	1.000	0.031	0.100	0.020
	3	BREVARD	3.842	0.120	0.366	0.071	1.000	0.031	0.095	0.018
	4	BROWARD	6.230	0.199	0.804	0.186	1.000	0.032	0.129	0.030
	5	BROWARD	9.760	0.294	1.798	0.516	1.000	0.030	0.184	0.053
	6	CITRUS	2.995	0.089	0.293	0.041	1.000	0.030	0.098	0.014
	7	CLAY	0.730	0.044	0.102	0.018	1.000	0.061	0.139	0.025
	8	COLLIER	4.953	0.192	0.593	0.106	1.000	0.039	0.120	0.021
	9	COLUMBIA	0.792	0.045	0.106	0.019	1.000	0.057	0.134	0.024
	10	DIXIE	2.217	0.137	0.430	0.100	1.000	0.062	0.194	0.045
	11	DUVAL	1.502	0.084	0.216	0.059	1.000	0.056	0.144	0.039
	12	FRANKLIN	4.420	0.219	1.087	0.307	1.000	0.050	0.246	0.069
	13	GLADES	4.952	0.157	0.476	0.086	1.000	0.032	0.096	0.017
	14	HAMILTON	0.722	0.041	0.095	0.018	1.000	0.057	0.132	0.024

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	15	HERNANDO	3.864	0.128	0.423	0.069	1.000	0.033	0.109	0.018
	16	HILLSBOROUGH	3.540	0.110	0.288	0.051	1.000	0.031	0.081	0.014
	17	HOLMES	1.248	0.073	0.157	0.032	1.000	0.058	0.126	0.025
	18	INDIAN RIVER	10.329	0.285	2.202	0.643	1.000	0.028	0.213	0.062
	19	JACKSON	0.985	0.056	0.123	0.024	1.000	0.057	0.124	0.024
	20	LEE	4.727	0.169	0.475	0.089	1.000	0.036	0.100	0.019
	21	LEON	0.953	0.058	0.130	0.025	1.000	0.061	0.136	0.027
	22	MARION	1.453	0.072	0.109	0.022	1.000	0.049	0.075	0.015
	23	MARTIN	5.014	0.154	0.714	0.099	1.000	0.031	0.142	0.020
	24	MARTIN	10.075	0.285	2.257	0.575	1.000	0.028	0.224	0.057
	25	MIAMI-DADE	5.630	0.182	0.706	0.159	1.000	0.032	0.125	0.028
	26	MIAMI-DADE	7.860	0.245	1.269	0.343	1.000	0.031	0.161	0.044
	27	MONROE	9.389	0.298	2.213	0.508	1.000	0.032	0.236	0.054
	28	MONROE	13.961	0.405	3.879	1.040	1.000	0.029	0.278	0.074
	29	OKALOOSA	2.355	0.149	0.430	0.105	1.000	0.063	0.183	0.045
	30	OSCEOLA	2.801	0.092	0.228	0.037	1.000	0.033	0.081	0.013
	31	OSCEOLA	3.586	0.122	0.314	0.059	1.000	0.034	0.088	0.016
	32	PALM BEACH	6.415	0.198	0.852	0.157	1.000	0.031	0.133	0.024
	33	PALM BEACH	8.910	0.267	1.526	0.368	1.000	0.030	0.171	0.041
	34	PINELLAS	3.923	0.114	0.451	0.061	1.000	0.029	0.115	0.016
	35	SAINT JOHNS	1.152	0.070	0.134	0.033	1.000	0.061	0.116	0.028
	36	SANTA ROSA	1.761	0.116	0.300	0.066	1.000	0.066	0.170	0.037
	37	SEMINOLE	2.863	0.081	0.295	0.037	1.000	0.028	0.103	0.013
	38	TAYLOR	0.900	0.057	0.142	0.024	1.000	0.063	0.158	0.027
	39	VOLUSIA	2.675	0.104	0.220	0.059	1.000	0.039	0.082	0.022
	40	WAKULLA	2.058	0.124	0.361	0.086	1.000	0.060	0.175	0.042
Masonry	1	BAY	2.881	0.172	0.576	0.146	1.000	0.060	0.200	0.051

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
Owners	2	BREVARD	3.920	0.123	0.383	0.078	1.000	0.031	0.098	0.020
	3	BREVARD	3.803	0.120	0.356	0.069	1.000	0.032	0.093	0.018
	4	BROWARD	6.097	0.199	0.776	0.180	1.000	0.033	0.127	0.030
	5	BROWARD	9.388	0.294	1.651	0.473	1.000	0.031	0.176	0.050
	6	CITRUS	2.953	0.089	0.286	0.040	1.000	0.030	0.097	0.013
	7	CLAY	0.706	0.044	0.094	0.016	1.000	0.063	0.133	0.023
	8	COLLIER	4.859	0.192	0.577	0.103	1.000	0.039	0.119	0.021
	9	COLUMBIA	0.765	0.045	0.098	0.017	1.000	0.059	0.129	0.022
	10	DIXIE	2.103	0.137	0.391	0.090	1.000	0.065	0.186	0.043
	11	DUVAL	1.389	0.084	0.167	0.044	1.000	0.061	0.121	0.032
	12	FRANKLIN	4.070	0.219	0.924	0.260	1.000	0.054	0.227	0.064
	13	GLADES	4.863	0.157	0.464	0.084	1.000	0.032	0.095	0.017
	14	HAMILTON	0.698	0.041	0.088	0.016	1.000	0.059	0.127	0.023
	15	HERNANDO	3.815	0.128	0.413	0.067	1.000	0.033	0.108	0.018
	16	HILLSBOROUGH	3.489	0.110	0.281	0.050	1.000	0.032	0.080	0.014
	17	HOLMES	1.193	0.073	0.146	0.029	1.000	0.061	0.122	0.024
	18	INDIAN RIVER	9.746	0.285	1.910	0.553	1.000	0.029	0.196	0.057
	19	JACKSON	0.944	0.056	0.114	0.021	1.000	0.060	0.120	0.023
	20	LEE	4.621	0.169	0.462	0.087	1.000	0.037	0.100	0.019
	21	LEON	0.918	0.058	0.120	0.023	1.000	0.063	0.131	0.025
	22	MARION	1.420	0.072	0.106	0.021	1.000	0.050	0.075	0.015
	23	MARTIN	4.826	0.154	0.690	0.097	1.000	0.032	0.143	0.020
	24	MARTIN	9.601	0.285	2.024	0.505	1.000	0.030	0.211	0.053
	25	MIAMI-DADE	5.516	0.182	0.685	0.155	1.000	0.033	0.124	0.028
	26	MIAMI-DADE	7.629	0.245	1.195	0.323	1.000	0.032	0.157	0.042
	27	MONROE	8.959	0.298	2.033	0.459	1.000	0.033	0.227	0.051
	28	MONROE	13.021	0.405	3.415	0.893	1.000	0.031	0.262	0.069

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	29	OKALOOSA	2.239	0.149	0.397	0.097	1.000	0.067	0.177	0.043
	30	OSCEOLA	2.757	0.092	0.223	0.036	1.000	0.033	0.081	0.013
	31	OSCEOLA	3.525	0.122	0.305	0.057	1.000	0.035	0.087	0.016
	32	PALM BEACH	6.166	0.198	0.809	0.149	1.000	0.032	0.131	0.024
	33	PALM BEACH	8.516	0.267	1.390	0.330	1.000	0.031	0.163	0.039
	34	PINELLAS	3.848	0.114	0.437	0.059	1.000	0.030	0.113	0.015
	35	SAINT JOHNS	1.094	0.070	0.119	0.028	1.000	0.064	0.109	0.026
	36	SANTA ROSA	1.680	0.116	0.278	0.061	1.000	0.069	0.166	0.036
	37	SEMINOLE	2.810	0.081	0.288	0.036	1.000	0.029	0.103	0.013
	38	TAYLOR	0.868	0.057	0.132	0.022	1.000	0.065	0.152	0.025
	39	VOLUSIA	2.631	0.104	0.213	0.057	1.000	0.040	0.081	0.022
	40	WAKULLA	1.940	0.124	0.319	0.074	1.000	0.064	0.165	0.038
Manufactured Homes	1	BAY	12.914	0.172	2.506	0.968	1.000	0.013	0.194	0.075
	2	BREVARD	10.944	0.123	1.703	0.697	1.000	0.011	0.156	0.064
	3	BREVARD	10.414	0.120	1.533	0.629	1.000	0.012	0.147	0.060
	4	BROWARD	20.160	0.199	3.641	1.558	1.000	0.010	0.181	0.077
	5	BROWARD	34.288	0.294	7.908	3.312	1.000	0.009	0.231	0.097
	6	CITRUS	6.994	0.089	0.771	0.308	1.000	0.013	0.110	0.044
	7	CLAY	2.428	0.044	0.196	0.066	1.000	0.018	0.081	0.027
	8	COLLIER	18.862	0.192	3.252	1.356	1.000	0.010	0.172	0.072
	9	COLUMBIA	2.458	0.045	0.183	0.059	1.000	0.018	0.075	0.024
	10	DIXIE	9.694	0.137	1.685	0.654	1.000	0.014	0.174	0.067
	11	DUVAL	5.687	0.084	0.906	0.351	1.000	0.015	0.159	0.062
	12	FRANKLIN	17.126	0.219	3.776	1.461	1.000	0.013	0.221	0.085
	13	GLADES	13.772	0.157	2.006	0.835	1.000	0.011	0.146	0.061
	14	HAMILTON	2.218	0.041	0.168	0.054	1.000	0.019	0.076	0.025
	15	HERNANDO	11.123	0.128	1.622	0.665	1.000	0.011	0.146	0.060

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	16	HILLSBOROUGH	9.084	0.110	1.091	0.448	1.000	0.012	0.120	0.049
	17	HOLMES	4.275	0.073	0.425	0.153	1.000	0.017	0.099	0.036
	18	INDIAN RIVER	33.057	0.285	8.288	3.330	1.000	0.009	0.251	0.101
	19	JACKSON	3.147	0.056	0.261	0.088	1.000	0.018	0.083	0.028
	20	LEE	15.818	0.169	2.430	1.014	1.000	0.011	0.154	0.064
	21	LEON	3.322	0.058	0.318	0.113	1.000	0.017	0.096	0.034
	22	MARION	5.411	0.072	0.515	0.200	1.000	0.013	0.095	0.037
	23	MARTIN	14.287	0.154	2.178	0.930	1.000	0.011	0.152	0.065
	24	MARTIN	34.149	0.285	8.236	3.425	1.000	0.008	0.241	0.100
	25	MIAMI-DADE	18.210	0.182	3.227	1.382	1.000	0.010	0.177	0.076
	26	MIAMI-DADE	27.497	0.245	5.961	2.515	1.000	0.009	0.217	0.091
	27	MONROE	37.915	0.298	9.632	4.075	1.000	0.008	0.254	0.107
	28	MONROE	53.265	0.405	14.542	6.112	1.000	0.008	0.273	0.115
	29	OKALOOSA	10.700	0.149	1.912	0.744	1.000	0.014	0.179	0.070
	30	OSCEOLA	7.124	0.092	0.723	0.289	1.000	0.013	0.102	0.041
	31	OSCEOLA	10.406	0.122	1.441	0.593	1.000	0.012	0.138	0.057
	32	PALM BEACH	19.810	0.198	3.527	1.507	1.000	0.010	0.178	0.076
	33	PALM BEACH	29.943	0.267	6.502	2.740	1.000	0.009	0.217	0.092
	34	PINELLAS	10.099	0.114	1.351	0.557	1.000	0.011	0.134	0.055
	35	SAINT JOHNS	4.437	0.070	0.592	0.227	1.000	0.016	0.133	0.051
	36	SANTA ROSA	7.817	0.116	1.218	0.473	1.000	0.015	0.156	0.061
	37	SEMINOLE	6.239	0.081	0.623	0.247	1.000	0.013	0.100	0.040
	38	TAYLOR	3.306	0.057	0.331	0.119	1.000	0.017	0.100	0.036
	39	VOLUSIA	9.471	0.104	1.568	0.633	1.000	0.011	0.166	0.067
	40	WAKULLA	8.582	0.124	1.424	0.550	1.000	0.014	0.166	0.064
Frame Renters	1	BAY			1.312	0.334			1.000	0.255

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	2	BREVARD			0.792	0.162			1.000	0.205
	3	BREVARD			0.731	0.141			1.000	0.193
	4	BROWARD			1.608	0.371			1.000	0.231
	5	BROWARD			3.596	1.032			1.000	0.287
	6	CITRUS			0.585	0.081			1.000	0.139
	7	CLAY			0.203	0.036			1.000	0.177
	8	COLLIER			1.187	0.211			1.000	0.178
	9	COLUMBIA			0.213	0.037			1.000	0.176
	10	DIXIE			0.859	0.200			1.000	0.232
	11	DUVAL			0.432	0.118			1.000	0.274
	12	FRANKLIN			2.175	0.614			1.000	0.282
	13	GLADES			0.953	0.172			1.000	0.181
	14	HAMILTON			0.191	0.035			1.000	0.184
	15	HERNANDO			0.845	0.137			1.000	0.162
	16	HILLSBOROUGH			0.576	0.102			1.000	0.178
	17	HOLMES			0.314	0.063			1.000	0.201
	18	INDIAN RIVER			4.404	1.286			1.000	0.292
	19	JACKSON			0.245	0.047			1.000	0.193
	20	LEE			0.950	0.178			1.000	0.187
	21	LEON			0.260	0.051			1.000	0.195
	22	MARION			0.219	0.044			1.000	0.202
	23	MARTIN			1.427	0.198			1.000	0.139
	24	MARTIN			4.514	1.150			1.000	0.255
	25	MIAMI-DADE			1.413	0.317			1.000	0.225
	26	MIAMI-DADE			2.537	0.686			1.000	0.270
	27	MONROE			4.427	1.015			1.000	0.229
	28	MONROE			7.758	2.080			1.000	0.268

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	29	OKALOOSA			0.860	0.210			1.000	0.244
	30	OSCEOLA			0.456	0.074			1.000	0.162
	31	OSCEOLA			0.629	0.118			1.000	0.188
	32	PALM BEACH			1.703	0.313			1.000	0.184
	33	PALM BEACH			3.053	0.736			1.000	0.241
	34	PINELLAS			0.901	0.123			1.000	0.136
	35	SAINT JOHNS			0.268	0.065			1.000	0.244
	36	SANTA ROSA			0.600	0.131			1.000	0.219
	37	SEMINOLE			0.589	0.074			1.000	0.126
	38	TAYLOR			0.284	0.049			1.000	0.171
	39	VOLUSIA			0.440	0.119			1.000	0.270
	40	WAKULLA			0.722	0.171			1.000	0.237
Masonry Renters	1	BAY			1.152	0.292			1.000	0.253
	2	BREVARD			0.765	0.156			1.000	0.204
	3	BREVARD			0.711	0.137			1.000	0.193
	4	BROWARD			1.553	0.360			1.000	0.232
	5	BROWARD			3.302	0.947			1.000	0.287
	6	CITRUS			0.573	0.079			1.000	0.138
	7	CLAY			0.188	0.032			1.000	0.171
	8	COLLIER			1.153	0.206			1.000	0.179
	9	COLUMBIA			0.197	0.033			1.000	0.170
	10	DIXIE			0.781	0.180			1.000	0.230
	11	DUVAL			0.335	0.088			1.000	0.263
	12	FRANKLIN			1.848	0.520			1.000	0.282
	13	GLADES			0.928	0.169			1.000	0.182
	14	HAMILTON			0.177	0.032			1.000	0.179
	15	HERNANDO			0.827	0.134			1.000	0.162

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	16	HILLSBOROUGH			0.561	0.099			1.000	0.177
	17	HOLMES			0.291	0.057			1.000	0.197
	18	INDIAN RIVER			3.819	1.105			1.000	0.289
	19	JACKSON			0.227	0.043			1.000	0.189
	20	LEE			0.923	0.174			1.000	0.189
	21	LEON			0.241	0.046			1.000	0.191
	22	MARION			0.212	0.042			1.000	0.200
	23	MARTIN			1.379	0.194			1.000	0.140
	24	MARTIN			4.048	1.009			1.000	0.249
	25	MIAMI-DADE			1.370	0.310			1.000	0.226
	26	MIAMI-DADE			2.389	0.647			1.000	0.271
	27	MONROE			4.067	0.918			1.000	0.226
	28	MONROE			6.830	1.787			1.000	0.262
	29	OKALOOSA			0.793	0.194			1.000	0.245
	30	OSCEOLA			0.445	0.072			1.000	0.161
	31	OSCEOLA			0.610	0.114			1.000	0.187
	32	PALM BEACH			1.617	0.297			1.000	0.184
	33	PALM BEACH			2.780	0.660			1.000	0.237
	34	PINELLAS			0.873	0.118			1.000	0.135
	35	SAINT JOHNS			0.239	0.057			1.000	0.239
	36	SANTA ROSA			0.557	0.121			1.000	0.218
	37	SEMINOLE			0.577	0.073			1.000	0.126
	38	TAYLOR			0.264	0.044			1.000	0.166
	39	VOLUSIA			0.425	0.115			1.000	0.270
	40	WAKULLA			0.639	0.149			1.000	0.233
Frame Condo Unit	1	BAY	0.321		1.312	0.334	0.245		1.000	0.255
	2	BREVARD	0.402		0.792	0.162	0.507		1.000	0.205

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	3	BREVARD	0.388		0.731	0.141	0.531		1.000	0.193
	4	BROWARD	0.632		1.608	0.371	0.393		1.000	0.231
	5	BROWARD	1.017		3.596	1.032	0.283		1.000	0.287
	6	CITRUS	0.300		0.585	0.081	0.513		1.000	0.139
	7	CLAY	0.073		0.203	0.036	0.359		1.000	0.177
	8	COLLIER	0.500		1.187	0.211	0.421		1.000	0.178
	9	COLUMBIA	0.079		0.213	0.037	0.373		1.000	0.176
	10	DIXIE	0.227		0.859	0.200	0.264		1.000	0.232
	11	DUVAL	0.155		0.432	0.118	0.358		1.000	0.274
	12	FRANKLIN	0.469		2.175	0.614	0.216		1.000	0.282
	13	GLADES	0.499		0.953	0.172	0.524		1.000	0.181
	14	HAMILTON	0.072		0.191	0.035	0.380		1.000	0.184
	15	HERNANDO	0.389		0.845	0.137	0.460		1.000	0.162
	16	HILLSBOROUGH	0.356		0.576	0.102	0.618		1.000	0.178
	17	HOLMES	0.125		0.314	0.063	0.399		1.000	0.201
	18	INDIAN RIVER	1.101		4.404	1.286	0.250		1.000	0.292
	19	JACKSON	0.099		0.245	0.047	0.403		1.000	0.193
	20	LEE	0.476		0.950	0.178	0.501		1.000	0.187
	21	LEON	0.096		0.260	0.051	0.368		1.000	0.195
	22	MARION	0.145		0.219	0.044	0.664		1.000	0.202
	23	MARTIN	0.506		1.427	0.198	0.355		1.000	0.139
	24	MARTIN	1.069		4.514	1.150	0.237		1.000	0.255
	25	MIAMI-DADE	0.570		1.413	0.317	0.403		1.000	0.225
	26	MIAMI-DADE	0.810		2.537	0.686	0.319		1.000	0.270
	27	MONROE	1.011		4.427	1.015	0.228		1.000	0.229
	28	MONROE	1.536		7.758	2.080	0.198		1.000	0.268
	29	OKALOOSA	0.240		0.860	0.210	0.279		1.000	0.244

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	30	OSCEOLA	0.281		0.456	0.074	0.615		1.000	0.162
	31	OSCEOLA	0.361		0.629	0.118	0.574		1.000	0.188
	32	PALM BEACH	0.654		1.703	0.313	0.384		1.000	0.184
	33	PALM BEACH	0.929		3.053	0.736	0.304		1.000	0.241
	34	PINELLAS	0.396		0.901	0.123	0.439		1.000	0.136
	35	SAINT JOHNS	0.116		0.268	0.065	0.433		1.000	0.244
	36	SANTA ROSA	0.179		0.600	0.131	0.298		1.000	0.219
	37	SEMINOLE	0.287		0.589	0.074	0.488		1.000	0.126
	38	TAYLOR	0.090		0.284	0.049	0.318		1.000	0.171
	39	VOLUSIA	0.270		0.440	0.119	0.614		1.000	0.270
	40	WAKULLA	0.211		0.722	0.171	0.292		1.000	0.237
Masonry Condo Unit	1	BAY	0.298		1.152	0.292	0.259		1.000	0.253
	2	BREVARD	0.396		0.765	0.156	0.517		1.000	0.204
	3	BREVARD	0.383		0.711	0.137	0.539		1.000	0.193
	4	BROWARD	0.616		1.553	0.360	0.397		1.000	0.232
	5	BROWARD	0.974		3.302	0.947	0.295		1.000	0.287
	6	CITRUS	0.296		0.573	0.079	0.517		1.000	0.138
	7	CLAY	0.071		0.188	0.032	0.376		1.000	0.171
	8	COLLIER	0.489		1.153	0.206	0.424		1.000	0.179
	9	COLUMBIA	0.077		0.197	0.033	0.389		1.000	0.170
	10	DIXIE	0.215		0.781	0.180	0.275		1.000	0.230
	11	DUVAL	0.142		0.335	0.088	0.424		1.000	0.263
	12	FRANKLIN	0.429		1.848	0.520	0.232		1.000	0.282
	13	GLADES	0.489		0.928	0.169	0.527		1.000	0.182
	14	HAMILTON	0.070		0.177	0.032	0.395		1.000	0.179
	15	HERNANDO	0.384		0.827	0.134	0.464		1.000	0.162
	16	HILLSBOROUGH	0.350		0.561	0.099	0.624		1.000	0.177

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	17	HOLMES	0.120		0.291	0.057	0.411		1.000	0.197
	18	INDIAN RIVER	1.033		3.819	1.105	0.271		1.000	0.289
	19	JACKSON	0.095		0.227	0.043	0.415		1.000	0.189
	20	LEE	0.464		0.923	0.174	0.503		1.000	0.189
	21	LEON	0.092		0.241	0.046	0.382		1.000	0.191
	22	MARION	0.142		0.212	0.042	0.669		1.000	0.200
	23	MARTIN	0.486		1.379	0.194	0.352		1.000	0.140
	24	MARTIN	1.014		4.048	1.009	0.251		1.000	0.249
	25	MIAMI-DADE	0.557		1.370	0.310	0.406		1.000	0.226
	26	MIAMI-DADE	0.783		2.389	0.647	0.328		1.000	0.271
	27	MONROE	0.959		4.067	0.918	0.236		1.000	0.226
	28	MONROE	1.428		6.830	1.787	0.209		1.000	0.262
	29	OKALOOSA	0.227		0.793	0.194	0.287		1.000	0.245
	30	OSCEOLA	0.276		0.445	0.072	0.620		1.000	0.161
	31	OSCEOLA	0.354		0.610	0.114	0.580		1.000	0.187
	32	PALM BEACH	0.626		1.617	0.297	0.387		1.000	0.184
	33	PALM BEACH	0.883		2.780	0.660	0.318		1.000	0.237
	34	PINELLAS	0.387		0.873	0.118	0.443		1.000	0.135
	35	SAINT JOHNS	0.110		0.239	0.057	0.461		1.000	0.239
	36	SANTA ROSA	0.170		0.557	0.121	0.305		1.000	0.218
	37	SEMINOLE	0.282		0.577	0.073	0.488		1.000	0.126
	38	TAYLOR	0.087		0.264	0.044	0.329		1.000	0.166
	39	VOLUSIA	0.265		0.425	0.115	0.624		1.000	0.270
	40	WAKULLA	0.198		0.639	0.149	0.309		1.000	0.233
Commercial Residential	1	BAY	13.834		0.295		1.000		0.021	
	2	BREVARD	8.534		0.168		1.000		0.020	
	3	BREVARD	7.860		0.152		1.000		0.019	

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	4	BROWARD	15.659		0.312		1.000		0.020	
	5	BROWARD	27.039		0.586		1.000		0.022	
	6	CITRUS	4.510		0.081		1.000		0.018	
	7	CLAY	1.750		0.030		1.000		0.017	
	8	COLLIER	14.542		0.288		1.000		0.020	
	9	COLUMBIA	1.615		0.027		1.000		0.017	
	10	DIXIE	7.821		0.159		1.000		0.020	
	11	DUVAL	5.280		0.106		1.000		0.020	
	12	FRANKLIN	16.425		0.361		1.000		0.022	
	13	GLADES	10.386		0.198		1.000		0.019	
	14	HAMILTON	1.386		0.023		1.000		0.017	
	15	HERNANDO	7.427		0.142		1.000		0.019	
	16	HILLSBOROUGH	6.790		0.125		1.000		0.018	
	17	HOLMES	3.978		0.072		1.000		0.018	
	18	INDIAN RIVER	24.797		0.564		1.000		0.023	
	19	JACKSON	2.665		0.047		1.000		0.017	
	20	LEE	11.218		0.216		1.000		0.019	
	21	LEON	2.471		0.044		1.000		0.018	
	22	MARION	3.360		0.059		1.000		0.018	
	23	MARTIN	11.041		0.211		1.000		0.019	
	24	MARTIN	26.932		0.596		1.000		0.022	
	25	MIAMI-DADE	15.407		0.307		1.000		0.020	
	26	MIAMI-DADE	22.680		0.481		1.000		0.021	
	27	MONROE	31.983		0.714		1.000		0.022	
	28	MONROE	38.591		0.882		1.000		0.023	
	29	OKALOOSA	11.921		0.247		1.000		0.021	
	30	OSCEOLA	4.777		0.085		1.000		0.018	

Construction / Policy	Location	County	Hurricane Loss Cost per Coverage				Ratios Relative to Dominant Coverage			
			Coverage A	Coverage B	Coverage C	Coverage D	Coverage A	Coverage B	Coverage C	Coverage D
	31	OSCEOLA	7.087		0.133		1.000		0.019	
	32	PALM BEACH	15.115		0.300		1.000		0.020	
	33	PALM BEACH	24.090		0.512		1.000		0.021	
	34	PINELLAS	7.775		0.147		1.000		0.019	
	35	SAINT JOHNS	4.180		0.080		1.000		0.019	
	36	SANTA ROSA	7.879		0.156		1.000		0.020	
	37	SEMINOLE	4.036		0.071		1.000		0.018	
	38	TAYLOR	2.633		0.047		1.000		0.018	
	39	VOLUSIA	7.230		0.145		1.000		0.020	
	40	WAKULLA	7.570		0.154		1.000		0.020	

Construction / Policy	Location	County	Hurricane Loss Cost per Year Built			Ratios Relative to 1980 Year Built		
			Year Built 1980	Year Built 1998	Year Built 2004	Year Built 1980	Year Built 1998	Year Built 2004
Frame Owners	1	BAY	4.495	2.887	2.021	1.000	0.642	0.450
	2	BREVARD	5.310	3.267	1.817	1.000	0.615	0.342
	3	BREVARD	5.110	3.158	1.776	1.000	0.618	0.347
	4	BROWARD	10.131	2.562	2.560	1.000	0.253	0.253
	5	BROWARD	17.149	3.696	3.720	1.000	0.216	0.217
	6	CITRUS	4.111	2.460	1.445	1.000	0.598	0.351
	7	CLAY	0.971	0.791	0.716	1.000	0.814	0.737
	8	COLLIER	8.070	4.774	2.521	1.000	0.592	0.312
	9	COLUMBIA	1.003	0.831	0.758	1.000	0.828	0.756
	10	DIXIE	3.247	2.255	1.703	1.000	0.694	0.525
	11	DUVAL	2.011	1.411	1.098	1.000	0.702	0.546
	12	FRANKLIN	6.840	4.227	2.657	1.000	0.618	0.388
	13	GLADES	7.199	4.137	2.286	1.000	0.575	0.318
	14	HAMILTON	0.926	0.763	0.689	1.000	0.824	0.745
	15	HERNANDO	5.442	3.330	1.877	1.000	0.612	0.345
	16	HILLSBOROUGH	5.137	3.024	1.728	1.000	0.589	0.336
	17	HOLMES	1.591	1.212	1.066	1.000	0.762	0.670
	18	INDIAN RIVER	15.288	9.327	4.748	1.000	0.610	0.311
	19	JACKSON	1.224	0.976	0.877	1.000	0.798	0.716
	20	LEE	7.787	4.403	2.387	1.000	0.565	0.307
	21	LEON	1.253	0.981	0.875	1.000	0.783	0.699
	22	MARION	3.361	2.051	1.223	1.000	0.610	0.364
	23	MARTIN	6.654	3.963	2.127	1.000	0.596	0.320
	24	MARTIN	14.741	8.686	4.169	1.000	0.589	0.283
	25	MIAMI-DADE	9.107	2.328	2.325	1.000	0.256	0.255
	26	MIAMI-DADE	13.523	2.993	3.001	1.000	0.221	0.222
	27	MONROE	12.789	7.245	3.687	1.000	0.567	0.288
	28	MONROE	19.745	11.944	6.637	1.000	0.605	0.336
	29	OKALOOSA	3.479	2.295	1.736	1.000	0.659	0.499
	30	OSCEOLA	4.287	2.591	1.522	1.000	0.605	0.355
	31	OSCEOLA	5.645	3.296	1.872	1.000	0.584	0.332
	32	PALM BEACH	8.532	5.050	2.617	1.000	0.592	0.307
	33	PALM BEACH	12.389	7.208	3.506	1.000	0.582	0.283

Construction / Policy	Location	County	Hurricane Loss Cost per Year Built			Ratios Relative to 1980 Year Built		
			Year Built 1980	Year Built 1998	Year Built 2004	Year Built 1980	Year Built 1998	Year Built 2004
	34	PINELLAS	4.875	3.016	1.719	1.000	0.619	0.353
	35	SAINT JOHNS	1.517	1.147	0.967	1.000	0.756	0.638
	36	SANTA ROSA	2.458	1.716	1.388	1.000	0.698	0.565
	37	SEMINOLE	3.808	2.303	1.355	1.000	0.605	0.356
	38	TAYLOR	1.154	0.959	0.858	1.000	0.831	0.743
	39	VOLUSIA	4.559	2.796	1.544	1.000	0.613	0.339
	40	WAKULLA	2.808	1.978	1.538	1.000	0.704	0.548
Masonry Owners	1	BAY	4.216	2.756	1.984	1.000	0.654	0.471
	2	BREVARD	5.241	3.212	1.778	1.000	0.613	0.339
	3	BREVARD	5.051	3.108	1.738	1.000	0.615	0.344
	4	BROWARD	9.926	2.538	2.541	1.000	0.256	0.256
	5	BROWARD	16.589	3.512	3.538	1.000	0.212	0.213
	6	CITRUS	4.056	2.418	1.402	1.000	0.596	0.346
	7	CLAY	0.923	0.766	0.708	1.000	0.830	0.766
	8	COLLIER	7.932	4.649	2.473	1.000	0.586	0.312
	9	COLUMBIA	0.954	0.806	0.750	1.000	0.845	0.787
	10	DIXIE	3.074	2.166	1.676	1.000	0.705	0.545
	11	DUVAL	1.896	1.358	1.086	1.000	0.716	0.573
	12	FRANKLIN	6.320	3.964	2.562	1.000	0.627	0.405
	13	GLADES	7.074	4.036	2.234	1.000	0.571	0.316
	14	HAMILTON	0.884	0.741	0.682	1.000	0.838	0.772
	15	HERNANDO	5.391	3.284	1.829	1.000	0.609	0.339
	16	HILLSBOROUGH	5.086	2.974	1.667	1.000	0.585	0.328
	17	HOLMES	1.507	1.172	1.053	1.000	0.778	0.699
	18	INDIAN RIVER	14.366	8.725	4.413	1.000	0.607	0.307
	19	JACKSON	1.160	0.946	0.867	1.000	0.816	0.748
	20	LEE	7.628	4.268	2.334	1.000	0.559	0.306
	21	LEON	1.191	0.950	0.865	1.000	0.798	0.726
	22	MARION	3.312	2.012	1.189	1.000	0.607	0.359
	23	MARTIN	6.458	3.787	2.084	1.000	0.586	0.323
	24	MARTIN	13.980	8.195	3.941	1.000	0.586	0.282
	25	MIAMI-DADE	8.930	2.309	2.311	1.000	0.259	0.259
	26	MIAMI-DADE	13.175	2.919	2.931	1.000	0.222	0.222
	27	MONROE	12.232	6.926	3.352	1.000	0.566	0.274
	28	MONROE	18.312	11.003	5.487	1.000	0.601	0.300
	29	OKALOOSA	3.294	2.204	1.710	1.000	0.669	0.519
	30	OSCEOLA	4.231	2.543	1.479	1.000	0.601	0.350

Construction / Policy	Location	County	Hurricane Loss Cost per Year Built			Ratios Relative to 1980 Year Built		
			Year Built 1980	Year Built 1998	Year Built 2004	Year Built 1980	Year Built 1998	Year Built 2004
	31	OSCEOLA	5.574	3.233	1.815	1.000	0.580	0.326
	32	PALM BEACH	8.253	4.806	2.527	1.000	0.582	0.306
	33	PALM BEACH	11.923	6.874	3.368	1.000	0.576	0.282
	34	PINELLAS	4.798	2.941	1.657	1.000	0.613	0.345
	35	SAINT JOHNS	1.440	1.110	0.957	1.000	0.771	0.665
	36	SANTA ROSA	2.331	1.652	1.369	1.000	0.709	0.587
	37	SEMINOLE	3.753	2.258	1.315	1.000	0.602	0.350
	38	TAYLOR	1.098	0.929	0.848	1.000	0.846	0.773
	39	VOLUSIA	4.501	2.746	1.502	1.000	0.610	0.334
	40	WAKULLA	2.668	1.906	1.519	1.000	0.715	0.569

Construction / Policy	Location	County	Hurricane Loss Cost per Year Built			Ratios Relative to 1980 Year Built		
			Year Built 1974	Year Built 1992	Year Built 2004	Year Built 1974	Year Built 1992	Year Built 2004
Manufactured Homes	1	BAY	26.474	26.474	2.870	1.000	1.000	0.108
	2	BREVARD	16.149	16.149	2.035	1.000	1.000	0.126
	3	BREVARD	15.213	15.213	1.969	1.000	1.000	0.129
	4	BROWARD	29.563	29.563	2.862	1.000	1.000	0.097
	5	BROWARD	52.939	52.939	5.103	1.000	1.000	0.096
	6	CITRUS	9.711	9.711	1.554	1.000	1.000	0.160
	7	CLAY	4.102	4.102	0.846	1.000	1.000	0.206
	8	COLLIER	27.353	27.353	2.749	1.000	1.000	0.101
	9	COLUMBIA	4.093	4.093	0.887	1.000	1.000	0.217
	10	DIXIE	19.299	19.299	2.324	1.000	1.000	0.120
	11	DUVAL	11.069	11.069	1.449	1.000	1.000	0.131
	12	FRANKLIN	37.322	37.322	3.818	1.000	1.000	0.102
	13	GLADES	20.117	20.117	2.503	1.000	1.000	0.124
	14	HAMILTON	3.699	3.699	0.802	1.000	1.000	0.217
	15	HERNANDO	16.221	16.221	2.095	1.000	1.000	0.129
	16	HILLSBOROUGH	12.817	12.817	1.854	1.000	1.000	0.145
	17	HOLMES	7.541	7.541	1.315	1.000	1.000	0.174
	18	INDIAN RIVER	53.738	53.738	7.244	1.000	1.000	0.135
	19	JACKSON	5.360	5.360	1.057	1.000	1.000	0.197
	20	LEE	22.413	22.413	2.532	1.000	1.000	0.113
	21	LEON	5.805	5.805	1.059	1.000	1.000	0.182
	22	MARION	7.345	7.345	1.306	1.000	1.000	0.178
	23	MARTIN	20.234	20.234	2.333	1.000	1.000	0.115
	24	MARTIN	53.171	53.171	5.571	1.000	1.000	0.105
	25	MIAMI-DADE	26.605	26.605	2.574	1.000	1.000	0.097
	26	MIAMI-DADE	41.947	41.947	3.693	1.000	1.000	0.088
	27	MONROE	60.077	60.077	5.369	1.000	1.000	0.089
	28	MONROE	85.112	85.112	10.896	1.000	1.000	0.128
	29	OKALOOSA	21.624	21.624	2.296	1.000	1.000	0.106
	30	OSCEOLA	9.776	9.776	1.631	1.000	1.000	0.167
	31	OSCEOLA	15.035	15.035	2.018	1.000	1.000	0.134
	32	PALM BEACH	28.953	28.953	2.875	1.000	1.000	0.099
	33	PALM BEACH	45.636	45.636	4.280	1.000	1.000	0.094
	34	PINELLAS	13.939	13.939	1.818	1.000	1.000	0.130
	35	SAINT JOHNS	8.311	8.311	1.203	1.000	1.000	0.145
	36	SANTA ROSA	15.281	15.281	1.811	1.000	1.000	0.118
	37	SEMINOLE	8.537	8.537	1.449	1.000	1.000	0.170
	38	TAYLOR	5.821	5.821	1.038	1.000	1.000	0.178
	39	VOLUSIA	14.127	14.127	1.754	1.000	1.000	0.124
	40	WAKULLA	16.938	16.938	2.038	1.000	1.000	0.120

Construction / Policy	Location	County	Hurricane Loss Cost per Year Built			Ratios Relative to 1980 Year Built		
			Year Built 1980	Year Built 1998	Year Built 2004	Year Built 1980	Year Built 1998	Year Built 2004
Frame Renters	1	BAY	1.684	0.873	0.505	1.000	0.518	0.300
	2	BREVARD	0.807	0.497	0.344	1.000	0.616	0.426
	3	BREVARD	0.713	0.456	0.335	1.000	0.639	0.469
	4	BROWARD	2.171	0.505	0.506	1.000	0.232	0.233
	5	BROWARD	5.878	0.881	0.899	1.000	0.150	0.153
	6	CITRUS	0.459	0.313	0.264	1.000	0.681	0.575
	7	CLAY	0.224	0.168	0.144	1.000	0.751	0.641
	8	COLLIER	1.258	0.728	0.501	1.000	0.579	0.399
	9	COLUMBIA	0.229	0.176	0.151	1.000	0.768	0.659
	10	DIXIE	1.090	0.627	0.402	1.000	0.575	0.369
	11	DUVAL	0.654	0.376	0.250	1.000	0.576	0.382
	12	FRANKLIN	3.005	1.500	0.755	1.000	0.499	0.251
	13	GLADES	0.963	0.561	0.434	1.000	0.583	0.450
	14	HAMILTON	0.218	0.163	0.136	1.000	0.746	0.624
	15	HERNANDO	0.747	0.474	0.359	1.000	0.635	0.481
	16	HILLSBOROUGH	0.604	0.395	0.322	1.000	0.654	0.532
	17	HOLMES	0.388	0.275	0.233	1.000	0.708	0.600
	18	INDIAN RIVER	5.670	3.130	1.631	1.000	0.552	0.288
	19	JACKSON	0.288	0.216	0.186	1.000	0.752	0.645
	20	LEE	1.099	0.614	0.462	1.000	0.558	0.420
	21	LEON	0.307	0.220	0.186	1.000	0.715	0.604
	22	MARION	0.362	0.260	0.221	1.000	0.719	0.609
	23	MARTIN	0.953	0.579	0.417	1.000	0.608	0.438
	24	MARTIN	5.049	2.683	1.342	1.000	0.531	0.266
	25	MIAMI-DADE	1.858	0.458	0.459	1.000	0.246	0.247
	26	MIAMI-DADE	3.986	0.636	0.643	1.000	0.159	0.161
	27	MONROE	4.072	2.199	1.027	1.000	0.540	0.252
	28	MONROE	8.050	4.790	2.765	1.000	0.595	0.343
	29	OKALOOSA	1.146	0.622	0.411	1.000	0.543	0.359
	30	OSCEOLA	0.463	0.326	0.277	1.000	0.704	0.598
	31	OSCEOLA	0.747	0.446	0.346	1.000	0.598	0.463
	32	PALM BEACH	1.455	0.809	0.515	1.000	0.556	0.354
	33	PALM BEACH	3.180	1.625	0.810	1.000	0.511	0.255
	34	PINELLAS	0.615	0.417	0.326	1.000	0.677	0.530
	35	SAINT JOHNS	0.415	0.273	0.209	1.000	0.658	0.504
	36	SANTA ROSA	0.717	0.433	0.326	1.000	0.603	0.454
	37	SEMINOLE	0.414	0.293	0.247	1.000	0.707	0.597
	38	TAYLOR	0.279	0.215	0.181	1.000	0.770	0.649
	39	VOLUSIA	0.772	0.461	0.300	1.000	0.597	0.389
	40	WAKULLA	0.889	0.523	0.355	1.000	0.589	0.400

Construction / Policy	Location	County	Hurricane Loss Cost per Year Built			Ratios Relative to 1980 Year Built		
			Year Built 1980	Year Built 1998	Year Built 2004	Year Built 1980	Year Built 1998	Year Built 2004
Masonry Renters	1	BAY	1.556	0.809	0.462	1.000	0.520	0.297
	2	BREVARD	0.787	0.485	0.332	1.000	0.616	0.422
	3	BREVARD	0.698	0.445	0.323	1.000	0.638	0.463
	4	BROWARD	2.133	0.484	0.486	1.000	0.227	0.228
	5	BROWARD	5.630	0.730	0.743	1.000	0.130	0.132
	6	CITRUS	0.449	0.303	0.255	1.000	0.676	0.568
	7	CLAY	0.201	0.151	0.133	1.000	0.753	0.660
	8	COLLIER	1.233	0.713	0.485	1.000	0.578	0.393
	9	COLUMBIA	0.204	0.158	0.139	1.000	0.773	0.681
	10	DIXIE	1.018	0.583	0.374	1.000	0.573	0.367
	11	DUVAL	0.601	0.346	0.229	1.000	0.575	0.381
	12	FRANKLIN	2.711	1.359	0.660	1.000	0.501	0.244
	13	GLADES	0.945	0.548	0.418	1.000	0.580	0.442
	14	HAMILTON	0.197	0.147	0.126	1.000	0.747	0.639
	15	HERNANDO	0.728	0.461	0.346	1.000	0.633	0.475
	16	HILLSBOROUGH	0.592	0.385	0.310	1.000	0.649	0.524
	17	HOLMES	0.352	0.248	0.216	1.000	0.705	0.612
	18	INDIAN RIVER	5.031	2.780	1.342	1.000	0.553	0.267
	19	JACKSON	0.259	0.195	0.172	1.000	0.753	0.663
	20	LEE	1.078	0.600	0.446	1.000	0.556	0.414
	21	LEON	0.278	0.199	0.172	1.000	0.714	0.618
	22	MARION	0.354	0.252	0.213	1.000	0.712	0.600
	23	MARTIN	0.932	0.565	0.403	1.000	0.606	0.432
	24	MARTIN	4.543	2.362	1.077	1.000	0.520	0.237
	25	MIAMI-DADE	1.831	0.440	0.441	1.000	0.241	0.241
	26	MIAMI-DADE	3.866	0.578	0.584	1.000	0.149	0.151
	27	MONROE	3.782	2.037	0.805	1.000	0.539	0.213
	28	MONROE	7.073	4.099	1.797	1.000	0.580	0.254
	29	OKALOOSA	1.069	0.579	0.383	1.000	0.541	0.358
	30	OSCEOLA	0.453	0.316	0.267	1.000	0.697	0.589
	31	OSCEOLA	0.731	0.435	0.333	1.000	0.595	0.456
	32	PALM BEACH	1.421	0.794	0.498	1.000	0.559	0.351
	33	PALM BEACH	2.998	1.556	0.761	1.000	0.519	0.254
	34	PINELLAS	0.603	0.406	0.315	1.000	0.673	0.522
	35	SAINT JOHNS	0.382	0.250	0.194	1.000	0.655	0.508
	36	SANTA ROSA	0.667	0.399	0.303	1.000	0.599	0.454
	37	SEMINOLE	0.405	0.284	0.238	1.000	0.700	0.588
	38	TAYLOR	0.252	0.195	0.168	1.000	0.773	0.667
	39	VOLUSIA	0.744	0.447	0.288	1.000	0.601	0.387
	40	WAKULLA	0.832	0.486	0.331	1.000	0.584	0.397

Construction / Policy	Location	County	Hurricane Loss Cost per Year Built			Ratios Relative to 1980 Year Built		
			Year Built 1980	Year Built 1998	Year Built 2004	Year Built 1980	Year Built 1998	Year Built 2004
Frame Condo Unit	1	BAY	2.051	1.105	0.664	1.000	0.539	0.324
	2	BREVARD	1.293	0.788	0.496	1.000	0.609	0.384
	3	BREVARD	1.182	0.738	0.484	1.000	0.624	0.409
	4	BROWARD	3.074	0.716	0.717	1.000	0.233	0.233
	5	BROWARD	7.366	1.178	1.197	1.000	0.160	0.163
	6	CITRUS	0.840	0.535	0.387	1.000	0.636	0.460
	7	CLAY	0.306	0.235	0.204	1.000	0.767	0.666
	8	COLLIER	1.994	1.152	0.709	1.000	0.577	0.356
	9	COLUMBIA	0.313	0.246	0.215	1.000	0.784	0.685
	10	DIXIE	1.357	0.810	0.539	1.000	0.597	0.397
	11	DUVAL	0.819	0.492	0.339	1.000	0.600	0.413
	12	FRANKLIN	3.561	1.838	0.961	1.000	0.516	0.270
	13	GLADES	1.626	0.932	0.625	1.000	0.573	0.384
	14	HAMILTON	0.296	0.227	0.194	1.000	0.767	0.656
	15	HERNANDO	1.246	0.772	0.516	1.000	0.619	0.414
	16	HILLSBOROUGH	1.080	0.667	0.467	1.000	0.618	0.433
	17	HOLMES	0.521	0.375	0.320	1.000	0.720	0.615
	18	INDIAN RIVER	6.996	3.911	1.996	1.000	0.559	0.285
	19	JACKSON	0.391	0.298	0.258	1.000	0.762	0.662
	20	LEE	1.815	1.008	0.661	1.000	0.555	0.364
	21	LEON	0.412	0.301	0.258	1.000	0.731	0.627
	22	MARION	0.674	0.446	0.325	1.000	0.661	0.481
	23	MARTIN	1.562	0.932	0.593	1.000	0.597	0.380
	24	MARTIN	6.336	3.417	1.663	1.000	0.539	0.262
	25	MIAMI-DADE	2.672	0.649	0.650	1.000	0.243	0.243
	26	MIAMI-DADE	5.170	0.879	0.887	1.000	0.170	0.171
	27	MONROE	5.212	2.800	1.315	1.000	0.537	0.252
	28	MONROE	9.765	5.739	3.250	1.000	0.588	0.333
	29	OKALOOSA	1.430	0.807	0.549	1.000	0.564	0.384
	30	OSCEOLA	0.861	0.560	0.406	1.000	0.651	0.472
	31	OSCEOLA	1.267	0.742	0.503	1.000	0.586	0.397
	32	PALM BEACH	2.232	1.257	0.731	1.000	0.563	0.327
	33	PALM BEACH	4.286	2.252	1.093	1.000	0.525	0.255
	34	PINELLAS	1.064	0.686	0.470	1.000	0.645	0.442
	35	SAINT JOHNS	0.541	0.367	0.288	1.000	0.679	0.534
	36	SANTA ROSA	0.919	0.572	0.437	1.000	0.622	0.475
	37	SEMINOLE	0.767	0.500	0.362	1.000	0.652	0.472
	38	TAYLOR	0.375	0.295	0.252	1.000	0.785	0.672
	39	VOLUSIA	1.187	0.709	0.429	1.000	0.597	0.361
	40	WAKULLA	1.120	0.684	0.479	1.000	0.611	0.428

Construction / Policy	Location	County	Hurricane Loss Cost per Year Built			Ratios Relative to 1980 Year Built		
			Year Built 1980	Year Built 1998	Year Built 2004	Year Built 1980	Year Built 1998	Year Built 2004
Masonry Condo Unit	1	BAY	1.898	1.031	0.620	1.000	0.543	0.327
	2	BREVARD	1.265	0.771	0.481	1.000	0.609	0.380
	3	BREVARD	1.160	0.723	0.469	1.000	0.623	0.404
	4	BROWARD	3.014	0.694	0.696	1.000	0.230	0.231
	5	BROWARD	7.063	1.015	1.030	1.000	0.144	0.146
	6	CITRUS	0.824	0.521	0.373	1.000	0.632	0.453
	7	CLAY	0.279	0.216	0.192	1.000	0.774	0.690
	8	COLLIER	1.955	1.125	0.689	1.000	0.576	0.352
	9	COLUMBIA	0.285	0.226	0.203	1.000	0.793	0.711
	10	DIXIE	1.270	0.759	0.509	1.000	0.598	0.401
	11	DUVAL	0.757	0.457	0.318	1.000	0.604	0.420
	12	FRANKLIN	3.223	1.676	0.862	1.000	0.520	0.267
	13	GLADES	1.594	0.909	0.605	1.000	0.570	0.380
	14	HAMILTON	0.271	0.210	0.184	1.000	0.773	0.676
	15	HERNANDO	1.222	0.754	0.499	1.000	0.617	0.408
	16	HILLSBOROUGH	1.062	0.652	0.451	1.000	0.614	0.424
	17	HOLMES	0.478	0.346	0.303	1.000	0.723	0.633
	18	INDIAN RIVER	6.283	3.516	1.688	1.000	0.560	0.269
	19	JACKSON	0.356	0.274	0.244	1.000	0.769	0.685
	20	LEE	1.777	0.981	0.640	1.000	0.552	0.360
	21	LEON	0.378	0.278	0.244	1.000	0.736	0.646
	22	MARION	0.661	0.434	0.314	1.000	0.656	0.474
	23	MARTIN	1.521	0.901	0.576	1.000	0.592	0.378
	24	MARTIN	5.770	3.061	1.389	1.000	0.531	0.241
	25	MIAMI-DADE	2.625	0.631	0.632	1.000	0.240	0.241
	26	MIAMI-DADE	5.012	0.816	0.823	1.000	0.163	0.164
	27	MONROE	4.870	2.613	1.070	1.000	0.536	0.220
	28	MONROE	8.676	4.985	2.216	1.000	0.575	0.255
	29	OKALOOSA	1.336	0.757	0.520	1.000	0.566	0.389
	30	OSCEOLA	0.845	0.545	0.392	1.000	0.645	0.464
	31	OSCEOLA	1.244	0.725	0.486	1.000	0.583	0.391
	32	PALM BEACH	2.168	1.218	0.706	1.000	0.562	0.326
	33	PALM BEACH	4.060	2.151	1.033	1.000	0.530	0.254
	34	PINELLAS	1.043	0.668	0.453	1.000	0.641	0.435
	35	SAINT JOHNS	0.501	0.342	0.273	1.000	0.683	0.545
	36	SANTA ROSA	0.857	0.533	0.413	1.000	0.622	0.482
	37	SEMINOLE	0.753	0.487	0.350	1.000	0.647	0.464
	38	TAYLOR	0.343	0.272	0.239	1.000	0.792	0.695
	39	VOLUSIA	1.154	0.691	0.414	1.000	0.599	0.358
	40	WAKULLA	1.051	0.642	0.454	1.000	0.611	0.432

Construction / Policy	Location	County	Hurricane Loss Cost per Year Built			Ratios Relative to 1980 Year Built		
			Year Built 1980	Year Built 1998	Year Built 2004	Year Built 1980	Year Built 1998	Year Built 2004
Commercial Residential	1	BAY	14.129	14.129	11.768	1.000	1.000	0.833
	2	BREVARD	8.702	8.702	6.873	1.000	1.000	0.790
	3	BREVARD	8.011	8.011	6.183	1.000	1.000	0.772
	4	BROWARD	15.970	12.971	12.971	1.000	0.812	0.812
	5	BROWARD	27.625	24.503	24.503	1.000	0.887	0.887
	6	CITRUS	4.591	4.591	3.247	1.000	1.000	0.707
	7	CLAY	1.780	1.780	1.164	1.000	1.000	0.654
	8	COLLIER	14.831	14.831	11.754	1.000	1.000	0.793
	9	COLUMBIA	1.642	1.642	1.043	1.000	1.000	0.635
	10	DIXIE	7.980	7.980	6.207	1.000	1.000	0.778
	11	DUVAL	5.386	5.386	4.240	1.000	1.000	0.787
	12	FRANKLIN	16.786	16.786	14.280	1.000	1.000	0.851
	13	GLADES	10.584	10.584	8.026	1.000	1.000	0.758
	14	HAMILTON	1.410	1.410	0.892	1.000	1.000	0.633
	15	HERNANDO	7.568	7.568	5.665	1.000	1.000	0.749
	16	HILLSBOROUGH	6.915	6.915	5.046	1.000	1.000	0.730
	17	HOLMES	4.050	4.050	2.845	1.000	1.000	0.703
	18	INDIAN RIVER	25.362	25.362	23.168	1.000	1.000	0.913
	19	JACKSON	2.711	2.711	1.814	1.000	1.000	0.669
	20	LEE	11.433	11.433	8.713	1.000	1.000	0.762
	21	LEON	2.514	2.514	1.699	1.000	1.000	0.676
	22	MARION	3.419	3.419	2.344	1.000	1.000	0.686
	23	MARTIN	11.252	11.252	8.797	1.000	1.000	0.782
	24	MARTIN	27.528	27.528	25.009	1.000	1.000	0.908
	25	MIAMI-DADE	15.713	12.847	12.847	1.000	0.818	0.818
	26	MIAMI-DADE	23.160	20.154	20.154	1.000	0.870	0.870
	27	MONROE	32.696	32.696	30.392	1.000	1.000	0.930
	28	MONROE	39.472	39.472	37.303	1.000	1.000	0.945
	29	OKALOOSA	12.168	12.168	9.892	1.000	1.000	0.813
	30	OSCEOLA	4.861	4.861	3.399	1.000	1.000	0.699
	31	OSCEOLA	7.220	7.220	5.358	1.000	1.000	0.742
	32	PALM BEACH	15.415	15.415	12.487	1.000	1.000	0.810
	33	PALM BEACH	24.602	24.602	21.469	1.000	1.000	0.873
	34	PINELLAS	7.922	7.922	6.003	1.000	1.000	0.758
	35	SAINT JOHNS	4.260	4.260	3.201	1.000	1.000	0.752
	36	SANTA ROSA	8.035	8.035	6.161	1.000	1.000	0.767
	37	SEMINOLE	4.107	4.107	2.857	1.000	1.000	0.696
	38	TAYLOR	2.681	2.681	1.857	1.000	1.000	0.693
	39	VOLUSIA	7.374	7.374	5.881	1.000	1.000	0.797
	40	WAKULLA	7.723	7.723	6.046	1.000	1.000	0.783

Form A - 6: Logical Relationship to Hurricane Risk - Building Strength (Trade Secret Item)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Construction / Policy	Location	County	Hurricane Loss Cost by Building Strength			Ratio Relative to Weak		
			Weak	Medium	Strong	Weak	Medium	Strong
Frame Owners	1	BAY	5.849	2.887	1.993	1.000	0.494	0.341
	2	BREVARD	6.594	3.267	1.817	1.000	0.495	0.276
	3	BREVARD	6.316	3.158	1.782	1.000	0.500	0.282
	4	BROWARD	10.812	2.562	2.569	1.000	0.237	0.238
	5	BROWARD	18.315	3.696	3.529	1.000	0.202	0.193
	6	CITRUS	4.741	2.460	1.453	1.000	0.519	0.306
	7	CLAY	1.061	0.791	0.715	1.000	0.745	0.674
	8	COLLIER	10.151	4.774	2.578	1.000	0.470	0.254
	9	COLUMBIA	1.089	0.831	0.758	1.000	0.763	0.696
	10	DIXIE	4.311	2.255	1.688	1.000	0.523	0.391
	11	DUVAL	2.516	1.411	1.097	1.000	0.561	0.436
	12	FRANKLIN	8.843	4.227	2.531	1.000	0.478	0.286
	13	GLADES	8.384	4.137	2.319	1.000	0.493	0.277
	14	HAMILTON	0.985	0.763	0.688	1.000	0.774	0.699
	15	HERNANDO	6.738	3.330	1.881	1.000	0.494	0.279
	16	HILLSBOROUGH	5.905	3.024	1.726	1.000	0.512	0.292
	17	HOLMES	1.780	1.212	1.067	1.000	0.681	0.599
	18	INDIAN RIVER	19.509	9.327	4.163	1.000	0.478	0.213
	19	JACKSON	1.346	0.976	0.877	1.000	0.725	0.652
	20	LEE	9.085	4.403	2.441	1.000	0.485	0.269
	21	LEON	1.412	0.981	0.875	1.000	0.695	0.619
	22	MARION	3.834	2.051	1.227	1.000	0.535	0.320
	23	MARTIN	8.185	3.963	2.175	1.000	0.484	0.266
	24	MARTIN	18.600	8.686	3.749	1.000	0.467	0.202
	25	MIAMI-DADE	9.715	2.328	2.340	1.000	0.240	0.241
	26	MIAMI-DADE	14.367	2.993	2.936	1.000	0.208	0.204
	27	MONROE	19.774	7.245	3.565	1.000	0.366	0.180
	28	MONROE	29.784	11.944	5.936	1.000	0.401	0.199
	29	OKALOOSA	4.474	2.295	1.713	1.000	0.513	0.383
	30	OSCEOLA	4.902	2.591	1.529	1.000	0.529	0.312
	31	OSCEOLA	6.554	3.296	1.869	1.000	0.503	0.285
	32	PALM BEACH	10.802	5.050	2.617	1.000	0.467	0.242
	33	PALM BEACH	15.950	7.208	3.381	1.000	0.452	0.212
	34	PINELLAS	5.988	3.016	1.721	1.000	0.504	0.287
	35	SAINT JOHNS	1.855	1.147	0.965	1.000	0.618	0.520
	36	SANTA ROSA	3.115	1.716	1.382	1.000	0.551	0.444
	37	SEMINOLE	4.351	2.303	1.359	1.000	0.529	0.312
	38	TAYLOR	1.382	0.959	0.858	1.000	0.694	0.621
	39	VOLUSIA	5.679	2.796	1.523	1.000	0.492	0.268

Construction / Policy	Location	County	Hurricane Loss Cost by Building Strength			Ratio Relative to Weak		
			Weak	Medium	Strong	Weak	Medium	Strong
	40	WAKULLA	3.704	1.978	1.532	1.000	0.534	0.414
Masonry Owners	1	BAY	5.474	2.756	1.959	1.000	0.503	0.358
	2	BREVARD	6.539	3.212	1.761	1.000	0.491	0.269
	3	BREVARD	6.277	3.108	1.727	1.000	0.495	0.275
	4	BROWARD	10.586	2.538	2.515	1.000	0.240	0.238
	5	BROWARD	17.579	3.512	3.379	1.000	0.200	0.192
	6	CITRUS	4.697	2.418	1.407	1.000	0.515	0.300
	7	CLAY	1.006	0.766	0.707	1.000	0.762	0.703
	8	COLLIER	10.086	4.649	2.489	1.000	0.461	0.247
	9	COLUMBIA	1.032	0.806	0.750	1.000	0.781	0.727
	10	DIXIE	4.044	2.166	1.661	1.000	0.536	0.411
	11	DUVAL	2.366	1.358	1.082	1.000	0.574	0.457
	12	FRANKLIN	8.176	3.964	2.470	1.000	0.485	0.302
	13	GLADES	8.317	4.036	2.236	1.000	0.485	0.269
	14	HAMILTON	0.934	0.741	0.681	1.000	0.793	0.730
	15	HERNANDO	6.693	3.284	1.821	1.000	0.491	0.272
	16	HILLSBOROUGH	5.855	2.974	1.666	1.000	0.508	0.284
	17	HOLMES	1.682	1.172	1.053	1.000	0.697	0.626
	18	INDIAN RIVER	18.360	8.725	3.938	1.000	0.475	0.215
	19	JACKSON	1.272	0.946	0.867	1.000	0.744	0.682
	20	LEE	9.007	4.268	2.352	1.000	0.474	0.261
	21	LEON	1.336	0.950	0.864	1.000	0.711	0.647
	22	MARION	3.798	2.012	1.191	1.000	0.530	0.314
	23	MARTIN	8.024	3.787	2.133	1.000	0.472	0.266
	24	MARTIN	17.694	8.195	3.618	1.000	0.463	0.205
	25	MIAMI-DADE	9.526	2.309	2.291	1.000	0.242	0.240
	26	MIAMI-DADE	13.940	2.919	2.850	1.000	0.209	0.204
	27	MONROE	18.851	6.926	3.445	1.000	0.367	0.183
	28	MONROE	27.714	11.003	5.594	1.000	0.397	0.202
	29	OKALOOSA	4.228	2.204	1.689	1.000	0.521	0.400
	30	OSCEOLA	4.859	2.543	1.481	1.000	0.523	0.305
	31	OSCEOLA	6.495	3.233	1.807	1.000	0.498	0.278
	32	PALM BEACH	10.574	4.806	2.564	1.000	0.455	0.242
	33	PALM BEACH	15.415	6.874	3.293	1.000	0.446	0.214
	34	PINELLAS	5.959	2.941	1.667	1.000	0.494	0.280
	35	SAINT JOHNS	1.757	1.110	0.953	1.000	0.632	0.543
	36	SANTA ROSA	2.948	1.652	1.362	1.000	0.560	0.462
	37	SEMINOLE	4.312	2.258	1.318	1.000	0.524	0.306
	38	TAYLOR	1.308	0.929	0.848	1.000	0.711	0.649

Construction / Policy	Location	County	Hurricane Loss Cost by Building Strength			Ratio Relative to Weak		
			Weak	Medium	Strong	Weak	Medium	Strong
	39	VOLUSIA	5.610	2.746	1.476	1.000	0.489	0.263
	40	WAKULLA	3.489	1.906	1.511	1.000	0.546	0.433

Construction / Policy	Location	County	Hurricane Loss Cost by Building Strength			Ratio Relative to Weak		
			Weak	Medium	Strong	Weak	Medium	Strong
Manufactured Homes	1	BAY	26.474	26.474	2.870	1.000	1.000	0.108
	2	BREVARD	16.149	16.149	2.035	1.000	1.000	0.126
	3	BREVARD	15.213	15.213	1.969	1.000	1.000	0.129
	4	BROWARD	29.563	29.563	2.862	1.000	1.000	0.097
	5	BROWARD	52.939	52.939	5.103	1.000	1.000	0.096
	6	CITRUS	9.711	9.711	1.554	1.000	1.000	0.160
	7	CLAY	4.102	4.102	0.846	1.000	1.000	0.206
	8	COLLIER	27.353	27.353	2.749	1.000	1.000	0.101
	9	COLUMBIA	4.093	4.093	0.887	1.000	1.000	0.217
	10	DIXIE	19.299	19.299	2.324	1.000	1.000	0.120
	11	DUVAL	11.069	11.069	1.449	1.000	1.000	0.131
	12	FRANKLIN	37.322	37.322	3.818	1.000	1.000	0.102
	13	GLADES	20.117	20.117	2.503	1.000	1.000	0.124
	14	HAMILTON	3.699	3.699	0.802	1.000	1.000	0.217
	15	HERNANDO	16.221	16.221	2.095	1.000	1.000	0.129
	16	HILLSBOROUGH	12.817	12.817	1.854	1.000	1.000	0.145
	17	HOLMES	7.541	7.541	1.315	1.000	1.000	0.174
	18	INDIAN RIVER	53.738	53.738	7.244	1.000	1.000	0.135
	19	JACKSON	5.360	5.360	1.057	1.000	1.000	0.197
	20	LEE	22.413	22.413	2.532	1.000	1.000	0.113
	21	LEON	5.805	5.805	1.059	1.000	1.000	0.182
	22	MARION	7.345	7.345	1.306	1.000	1.000	0.178
	23	MARTIN	20.234	20.234	2.333	1.000	1.000	0.115
	24	MARTIN	53.171	53.171	5.571	1.000	1.000	0.105
	25	MIAMI-DADE	26.605	26.605	2.574	1.000	1.000	0.097
	26	MIAMI-DADE	41.947	41.947	3.693	1.000	1.000	0.088
	27	MONROE	60.077	60.077	5.369	1.000	1.000	0.089
	28	MONROE	85.112	85.112	10.896	1.000	1.000	0.128
	29	OKALOOSA	21.624	21.624	2.296	1.000	1.000	0.106
	30	OSCEOLA	9.776	9.776	1.631	1.000	1.000	0.167
	31	OSCEOLA	15.035	15.035	2.018	1.000	1.000	0.134
	32	PALM BEACH	28.953	28.953	2.875	1.000	1.000	0.099
	33	PALM BEACH	45.636	45.636	4.280	1.000	1.000	0.094
	34	PINELLAS	13.939	13.939	1.818	1.000	1.000	0.130
	35	SAINT JOHNS	8.311	8.311	1.203	1.000	1.000	0.145
	36	SANTA ROSA	15.281	15.281	1.811	1.000	1.000	0.118
	37	SEMINOLE	8.537	8.537	1.449	1.000	1.000	0.170
	38	TAYLOR	5.821	5.821	1.038	1.000	1.000	0.178
	39	VOLUSIA	14.127	14.127	1.754	1.000	1.000	0.124
	40	WAKULLA	16.938	16.938	2.038	1.000	1.000	0.120

Construction / Policy	Location	County	Hurricane Loss Cost by Building Strength			Ratio Relative to Weak		
			Weak	Medium	Strong	Weak	Medium	Strong
Frame Renters	1	BAY	2.355	0.873	0.482	1.000	0.371	0.205
	2	BREVARD	1.138	0.497	0.337	1.000	0.436	0.296
	3	BREVARD	0.993	0.456	0.330	1.000	0.459	0.332
	4	BROWARD	2.155	0.505	0.494	1.000	0.234	0.229
	5	BROWARD	6.031	0.881	0.743	1.000	0.146	0.123
	6	CITRUS	0.560	0.313	0.263	1.000	0.559	0.470
	7	CLAY	0.247	0.168	0.144	1.000	0.681	0.580
	8	COLLIER	1.824	0.728	0.493	1.000	0.399	0.270
	9	COLUMBIA	0.250	0.176	0.151	1.000	0.703	0.602
	10	DIXIE	1.609	0.627	0.394	1.000	0.390	0.245
	11	DUVAL	0.883	0.376	0.244	1.000	0.426	0.277
	12	FRANKLIN	4.116	1.500	0.660	1.000	0.364	0.160
	13	GLADES	1.201	0.561	0.428	1.000	0.468	0.357
	14	HAMILTON	0.227	0.163	0.136	1.000	0.717	0.599
	15	HERNANDO	1.050	0.474	0.356	1.000	0.451	0.339
	16	HILLSBOROUGH	0.722	0.395	0.319	1.000	0.548	0.442
	17	HOLMES	0.439	0.275	0.232	1.000	0.626	0.529
	18	INDIAN RIVER	7.813	3.130	1.131	1.000	0.401	0.145
	19	JACKSON	0.318	0.216	0.185	1.000	0.681	0.583
	20	LEE	1.379	0.614	0.454	1.000	0.445	0.330
	21	LEON	0.347	0.220	0.185	1.000	0.633	0.533
	22	MARION	0.418	0.260	0.220	1.000	0.622	0.525
	23	MARTIN	1.292	0.579	0.409	1.000	0.448	0.316
	24	MARTIN	6.796	2.683	0.895	1.000	0.395	0.132
	25	MIAMI-DADE	1.836	0.458	0.450	1.000	0.249	0.245
	26	MIAMI-DADE	4.026	0.636	0.583	1.000	0.158	0.145
	27	MONROE	7.674	2.199	0.827	1.000	0.286	0.108
	28	MONROE	13.974	4.790	1.876	1.000	0.343	0.134
	29	OKALOOSA	1.571	0.622	0.401	1.000	0.396	0.255
	30	OSCEOLA	0.542	0.326	0.276	1.000	0.602	0.509
	31	OSCEOLA	0.928	0.446	0.341	1.000	0.481	0.367
	32	PALM BEACH	2.119	0.809	0.500	1.000	0.382	0.236
	33	PALM BEACH	4.619	1.625	0.710	1.000	0.352	0.154
	34	PINELLAS	0.833	0.417	0.323	1.000	0.500	0.388
	35	SAINT JOHNS	0.545	0.273	0.207	1.000	0.501	0.380
	36	SANTA ROSA	0.962	0.433	0.322	1.000	0.450	0.335
	37	SEMINOLE	0.482	0.293	0.246	1.000	0.607	0.511
	38	TAYLOR	0.354	0.215	0.181	1.000	0.607	0.511
	39	VOLUSIA	1.089	0.461	0.286	1.000	0.423	0.263
	40	WAKULLA	1.299	0.523	0.351	1.000	0.403	0.270

Construction / Policy	Location	County	Hurricane Loss Cost by Building Strength			Ratio Relative to Weak		
			Weak	Medium	Strong	Weak	Medium	Strong
Masonry Renters	1	BAY	2.162	0.809	0.450	1.000	0.374	0.208
	2	BREVARD	1.099	0.485	0.325	1.000	0.441	0.296
	3	BREVARD	0.965	0.445	0.319	1.000	0.461	0.330
	4	BROWARD	2.076	0.484	0.477	1.000	0.233	0.230
	5	BROWARD	5.539	0.730	0.674	1.000	0.132	0.122
	6	CITRUS	0.547	0.303	0.254	1.000	0.554	0.464
	7	CLAY	0.223	0.151	0.133	1.000	0.678	0.594
	8	COLLIER	1.769	0.713	0.477	1.000	0.403	0.269
	9	COLUMBIA	0.225	0.158	0.139	1.000	0.702	0.619
	10	DIXIE	1.479	0.583	0.367	1.000	0.394	0.248
	11	DUVAL	0.811	0.346	0.227	1.000	0.427	0.280
	12	FRANKLIN	3.712	1.359	0.615	1.000	0.366	0.166
	13	GLADES	1.174	0.548	0.414	1.000	0.467	0.353
	14	HAMILTON	0.204	0.147	0.126	1.000	0.720	0.615
	15	HERNANDO	1.017	0.461	0.343	1.000	0.453	0.337
	16	HILLSBOROUGH	0.707	0.385	0.308	1.000	0.544	0.436
	17	HOLMES	0.401	0.248	0.215	1.000	0.619	0.536
	18	INDIAN RIVER	6.902	2.780	1.055	1.000	0.403	0.153
	19	JACKSON	0.288	0.195	0.172	1.000	0.677	0.595
	20	LEE	1.343	0.600	0.439	1.000	0.447	0.327
	21	LEON	0.317	0.199	0.171	1.000	0.627	0.541
	22	MARION	0.410	0.252	0.212	1.000	0.616	0.517
	23	MARTIN	1.257	0.565	0.395	1.000	0.449	0.314
	24	MARTIN	6.146	2.362	0.851	1.000	0.384	0.138
	25	MIAMI-DADE	1.779	0.440	0.435	1.000	0.248	0.244
	26	MIAMI-DADE	3.784	0.578	0.552	1.000	0.153	0.146
	27	MONROE	7.004	2.037	0.794	1.000	0.291	0.113
	28	MONROE	12.303	4.099	1.725	1.000	0.333	0.140
	29	OKALOOSA	1.467	0.579	0.374	1.000	0.394	0.255
	30	OSCEOLA	0.531	0.316	0.266	1.000	0.595	0.501
	31	OSCEOLA	0.904	0.435	0.329	1.000	0.481	0.364
	32	PALM BEACH	2.044	0.794	0.484	1.000	0.388	0.237
	33	PALM BEACH	4.297	1.556	0.683	1.000	0.362	0.159
	34	PINELLAS	0.813	0.406	0.312	1.000	0.499	0.384
	35	SAINT JOHNS	0.505	0.250	0.192	1.000	0.496	0.381
	36	SANTA ROSA	0.899	0.399	0.300	1.000	0.444	0.334
	37	SEMINOLE	0.472	0.284	0.237	1.000	0.600	0.502
	38	TAYLOR	0.324	0.195	0.168	1.000	0.601	0.518
	39	VOLUSIA	1.039	0.447	0.276	1.000	0.430	0.266
	40	WAKULLA	1.203	0.486	0.327	1.000	0.404	0.272

Construction / Policy	Location	County	Hurricane Loss Cost by Building Strength			Ratio Relative to Weak		
			Weak	Medium	Strong	Weak	Medium	Strong
Frame Condo Unit	1	BAY	4.831	1.105	0.745	1.000	0.229	0.154
	2	BREVARD	2.706	0.788	0.510	1.000	0.291	0.189
	3	BREVARD	2.420	0.738	0.493	1.000	0.305	0.204
	4	BROWARD	5.202	0.716	0.735	1.000	0.138	0.141
	5	BROWARD	12.425	1.178	1.333	1.000	0.095	0.107
	6	CITRUS	1.372	0.535	0.390	1.000	0.390	0.284
	7	CLAY	0.431	0.235	0.204	1.000	0.545	0.473
	8	COLLIER	4.536	1.152	0.733	1.000	0.254	0.162
	9	COLUMBIA	0.422	0.246	0.215	1.000	0.583	0.509
	10	DIXIE	3.271	0.810	0.592	1.000	0.248	0.181
	11	DUVAL	1.776	0.492	0.362	1.000	0.277	0.204
	12	FRANKLIN	8.067	1.838	1.156	1.000	0.228	0.143
	13	GLADES	3.056	0.932	0.633	1.000	0.305	0.207
	14	HAMILTON	0.384	0.227	0.194	1.000	0.592	0.506
	15	HERNANDO	2.554	0.772	0.530	1.000	0.302	0.208
	16	HILLSBOROUGH	1.815	0.667	0.469	1.000	0.368	0.258
	17	HOLMES	0.827	0.375	0.321	1.000	0.453	0.388
	18	INDIAN RIVER	14.746	3.911	2.333	1.000	0.265	0.158
	19	JACKSON	0.558	0.298	0.259	1.000	0.533	0.464
	20	LEE	3.494	1.008	0.673	1.000	0.288	0.193
	21	LEON	0.642	0.301	0.258	1.000	0.469	0.403
	22	MARION	1.006	0.446	0.326	1.000	0.443	0.324
	23	MARTIN	3.216	0.932	0.605	1.000	0.290	0.188
	24	MARTIN	13.442	3.417	1.829	1.000	0.254	0.136
	25	MIAMI-DADE	4.532	0.649	0.664	1.000	0.143	0.146
	26	MIAMI-DADE	8.868	0.879	0.946	1.000	0.099	0.107
	27	MONROE	15.361	2.800	1.756	1.000	0.182	0.114
	28	MONROE	25.499	5.739	3.958	1.000	0.225	0.155
	29	OKALOOSA	3.415	0.807	0.566	1.000	0.236	0.166
	30	OSCEOLA	1.331	0.560	0.407	1.000	0.421	0.306
	31	OSCEOLA	2.305	0.742	0.507	1.000	0.322	0.220
	32	PALM BEACH	5.104	1.257	0.764	1.000	0.246	0.150
	33	PALM BEACH	9.927	2.252	1.268	1.000	0.227	0.128
	34	PINELLAS	2.064	0.686	0.475	1.000	0.333	0.230
	35	SAINT JOHNS	1.110	0.367	0.292	1.000	0.331	0.263
	36	SANTA ROSA	2.095	0.572	0.441	1.000	0.273	0.211
	37	SEMINOLE	1.174	0.500	0.363	1.000	0.426	0.309
	38	TAYLOR	0.660	0.295	0.253	1.000	0.447	0.384
	39	VOLUSIA	2.500	0.709	0.447	1.000	0.284	0.179
	40	WAKULLA	2.690	0.684	0.507	1.000	0.254	0.188

Construction / Policy	Location	County	Hurricane Loss Cost by Building Strength			Ratio Relative to Weak		
			Weak	Medium	Strong	Weak	Medium	Strong
Masonry Condo Unit	1	BAY	4.427	1.031	0.703	1.000	0.233	0.159
	2	BREVARD	2.611	0.771	0.493	1.000	0.295	0.189
	3	BREVARD	2.356	0.723	0.476	1.000	0.307	0.202
	4	BROWARD	4.987	0.694	0.708	1.000	0.139	0.142
	5	BROWARD	11.302	1.015	1.119	1.000	0.090	0.099
	6	CITRUS	1.356	0.521	0.376	1.000	0.384	0.277
	7	CLAY	0.404	0.216	0.193	1.000	0.534	0.476
	8	COLLIER	4.403	1.125	0.709	1.000	0.256	0.161
	9	COLUMBIA	0.394	0.226	0.203	1.000	0.574	0.515
	10	DIXIE	3.008	0.759	0.560	1.000	0.252	0.186
	11	DUVAL	1.639	0.457	0.342	1.000	0.279	0.209
	12	FRANKLIN	7.224	1.676	1.080	1.000	0.232	0.149
	13	GLADES	3.005	0.909	0.610	1.000	0.303	0.203
	14	HAMILTON	0.359	0.210	0.184	1.000	0.584	0.512
	15	HERNANDO	2.488	0.754	0.511	1.000	0.303	0.206
	16	HILLSBOROUGH	1.797	0.652	0.452	1.000	0.363	0.251
	17	HOLMES	0.785	0.346	0.303	1.000	0.441	0.386
	18	INDIAN RIVER	13.016	3.516	2.149	1.000	0.270	0.165
	19	JACKSON	0.525	0.274	0.244	1.000	0.522	0.465
	20	LEE	3.423	0.981	0.649	1.000	0.287	0.190
	21	LEON	0.606	0.278	0.244	1.000	0.459	0.403
	22	MARION	0.996	0.434	0.314	1.000	0.435	0.316
	23	MARTIN	3.128	0.901	0.588	1.000	0.288	0.188
	24	MARTIN	12.039	3.061	1.712	1.000	0.254	0.142
	25	MIAMI-DADE	4.372	0.631	0.641	1.000	0.144	0.147
	26	MIAMI-DADE	8.249	0.816	0.866	1.000	0.099	0.105
	27	MONROE	13.807	2.613	1.655	1.000	0.189	0.120
	28	MONROE	22.421	4.985	3.628	1.000	0.222	0.162
	29	OKALOOSA	3.203	0.757	0.538	1.000	0.236	0.168
	30	OSCEOLA	1.322	0.545	0.393	1.000	0.412	0.297
	31	OSCEOLA	2.258	0.725	0.490	1.000	0.321	0.217
	32	PALM BEACH	4.891	1.218	0.742	1.000	0.249	0.152
	33	PALM BEACH	9.161	2.151	1.211	1.000	0.235	0.132
	34	PINELLAS	2.031	0.668	0.459	1.000	0.329	0.226
	35	SAINT JOHNS	1.045	0.342	0.276	1.000	0.327	0.264
	36	SANTA ROSA	1.992	0.533	0.418	1.000	0.268	0.210
	37	SEMINOLE	1.164	0.487	0.351	1.000	0.418	0.301
	38	TAYLOR	0.622	0.272	0.240	1.000	0.437	0.385
	39	VOLUSIA	2.386	0.691	0.431	1.000	0.290	0.181
	40	WAKULLA	2.499	0.642	0.481	1.000	0.257	0.192

Construction / Policy	Location	County	Hurricane Loss Cost by Building Strength			Ratio Relative to Weak		
			Weak	Medium	Strong	Weak	Medium	Strong
Commercial Residential	1	BAY	14.869	14.129	7.944	1.000	0.950	0.534
	2	BREVARD	9.224	8.702	4.361	1.000	0.943	0.473
	3	BREVARD	8.517	8.011	3.796	1.000	0.941	0.446
	4	BROWARD	16.868	12.971	8.334	1.000	0.769	0.494
	5	BROWARD	28.801	24.503	17.963	1.000	0.851	0.624
	6	CITRUS	4.932	4.591	1.830	1.000	0.931	0.371
	7	CLAY	1.928	1.780	0.632	1.000	0.923	0.328
	8	COLLIER	15.717	14.831	7.270	1.000	0.944	0.463
	9	COLUMBIA	1.784	1.642	0.562	1.000	0.921	0.315
	10	DIXIE	8.475	7.980	3.947	1.000	0.942	0.466
	11	DUVAL	5.710	5.386	2.739	1.000	0.943	0.480
	12	FRANKLIN	17.612	16.786	10.030	1.000	0.953	0.570
	13	GLADES	11.279	10.584	4.732	1.000	0.938	0.420
	14	HAMILTON	1.532	1.410	0.484	1.000	0.920	0.316
	15	HERNANDO	8.077	7.568	3.368	1.000	0.937	0.417
	16	HILLSBOROUGH	7.403	6.915	2.862	1.000	0.934	0.387
	17	HOLMES	4.354	4.050	1.572	1.000	0.930	0.361
	18	INDIAN RIVER	26.314	25.362	17.922	1.000	0.964	0.681
	19	JACKSON	2.929	2.711	0.977	1.000	0.925	0.334
	20	LEE	12.177	11.433	5.169	1.000	0.939	0.424
	21	LEON	2.714	2.514	0.936	1.000	0.926	0.345
	22	MARION	3.685	3.419	1.295	1.000	0.928	0.351
	23	MARTIN	11.944	11.252	5.407	1.000	0.942	0.453
	24	MARTIN	28.590	27.528	19.013	1.000	0.963	0.665
	25	MIAMI-DADE	16.582	12.847	8.250	1.000	0.775	0.498
	26	MIAMI-DADE	24.220	20.154	14.260	1.000	0.832	0.589
	27	MONROE	33.838	32.696	23.502	1.000	0.966	0.695
	28	MONROE	40.730	39.472	29.702	1.000	0.969	0.729
	29	OKALOOSA	12.850	12.168	6.356	1.000	0.947	0.495
	30	OSCEOLA	5.229	4.861	1.874	1.000	0.930	0.358
	31	OSCEOLA	7.714	7.220	3.143	1.000	0.936	0.407
	32	PALM BEACH	16.286	15.415	8.032	1.000	0.946	0.493
	33	PALM BEACH	25.714	24.602	15.356	1.000	0.957	0.597
	34	PINELLAS	8.442	7.922	3.559	1.000	0.938	0.422
	35	SAINT JOHNS	4.543	4.260	1.929	1.000	0.938	0.425
	36	SANTA ROSA	8.551	8.035	3.665	1.000	0.940	0.429
	37	SEMINOLE	4.420	4.107	1.587	1.000	0.929	0.359
	38	TAYLOR	2.886	2.681	1.046	1.000	0.929	0.363
	39	VOLUSIA	7.806	7.374	3.800	1.000	0.945	0.487
	40	WAKULLA	8.195	7.723	3.842	1.000	0.942	0.469

Form A - 6: Logical Relationship to Hurricane Risk - Condo Unit Floor Sensitivity
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: November 5, 2018

Construction / Policy	Location	County / City	Hurricane Loss Cost by Floor of Interest				Ratios Relative to 3rd Floor			
			3rd Floor	9th Floor	15th Floor	20th Floor	3rd Floor	9th Floor	15th Floor	20th Floor
Condo Unit A	1	BAY	1.269	4.332	7.629	16.010	1.000	3.413	6.009	12.612
	2	BREVARD	0.505	1.975	3.841	8.529	1.000	3.911	7.607	16.890
	3	BREVARD	0.424	1.623	3.276	7.469	1.000	3.828	7.726	17.610
	4	BROWARD	1.025	3.733	7.144	15.853	1.000	3.642	6.969	15.464
	5	BROWARD	3.476	10.121	16.224	31.431	1.000	2.912	4.668	9.043
	6	CITRUS	0.201	0.693	1.506	3.598	1.000	3.449	7.496	17.907
	7	CLAY	0.071	0.239	0.548	1.345	1.000	3.363	7.716	18.924
	8	COLLIER	0.831	3.098	6.185	14.022	1.000	3.729	7.442	16.874
	9	COLUMBIA	0.064	0.204	0.470	1.156	1.000	3.170	7.323	17.992
	10	DIXIE	0.837	2.137	3.542	7.247	1.000	2.552	4.230	8.654
	11	DUVAL	0.474	1.566	2.793	5.943	1.000	3.303	5.891	12.536
	12	FRANKLIN	2.622	6.507	10.037	18.469	1.000	2.482	3.828	7.044
	13	GLADES	0.493	1.828	3.843	8.922	1.000	3.708	7.797	18.105
	14	HAMILTON	0.063	0.193	0.431	1.051	1.000	3.081	6.885	16.793
	15	HERNANDO	0.461	1.451	2.836	6.355	1.000	3.145	6.145	13.772
	16	HILLSBOROUGH	0.275	1.048	2.346	5.655	1.000	3.817	8.543	20.591
	17	HOLMES	0.146	0.586	1.394	3.432	1.000	4.024	9.573	23.573
	18	INDIAN RIVER	5.340	12.283	17.353	29.057	1.000	2.300	3.250	5.442
	19	JACKSON	0.088	0.336	0.818	2.058	1.000	3.805	9.262	23.291
	20	LEE	0.599	2.105	4.340	9.973	1.000	3.515	7.248	16.655
	21	LEON	0.116	0.380	0.844	2.031	1.000	3.274	7.270	17.499
	22	MARION	0.137	0.474	1.066	2.585	1.000	3.459	7.783	18.879
	23	MARTIN	0.544	2.174	4.495	10.350	1.000	3.996	8.261	19.021
	24	MARTIN	4.263	11.716	18.018	33.320	1.000	2.748	4.227	7.816
	25	MIAMI-DADE	0.884	3.688	7.400	16.720	1.000	4.170	8.368	18.907
	26	MIAMI-DADE	2.161	7.545	13.052	26.766	1.000	3.492	6.040	12.387
	27	MONROE	5.230	16.111	25.138	46.955	1.000	3.080	4.807	8.978
	28	MONROE	10.277	21.276	29.001	51.737	1.000	2.070	2.822	5.034

Construction / Policy	Location	County / City	Hurricane Loss Cost by Floor of Interest				Ratios Relative to 3rd Floor			
			3rd Floor	9th Floor	15th Floor	20th Floor	3rd Floor	9th Floor	15th Floor	20th Floor
	29	OKALOOSA	0.774	3.093	6.118	13.642	1.000	3.997	7.905	17.628
	30	OSCEOLA	0.178	0.644	1.466	3.574	1.000	3.607	8.217	20.035
	31	OSCEOLA	0.373	1.243	2.556	5.901	1.000	3.334	6.856	15.826
	32	PALM BEACH	0.988	3.596	6.870	15.194	1.000	3.638	6.952	15.374
	33	PALM BEACH	2.542	8.270	13.910	27.717	1.000	3.253	5.472	10.904
	34	PINELLAS	0.336	1.392	3.000	7.048	1.000	4.150	8.940	21.005
	35	SAINT JOHNS	0.233	0.891	1.848	4.185	1.000	3.816	7.917	17.933
	36	SANTA ROSA	0.463	1.697	3.541	8.190	1.000	3.664	7.644	17.680
	37	SEMINOLE	0.163	0.584	1.301	3.145	1.000	3.586	7.993	19.311
	38	TAYLOR	0.123	0.440	0.966	2.332	1.000	3.575	7.848	18.948
	39	VOLUSIA	0.549	1.956	3.610	7.796	1.000	3.559	6.571	14.189
	40	WAKULLA	0.653	2.050	3.676	7.829	1.000	3.138	5.628	11.986

Construction / Policy	Location	County / City	Hurricane Loss Cost by Floor of Interest				Ratios Relative to 3rd Floor			
			3rd Floor	9th Floor	15th Floor	20th Floor	3rd Floor	9th Floor	15th Floor	20th Floor
Condo Unit B	1	BAY	4.428	14.313	21.155	40.176	1.000	3.232	4.777	9.072
	2	BREVARD	1.970	7.912	12.532	24.859	1.000	4.017	6.363	12.621
	3	BREVARD	1.708	7.191	11.619	23.535	1.000	4.211	6.804	13.782
	4	BROWARD	4.058	14.512	22.142	43.439	1.000	3.576	5.456	10.705
	5	BROWARD	10.545	26.742	36.899	64.971	1.000	2.536	3.499	6.161
	6	CITRUS	0.795	4.066	7.059	14.863	1.000	5.114	8.878	18.692
	7	CLAY	0.239	1.598	3.051	6.711	1.000	6.673	12.742	28.025
	8	COLLIER	3.461	13.548	21.106	42.128	1.000	3.914	6.098	12.172
	9	COLUMBIA	0.206	1.411	2.752	6.108	1.000	6.867	13.389	29.718
	10	DIXIE	2.939	8.357	12.036	22.900	1.000	2.843	4.095	7.791
	11	DUVAL	1.682	5.795	8.871	17.248	1.000	3.445	5.274	10.254
	12	FRANKLIN	7.938	18.697	25.330	44.059	1.000	2.355	3.191	5.550
	13	GLADES	2.085	9.192	14.899	30.415	1.000	4.408	7.146	14.587
	14	HAMILTON	0.203	1.302	2.503	5.526	1.000	6.423	12.353	27.266
	15	HERNANDO	1.826	7.064	11.216	22.571	1.000	3.869	6.143	12.362
	16	HILLSBOROUGH	1.125	6.022	10.367	21.748	1.000	5.353	9.215	19.331
	17	HOLMES	0.561	3.668	6.734	14.502	1.000	6.538	12.004	25.851
	18	INDIAN RIVER	13.375	27.419	35.244	56.490	1.000	2.050	2.635	4.224
	19	JACKSON	0.307	2.306	4.493	9.960	1.000	7.519	14.651	32.476
	20	LEE	2.531	10.415	16.628	33.643	1.000	4.115	6.570	13.293
	21	LEON	0.433	2.405	4.343	9.314	1.000	5.554	10.030	21.510
	22	MARION	0.517	2.997	5.415	11.637	1.000	5.797	10.475	22.509
	23	MARTIN	2.261	9.726	15.652	31.794	1.000	4.301	6.921	14.060
	24	MARTIN	11.943	27.960	37.617	63.849	1.000	2.341	3.150	5.346
	25	MIAMI-DADE	3.624	14.522	22.648	44.843	1.000	4.007	6.249	12.373
	26	MIAMI-DADE	7.466	22.261	31.866	58.250	1.000	2.982	4.268	7.802
	27	MONROE	15.433	37.481	49.956	83.379	1.000	2.429	3.237	5.403
	28	MONROE	24.842	45.239	55.240	88.438	1.000	1.821	2.224	3.560
	29	OKALOOSA	3.127	12.185	18.920	37.337	1.000	3.896	6.050	11.938
	30	OSCEOLA	0.700	4.038	7.206	15.379	1.000	5.772	10.300	21.981
	31	OSCEOLA	1.530	6.358	10.388	21.289	1.000	4.155	6.789	13.912
	32	PALM BEACH	3.923	13.910	21.207	41.586	1.000	3.546	5.406	10.602
	33	PALM BEACH	8.276	23.438	33.236	60.039	1.000	2.832	4.016	7.255
	34	PINELLAS	1.372	6.943	11.672	24.077	1.000	5.061	8.509	17.551

Construction / Policy	Location	County / City	Hurricane Loss Cost by Floor of Interest				Ratios Relative to 3rd Floor			
			3rd Floor	9th Floor	15th Floor	20th Floor	3rd Floor	9th Floor	15th Floor	20th Floor
	35	SAINT JOHNS	0.930	4.196	6.967	14.203	1.000	4.514	7.495	15.280
	36	SANTA ROSA	1.962	8.384	13.432	27.288	1.000	4.274	6.847	13.911
	37	SEMINOLE	0.632	3.541	6.301	13.426	1.000	5.605	9.975	21.255
	38	TAYLOR	0.466	2.598	4.652	9.975	1.000	5.577	9.986	21.415
	39	VOLUSIA	2.012	7.320	11.287	22.044	1.000	3.638	5.610	10.957
	40	WAKULLA	2.452	8.060	12.127	23.495	1.000	3.287	4.946	9.582

Form A-6: Logical Relationship to Hurricane Risk - Number of Stories Sensitivity (Trade Secret Item)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
Frame	1	BAY	3.545	4.775	1.000	1.347						
Owners	2	BREVARD	4.589	5.123	1.000	1.116						
	3	BREVARD	4.435	4.884	1.000	1.101						
	4	BROWARD	7.207	8.349	1.000	1.158						
	5	BROWARD	11.685	14.764	1.000	1.263						
	6	CITRUS	3.478	3.645	1.000	1.048						
	7	CLAY	0.847	0.885	1.000	1.044						
	8	COLLIER	6.861	7.824	1.000	1.140						
	9	COLUMBIA	0.885	0.915	1.000	1.034						
	10	DIXIE	2.731	3.516	1.000	1.287						
	11	DUVAL	1.653	2.062	1.000	1.247						
	12	FRANKLIN	5.296	7.411	1.000	1.399						
	13	GLADES	5.878	6.408	1.000	1.090						
	14	HAMILTON	0.800	0.829	1.000	1.036						
	15	HERNANDO	4.741	5.201	1.000	1.097						
	16	HILLSBOROUGH	4.277	4.521	1.000	1.057						
	17	HOLMES	1.333	1.434	1.000	1.076						
	18	INDIAN RIVER	12.684	16.276	1.000	1.283						
	19	JACKSON	1.058	1.106	1.000	1.046						
	20	LEE	6.303	6.943	1.000	1.102						
	21	LEON	1.074	1.151	1.000	1.072						
	22	MARION	2.859	2.956	1.000	1.034						
	23	MARTIN	5.687	6.287	1.000	1.106						
	24	MARTIN	11.897	15.196	1.000	1.277						
	25	MIAMI-DADE	6.494	7.470	1.000	1.150						
	26	MIAMI-DADE	9.171	11.357	1.000	1.238						

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
	27	MONROE	12.234	16.201	1.000	1.324						
	28	MONROE	18.716	24.989	1.000	1.335						
	29	OKALOOSA	2.712	3.558	1.000	1.312						
	30	OSCEOLA	3.628	3.767	1.000	1.038						
	31	OSCEOLA	4.646	5.031	1.000	1.083						
	32	PALM BEACH	7.246	8.350	1.000	1.152						
	33	PALM BEACH	10.277	12.680	1.000	1.234						
	34	PINELLAS	4.271	4.604	1.000	1.078						
	35	SAINT JOHNS	1.282	1.502	1.000	1.172						
	36	SANTA ROSA	1.980	2.440	1.000	1.232						
	37	SEMINOLE	3.226	3.350	1.000	1.038						
	38	TAYLOR	1.046	1.134	1.000	1.084						
	39	VOLUSIA	3.923	4.438	1.000	1.131						
	40	WAKULLA	2.363	2.997	1.000	1.268						
Masonry Owners	1	BAY	3.314	4.414	1.000	1.332						
	2	BREVARD	4.544	5.040	1.000	1.109						
	3	BREVARD	4.399	4.822	1.000	1.096						
	4	BROWARD	7.048	8.140	1.000	1.155						
	5	BROWARD	11.234	13.946	1.000	1.241						
	6	CITRUS	3.439	3.604	1.000	1.048						
	7	CLAY	0.809	0.846	1.000	1.045						
	8	COLLIER	6.801	7.708	1.000	1.133						
	9	COLUMBIA	0.846	0.876	1.000	1.036						
	10	DIXIE	2.562	3.269	1.000	1.276						
	11	DUVAL	1.559	1.929	1.000	1.237						
	12	FRANKLIN	4.873	6.705	1.000	1.376						
	13	GLADES	5.814	6.335	1.000	1.090						

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
	14	HAMILTON	0.766	0.794	1.000	1.037						
	15	HERNANDO	4.700	5.133	1.000	1.092						
	16	HILLSBOROUGH	4.230	4.471	1.000	1.057						
	17	HOLMES	1.265	1.363	1.000	1.078						
	18	INDIAN RIVER	11.828	14.798	1.000	1.251						
	19	JACKSON	1.006	1.054	1.000	1.047						
	20	LEE	6.235	6.859	1.000	1.100						
	21	LEON	1.022	1.097	1.000	1.074						
	22	MARION	2.827	2.923	1.000	1.034						
	23	MARTIN	5.562	6.149	1.000	1.106						
	24	MARTIN	11.330	14.175	1.000	1.251						
	25	MIAMI-DADE	6.356	7.298	1.000	1.148						
	26	MIAMI-DADE	8.914	10.909	1.000	1.224						
	27	MONROE	11.692	15.135	1.000	1.294						
	28	MONROE	17.320	22.599	1.000	1.305						
	29	OKALOOSA	2.560	3.346	1.000	1.307						
	30	OSCEOLA	3.588	3.726	1.000	1.039						
	31	OSCEOLA	4.596	4.970	1.000	1.081						
	32	PALM BEACH	7.085	8.139	1.000	1.149						
	33	PALM BEACH	9.942	12.110	1.000	1.218						
	34	PINELLAS	4.240	4.559	1.000	1.075						
	35	SAINT JOHNS	1.219	1.425	1.000	1.170						
	36	SANTA ROSA	1.871	2.308	1.000	1.233						
	37	SEMINOLE	3.191	3.313	1.000	1.038						
	38	TAYLOR	0.996	1.081	1.000	1.085						
	39	VOLUSIA	3.872	4.339	1.000	1.121						

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
	40	WAKULLA	2.228	2.808	1.000	1.260						

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
Frame Renters	1	BAY	1.223	2.142	1.000	1.752						
	2	BREVARD	0.614	0.982	1.000	1.600						
	3	BREVARD	0.548	0.838	1.000	1.531						
	4	BROWARD	1.051	1.860	1.000	1.769						
	5	BROWARD	3.141	5.770	1.000	1.837						
	6	CITRUS	0.366	0.461	1.000	1.259						
	7	CLAY	0.192	0.210	1.000	1.093						
	8	COLLIER	0.902	1.529	1.000	1.694						
	9	COLUMBIA	0.200	0.214	1.000	1.070						
	10	DIXIE	0.875	1.448	1.000	1.656						
	11	DUVAL	0.496	0.789	1.000	1.591						
	12	FRANKLIN	2.194	3.912	1.000	1.783						
	13	GLADES	0.659	0.977	1.000	1.483						
	14	HAMILTON	0.181	0.194	1.000	1.073						
	15	HERNANDO	0.587	0.883	1.000	1.505						
	16	HILLSBOROUGH	0.448	0.585	1.000	1.304						
	17	HOLMES	0.314	0.363	1.000	1.157						
	18	INDIAN RIVER	4.478	7.703	1.000	1.720						
	19	JACKSON	0.246	0.269	1.000	1.092						
	20	LEE	0.732	1.130	1.000	1.544						
	21	LEON	0.252	0.291	1.000	1.155						
	22	MARION	0.295	0.347	1.000	1.178						
	23	MARTIN	0.685	1.079	1.000	1.574						
	24	MARTIN	3.687	6.627	1.000	1.797						
	25	MIAMI-DADE	0.891	1.558	1.000	1.749						
	26	MIAMI-DADE	1.957	3.713	1.000	1.897						
	27	MONROE	3.966	7.488	1.000	1.888						
	28	MONROE	7.980	13.854	1.000	1.736						
	29	OKALOOSA	0.790	1.349	1.000	1.707						
	30	OSCEOLA	0.370	0.442	1.000	1.196						

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
	31	OSCEOLA	0.528	0.769	1.000	1.457						
	32	PALM BEACH	1.041	1.834	1.000	1.761						
	33	PALM BEACH	2.332	4.316	1.000	1.851						
	34	PINELLAS	0.486	0.684	1.000	1.408						
	35	SAINT JOHNS	0.327	0.462	1.000	1.413						
	36	SANTA ROSA	0.521	0.791	1.000	1.517						
	37	SEMINOLE	0.331	0.397	1.000	1.201						
	38	TAYLOR	0.251	0.298	1.000	1.186						
	39	VOLUSIA	0.587	0.962	1.000	1.639						
	40	WAKULLA	0.703	1.145	1.000	1.630						

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
Masonry Renters	1	BAY	1.119	1.948	1.000	1.741						
	2	BREVARD	0.600	0.952	1.000	1.586						
	3	BREVARD	0.536	0.821	1.000	1.530						
	4	BROWARD	1.029	1.804	1.000	1.753						
	5	BROWARD	2.902	5.172	1.000	1.782						
	6	CITRUS	0.356	0.453	1.000	1.271						
	7	CLAY	0.169	0.188	1.000	1.110						
	8	COLLIER	0.888	1.502	1.000	1.692						
	9	COLUMBIA	0.176	0.191	1.000	1.083						
	10	DIXIE	0.796	1.319	1.000	1.657						
	11	DUVAL	0.451	0.719	1.000	1.595						
	12	FRANKLIN	1.963	3.449	1.000	1.757						
	13	GLADES	0.645	0.969	1.000	1.501						
	14	HAMILTON	0.159	0.173	1.000	1.088						
	15	HERNANDO	0.572	0.861	1.000	1.506						
	16	HILLSBOROUGH	0.437	0.577	1.000	1.320						
	17	HOLMES	0.279	0.330	1.000	1.183						
	18	INDIAN RIVER	3.896	6.560	1.000	1.684						
	19	JACKSON	0.218	0.241	1.000	1.108						
	20	LEE	0.718	1.118	1.000	1.556						
	21	LEON	0.224	0.264	1.000	1.181						
	22	MARION	0.286	0.340	1.000	1.188						
	23	MARTIN	0.672	1.063	1.000	1.581						
	24	MARTIN	3.328	5.814	1.000	1.747						
	25	MIAMI-DADE	0.875	1.524	1.000	1.741						
	26	MIAMI-DADE	1.872	3.453	1.000	1.845						
	27	MONROE	3.647	6.642	1.000	1.821						
	28	MONROE	6.880	11.747	1.000	1.707						
	29	OKALOOSA	0.733	1.269	1.000	1.732						
	30	OSCEOLA	0.359	0.435	1.000	1.210						
	31	OSCEOLA	0.517	0.757	1.000	1.464						

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
	32	PALM BEACH	1.022	1.781	1.000	1.742						
	33	PALM BEACH	2.192	3.953	1.000	1.804						
	34	PINELLAS	0.475	0.674	1.000	1.419						
	35	SAINT JOHNS	0.296	0.428	1.000	1.446						
	36	SANTA ROSA	0.477	0.747	1.000	1.567						
	37	SEMINOLE	0.322	0.390	1.000	1.213						
	38	TAYLOR	0.223	0.271	1.000	1.215						
	39	VOLUSIA	0.568	0.914	1.000	1.610						
	40	WAKULLA	0.646	1.059	1.000	1.640						

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
Commercial Residential	1	BAY					2.227	5.442	14.129	1.000	2.443	6.343
	2	BREVARD					1.103	3.037	8.702	1.000	2.754	7.892
	3	BREVARD					0.955	2.712	8.011	1.000	2.840	8.387
	4	BROWARD					2.269	5.884	15.970	1.000	2.593	7.038
	5	BROWARD					5.577	11.898	27.625	1.000	2.133	4.954
	6	CITRUS					0.447	1.408	4.591	1.000	3.148	10.266
	7	CLAY					0.131	0.478	1.780	1.000	3.636	13.543
	8	COLLIER					1.937	5.282	14.831	1.000	2.726	7.655
	9	COLUMBIA					0.116	0.429	1.642	1.000	3.707	14.186
	10	DIXIE					1.370	3.171	7.980	1.000	2.315	5.826
	11	DUVAL					0.773	1.970	5.386	1.000	2.549	6.967
	12	FRANKLIN					3.533	7.376	16.786	1.000	2.088	4.751
	13	GLADES					1.212	3.540	10.584	1.000	2.920	8.731
	14	HAMILTON					0.104	0.374	1.410	1.000	3.597	13.553
	15	HERNANDO					0.965	2.631	7.568	1.000	2.726	7.840
	16	HILLSBOROUGH					0.663	2.134	6.915	1.000	3.218	10.425
	17	HOLMES					0.319	1.139	4.050	1.000	3.570	12.698
	18	INDIAN RIVER					6.345	12.088	25.362	1.000	1.905	3.997
	19	JACKSON					0.186	0.712	2.711	1.000	3.820	14.550
	20	LEE					1.395	3.924	11.433	1.000	2.814	8.198
	21	LEON					0.219	0.728	2.514	1.000	3.326	11.487
	22	MARION					0.295	0.990	3.419	1.000	3.354	11.589
	23	MARTIN					1.332	3.820	11.252	1.000	2.868	8.446
	24	MARTIN					6.046	12.309	27.528	1.000	2.036	4.553
	25	MIAMI-DADE					2.046	5.609	15.713	1.000	2.742	7.681
	26	MIAMI-DADE					4.037	9.411	23.160	1.000	2.331	5.737
	27	MONROE					7.183	14.804	32.696	1.000	2.061	4.552
	28	MONROE					11.170	20.031	39.472	1.000	1.793	3.534
	29	OKALOOSA					1.621	4.375	12.168	1.000	2.700	7.509
	30	OSCEOLA					0.425	1.428	4.861	1.000	3.359	11.435
	31	OSCEOLA					0.852	2.420	7.220	1.000	2.840	8.473

Construction / Policy	Location	County / City	Hurricane Loss Cost by Number of Stories		Ratios Relative to 1 Story		Hurricane Loss Cost by Number of Stories			Ratios Relative to 5 Story		
			1 Story	2 Story	1 Story	2 Story	5 Story	10 Story	20 Story	5 Story	10 Story	20 Story
	32	PALM BEACH					2.198	5.686	15.415	1.000	2.587	7.013
	33	PALM BEACH					4.485	10.160	24.602	1.000	2.265	5.486
	34	PINELLAS					0.819	2.534	7.922	1.000	3.094	9.672
	35	SAINT JOHNS					0.472	1.392	4.260	1.000	2.950	9.026
	36	SANTA ROSA					0.956	2.735	8.035	1.000	2.862	8.408
	37	SEMINOLE					0.363	1.206	4.107	1.000	3.324	11.322
	38	TAYLOR					0.240	0.786	2.681	1.000	3.279	11.188
	39	VOLUSIA					1.023	2.672	7.374	1.000	2.612	7.208
	40	WAKULLA					1.161	2.899	7.723	1.000	2.498	6.654

Appendix K – Form A-7: Percentage Change in Logical Relationship to Hurricane Risk

Florida International University
Florida Public Hurricane Loss Model 7.0
March 29, 2019

Form A-7: Percent Change in Logical Relationship to Hurricane Risk - Deductibles
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost					
		$0	**$500**	**1%**	**2%**	**5%**	**10%**
Frame Owners	Coastal	2.7%	2.7%	2.7%	2.8%	3.1%	3.3%
	Inland	1.7%	1.7%	1.6%	1.5%	0.9%	0.2%
	North	2.2%	2.0%	1.7%	1.4%	0.8%	0.7%
	Central	1.6%	1.6%	1.6%	1.6%	1.6%	1.8%
	South	3.2%	3.3%	3.3%	3.4%	3.7%	3.9%
	Statewide	2.5%	2.5%	2.6%	2.7%	2.9%	3.1%
Masonry Owners	Coastal	2.6%	2.7%	2.7%	2.8%	3.0%	3.3%
	Inland	1.7%	1.7%	1.6%	1.5%	1.0%	0.3%
	North	2.3%	2.1%	1.7%	1.4%	0.8%	0.8%
	Central	1.6%	1.6%	1.6%	1.6%	1.5%	1.7%
	South	3.2%	3.2%	3.3%	3.4%	3.6%	3.8%
	Statewide	2.5%	2.5%	2.6%	2.6%	2.8%	3.1%
Manufactured Homes	Coastal	2.6%	2.7%	2.7%	2.7%	2.7%	2.8%
	Inland	1.4%	1.4%	1.4%	1.3%	1.0%	0.5%
	North	2.0%	1.9%	1.9%	1.8%	1.5%	1.3%
	Central	1.3%	1.3%	1.3%	1.3%	1.2%	1.0%
	South	3.3%	3.3%	3.3%	3.3%	3.4%	3.4%
	Statewide	2.5%	2.5%	2.5%	2.5%	2.5%	2.6%
Frame Renters	Coastal	2.9%	3.3%	3.2%	3.3%	3.5%	3.6%
	Inland	1.3%	0.3%	0.5%	0.3%	-0.1%	-0.1%
	North	1.7%	0.7%	0.8%	0.7%	0.7%	0.7%
	Central	1.6%	1.9%	1.8%	1.9%	2.2%	2.4%
	South	3.5%	3.8%	3.7%	3.8%	4.1%	4.2%
	Statewide	2.7%	3.1%	3.0%	3.1%	3.3%	3.4%
Masonry Renters	Coastal	2.8%	3.2%	3.1%	3.2%	3.4%	3.5%
	Inland	1.3%	0.4%	0.5%	0.4%	0.0%	0.1%
	North	1.8%	0.8%	0.9%	0.8%	0.7%	0.8%

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost					
		$0	$500	1%	2%	5%	10%
	Central	1.5%	1.8%	1.7%	1.8%	2.0%	2.2%
	South	3.4%	3.7%	3.6%	3.7%	3.9%	4.0%
	Statewide	2.7%	3.0%	2.9%	3.0%	3.2%	3.3%
Frame Condo Unit	Coastal	2.8%	3.1%	3.1%	3.2%	3.4%	3.6%
	Inland	1.5%	0.9%	0.9%	0.4%	0.0%	-0.2%
	North	1.8%	1.1%	1.1%	0.7%	0.6%	0.7%
	Central	1.6%	1.7%	1.7%	1.8%	2.1%	2.4%
	South	3.4%	3.6%	3.6%	3.8%	4.0%	4.1%
	Statewide	2.7%	2.9%	2.9%	3.0%	3.3%	3.4%
Masonry Condo Unit	Coastal	2.8%	3.0%	3.0%	3.1%	3.4%	3.5%
	Inland	1.5%	1.0%	1.0%	0.4%	0.1%	0.0%
	North	1.9%	1.2%	1.2%	0.8%	0.7%	0.8%
	Central	1.5%	1.6%	1.6%	1.7%	1.9%	2.2%
	South	3.3%	3.5%	3.5%	3.7%	3.9%	4.0%
	Statewide	2.6%	2.8%	2.8%	3.0%	3.2%	3.3%

Construction / Policy	Region	Percent Change in Loss Cost					
		$0	2%	3%	5%	10%	
Commercial Residential	Coastal	2.7%	2.7%	2.7%	2.7%	2.8%	
	Inland	1.4%	1.0%	0.8%	0.3%	-0.5%	
	North	1.9%	1.6%	1.5%	1.4%	1.0%	
	Central	1.2%	1.0%	1.0%	0.8%	0.7%	
	South	3.4%	3.4%	3.4%	3.5%	3.5%	
	Statewide	2.5%	2.5%	2.5%	2.5%	2.5%	

Form A-7: Percent Change in Logical Relationship to Hurricane Risk - Policy Form
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Policy Form	Region	Percentage Change in Hurricane Loss Cost	
		Masonry	Frame
Owners	Coastal	2.6%	2.7%
	Inland	1.7%	1.7%
	North	2.3%	2.2%
	Central	1.6%	1.6%
	South	3.2%	3.2%
	Statewide	2.5%	2.5%
Renters	Coastal	2.8%	2.9%
	Inland	1.3%	1.3%
	North	1.8%	1.7%
	Central	1.5%	1.6%
	South	3.4%	3.5%
	Statewide	2.7%	2.7%
Condo Unit	Coastal	2.8%	2.8%
	Inland	1.5%	1.5%
	North	1.9%	1.8%
	Central	1.5%	1.6%
	South	3.3%	3.4%
	Statewide	2.6%	2.7%
Policy Form	**Region**	**Percentage Change in Hurricane Loss Cost**	
		Concrete	
Commercial Residential	Coastal	2.7%	
	Inland	1.4%	
	North	1.9%	
	Central	1.2%	
	South	3.4%	
	Statewide	2.5%	

Form A-7: Percent Change in Logical Relationship to Hurricane Risk - Policy Form/Construction
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Region	Percentage Change in Hurricane Loss Cost		
	Frame Owners	**Masonry Owners**	**Manufactured Homes**
Coastal	2.7%	2.6%	2.6%
Inland	1.7%	1.7%	1.4%
North	2.2%	2.3%	2.0%
Central	1.6%	1.6%	1.3%
South	3.2%	3.2%	3.3%
Statewide	2.5%	2.5%	2.5%

Form A-7: Percent Change in Logical Relationship to Hurricane Risk - Coverage
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Construction / Policy	**Region**	**Percentage Change in Hurricane Loss Cost**			
		Coverage A	**Coverage B**	**Coverage C**	**Coverage D**
Frame Owners	Coastal	2.6%	2.5%	2.8%	3.5%
	Inland	1.7%	1.9%	1.3%	1.3%
	North	2.3%	2.5%	1.7%	1.5%
	Central	1.6%	1.5%	1.5%	2.1%
	South	3.2%	3.1%	3.3%	4.1%
	Statewide	2.5%	2.4%	2.6%	3.3%
Masonry Owners	Coastal	2.6%	2.5%	2.7%	3.4%
	Inland	1.7%	1.9%	1.4%	1.3%
	North	2.3%	2.5%	1.8%	1.5%
	Central	1.6%	1.5%	1.5%	2.0%
	South	3.2%	3.1%	3.2%	4.0%
	Statewide	2.5%	2.4%	2.5%	3.2%
Manufactured Homes	Coastal	2.6%	2.5%	2.5%	3.0%
	Inland	1.6%	1.9%	0.2%	0.6%
	North	2.2%	2.5%	1.2%	1.3%
	Central	1.4%	1.5%	0.8%	1.2%
	South	3.2%	3.1%	3.2%	3.6%
	Statewide	2.5%	2.4%	2.3%	2.8%
Frame Renters	Coastal	NA	NA	2.8%	3.5%
	Inland	NA	NA	1.3%	1.3%
	North	NA	NA	1.7%	1.5%
	Central	NA	NA	1.5%	2.1%
	South	NA	NA	3.3%	4.1%
	Statewide	NA	NA	2.6%	3.3%
Masonry Renters	Coastal	NA	NA	2.7%	3.4%
	Inland	NA	NA	1.4%	1.3%
	North	NA	NA	1.8%	1.5%
	Central	NA	NA	1.5%	2.0%
	South	NA	NA	3.2%	4.0%
	Statewide	NA	NA	2.5%	3.2%
Frame Condo Unit	Coastal	2.6%	NA	2.8%	3.5%
	Inland	1.7%	NA	1.3%	1.3%
	North	2.3%	NA	1.7%	1.5%
	Central	1.6%	NA	1.5%	2.1%
	South	3.2%	NA	3.3%	4.1%
	Statewide	2.5%	NA	2.6%	3.3%
Masonry Condo Unit	Coastal	2.6%	NA	2.7%	3.4%
	Inland	1.7%	NA	1.4%	1.3%
	North	2.3%	NA	1.8%	1.5%
	Central	1.6%	NA	1.5%	2.0%
	South	3.2%	NA	3.2%	4.0%
	Statewide	2.5%	NA	2.5%	3.2%
Commercial Residential	Coastal	2.7%	NA	2.4%	NA
	Inland	1.4%	NA	0.9%	NA
	North	1.9%	NA	1.5%	NA
	Central	1.2%	NA	0.9%	NA
	South	3.4%	NA	3.2%	NA

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost			
		Coverage A	Coverage B	Coverage C	Coverage D
	Statewide	2.5%	NA	2.3%	NA

Form A-7: Percent Change in Logical Relationship to Hurricane Risk - Building Code / Enforcement (Year Built) Sensitivity
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost		
		Year Built 1980	Year Built 1998	Year Built 2004
Frame Owners	Coastal	2.7%	2.5%	2.6%
	Inland	1.6%	1.8%	1.9%
	North	2.1%	2.5%	2.8%
	Central	1.6%	1.7%	1.7%
	South	3.2%	3.1%	3.1%
	Statewide	2.5%	2.4%	2.5%
Masonry Owners	Coastal	2.7%	2.5%	2.6%
	Inland	1.6%	1.8%	1.9%
	North	2.1%	2.5%	2.9%
	Central	1.6%	1.6%	1.6%
	South	3.2%	3.0%	3.1%
	Statewide	2.5%	2.3%	2.4%

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost		
		Year Built 1974	Year Built 1992	Year Built 2004
Manufactured Homes	Coastal	2.6%	2.6%	2.8%
	Inland	1.5%	1.5%	2.0%
	North	2.0%	2.0%	2.7%
	Central	1.3%	1.3%	1.8%
	South	3.3%	3.3%	3.4%
	Statewide	2.4%	2.4%	2.6%

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost		
		Year Built 1980	Year Built 1998	Year Built 2004
Frame Renters	Coastal	3.0%	2.9%	2.9%
	Inland	0.9%	1.6%	2.0%
	North	1.4%	2.0%	2.6%
	Central	1.6%	1.9%	1.9%
	South	3.6%	3.5%	3.4%
	Statewide	2.8%	2.7%	2.7%
Masonry Renters	Coastal	3.0%	2.8%	2.7%

	Inland	0.9%	1.5%	2.0%
	North	1.3%	1.9%	2.6%
	Central	1.5%	1.8%	1.8%
	South	3.5%	3.4%	3.2%
	Statewide	2.8%	2.6%	2.6%
Frame Condo Unit	Coastal	2.9%	2.8%	2.8%
	Inland	1.2%	1.7%	2.0%
	North	1.5%	2.1%	2.7%
	Central	1.6%	1.8%	1.8%
	South	3.5%	3.4%	3.3%
	Statewide	2.7%	2.6%	2.6%
Masonry Condo Unit	Coastal	2.9%	2.7%	2.7%
	Inland	1.2%	1.6%	1.9%
	North	1.5%	2.1%	2.7%
	Central	1.5%	1.7%	1.7%
	South	3.4%	3.3%	3.2%
	Statewide	2.7%	2.5%	2.5%
Commercial Residential	Coastal	2.7%	2.6%	2.7%
	Inland	1.4%	1.4%	1.0%
	North	1.9%	1.9%	1.6%
	Central	1.2%	1.2%	1.1%
	South	3.4%	3.3%	3.4%
	Statewide	2.5%	2.4%	2.5%

Form A-7: Percent Change in Logical Relationship to Hurricane Risk - Building Strength
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost		
		Weak	Medium	Strong
Frame Owners	Coastal	2.6%	2.5%	2.5%
	Inland	1.6%	1.8%	2.0%
	North	2.0%	2.5%	2.9%
	Central	1.6%	1.7%	1.6%
	South	3.2%	3.1%	3.0%
	Statewide	2.5%	2.4%	2.4%
Masonry Owners	Coastal	2.6%	2.5%	2.5%
	Inland	1.6%	1.8%	1.9%
	North	2.0%	2.5%	2.9%
	Central	1.5%	1.6%	1.6%
	South	3.2%	3.0%	3.0%
	Statewide	2.5%	2.3%	2.4%
Manufactured Homes	Coastal	2.6%	2.6%	2.8%
	Inland	1.5%	1.5%	2.0%
	North	2.0%	2.0%	2.7%
	Central	1.3%	1.3%	1.8%
	South	3.3%	3.3%	3.4%
	Statewide	2.4%	2.4%	2.6%
Frame Renters	Coastal	3.0%	2.9%	2.6%
	Inland	0.7%	1.6%	2.0%
	North	1.3%	2.0%	2.7%
	Central	1.5%	1.9%	1.7%
	South	3.6%	3.5%	3.1%
	Statewide	2.7%	2.7%	2.5%
Masonry Renters	Coastal	2.9%	2.8%	2.6%
	Inland	0.7%	1.5%	2.0%
	North	1.2%	1.9%	2.7%
	Central	1.4%	1.8%	1.7%

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost		
		Weak	Medium	Strong
	South	3.5%	3.4%	3.1%
	Statewide	2.6%	2.6%	2.5%
Frame Condo Unit	Coastal	2.8%	2.8%	2.9%
	Inland	0.6%	1.7%	1.9%
	North	1.2%	2.1%	2.6%
	Central	1.3%	1.8%	1.9%
	South	3.4%	3.4%	3.4%
	Statewide	2.5%	2.6%	2.7%
Masonry Condo Unit	Coastal	2.7%	2.7%	2.8%
	Inland	0.7%	1.6%	1.9%
	North	1.2%	2.1%	2.6%
	Central	1.2%	1.7%	1.8%
	South	3.3%	3.3%	3.3%
	Statewide	2.5%	2.5%	2.6%
Commercial Residential	Coastal	2.6%	2.6%	2.8%
	Inland	1.5%	1.4%	0.6%
	North	1.9%	1.9%	1.3%
	Central	1.2%	1.2%	1.1%
	South	3.4%	3.3%	3.5%
	Statewide	2.5%	2.4%	2.6%

Form A-7: Percent Change in Logical Relationship to Hurricane Risk - Condo Unit Floor
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost			
		3rd Floor	9th Floor	15th Floor	20th Floor
Condo Unit A	Coastal	3.9%	3.5%	3.3%	3.1%
	Inland	0.3%	0.3%	0.7%	0.9%
	North	0.9%	0.8%	1.1%	1.4%
	Central	2.3%	1.4%	1.2%	1.0%
	South	4.7%	4.4%	4.3%	4.1%
	Statewide	3.7%	3.2%	3.1%	2.9%
Condo Unit B	Coastal	3.4%	3.1%	3.1%	3.0%
	Inland	0.4%	1.4%	1.7%	1.9%
	North	1.0%	1.9%	2.1%	2.3%
	Central	1.4%	1.2%	1.3%	1.3%
	South	4.3%	4.1%	4.1%	4.0%
	Statewide	3.2%	2.9%	2.9%	2.8%

Form A-7: Percent Change in Logical Relationship to Hurricane Risk - Number of Stories
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost		
		1 Story	2 Story	
Frame Owners	Coastal	2.7%	2.7%	
	Inland	1.7%	1.6%	
	North	2.3%	1.9%	
	Central	1.7%	1.6%	
	South	3.2%	3.3%	
	Statewide	2.5%	2.5%	
Masonry Owners	Coastal	2.6%	2.6%	
	Inland	1.7%	1.6%	
	North	2.3%	1.9%	
	Central	1.6%	1.6%	
	South	3.2%	3.2%	
	Statewide	2.5%	2.5%	
Frame Renters	Coastal	3.1%	3.0%	
	Inland	1.3%	0.5%	
	North	1.7%	1.1%	
	Central	1.9%	1.7%	
	South	3.7%	3.6%	
	Statewide	2.9%	2.8%	
Masonry Renters	Coastal	3.0%	2.9%	
	Inland	1.3%	0.5%	
	North	1.6%	1.1%	
	Central	1.8%	1.5%	
	South	3.6%	3.5%	
	Statewide	2.8%	2.7%	

Construction / Policy	Region	Percentage Change in Hurricane Loss Cost		
		5 Story	10 Story	20 Story
Commercial Residential	Coastal	2.9%	2.7%	2.7%
	Inland	0.2%	0.9%	1.4%
	North	1.0%	1.5%	1.9%
	Central	1.2%	1.1%	1.2%
	South	3.6%	3.5%	3.4%
	Statewide	2.7%	2.5%	2.5%

Appendix L – Form A-8A: Hurricane Probable Maximum Loss for Florida (2012 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
March 29, 2019

Form A-8A: Hurricane Probable Maximum Loss for Florida (2012 FHCF Exposure Data)
Part A - Personal and Commercial Residential Probable Maximum Loss for Florida
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: November 5, 2018

RangeStart (Millions)	RangeEnd (Millions)	Total Loss (Millions)	Average Loss per Year (Millions)	Number of Hurricanes	Expected Annual Hurricane Losses (Millions)	Return Period (Years)
0	500	1,180,943.28	32.60	9,754	20.02	2.11
501	1000	2,125,713.05	731.99	4,120	36.03	2.77
1001	1500	2,225,850.26	1,231.11	2,816	37.73	3.12
1501	2000	2,043,234.12	1,727.16	1,920	34.63	3.38
2001	2500	1,910,309.55	2,239.52	1,397	32.38	3.59
2501	3000	1,776,974.46	2,742.24	1,083	30.12	3.76
3001	3500	1,744,214.27	3,248.07	931	29.56	3.91
3501	4000	1,753,324.50	3,746.42	825	29.72	4.04
4001	4500	2,132,526.85	4,239.62	843	36.14	4.18
4501	5000	2,110,415.22	4,742.51	811	35.77	4.32
5001	6000	4,389,490.28	5,500.61	1,426	74.40	4.53
6001	7000	4,698,749.34	6,498.96	1,271	79.64	4.81
7001	8000	5,226,660.97	7,498.80	1,273	88.59	5.10
8001	9000	5,448,624.28	8,486.95	1,211	92.35	5.43
9001	10000	5,760,397.71	9,489.95	1,127	97.63	5.76
10001	11000	6,787,355.76	10,506.74	1,241	115.04	6.13
11001	12000	6,624,493.22	11,500.86	1,104	112.28	6.54
12001	13000	7,226,008.87	12,523.41	1,117	122.47	6.98
13001	14000	7,560,597.66	13,477.00	1,086	128.15	7.50
14001	15000	6,827,426.51	14,495.60	967	115.72	8.01
15001	16000	7,576,935.92	15,494.76	985	128.42	8.58
16001	17000	7,675,322.69	16,506.07	957	130.09	9.22
17001	18000	7,575,936.80	17,496.39	892	128.41	9.91
18001	19000	7,322,366.88	18,490.83	852	124.11	10.66
19001	20000	7,943,961.51	19,470.49	843	134.64	11.48
20001	21000	7,153,983.21	20,498.52	721	121.25	12.41
21001	22000	6,551,141.23	21,479.15	624	111.04	13.32
22001	23000	7,195,327.91	22,485.40	660	121.95	14.33
23001	24000	6,672,375.27	23,494.28	627	113.09	15.46
24001	25000	5,662,712.91	24,513.91	520	95.98	16.57
25001	26000	6,194,165.41	25,490.39	543	104.99	17.77
26001	27000	6,145,769.78	26,490.39	507	104.17	19.14
27001	28000	6,164,360.28	27,519.47	503	104.48	20.64
28001	29000	5,695,391.02	28,476.96	465	96.53	22.38
29001	30000	5,042,154.47	29,486.28	381	85.46	24.02
30001	35000	23,110,196.87	32,367.22	1,684	391.70	29.29
35001	40000	20,072,606.99	37,448.89	1,332	340.21	42.82
40001	45000	15,432,604.19	42,397.26	951	261.57	62.63
45001	50000	12,119,396.38	47,157.18	667	205.41	95.16
50001	55000	8,514,581.17	52,236.69	458	144.31	142.17
55001	60000	7,093,678.91	57,207.09	340	120.23	216.12
60001	65000	4,549,809.22	62,326.15	203	77.12	329.61
65001	70000	3,429,120.28	67,237.65	143	58.12	522.12

RangeStart (Millions)	RangeEnd (Millions)	Total Loss (Millions)	Average Loss per Year (Millions)	Number of Hurricanes	Expected Annual Hurricane Losses (Millions)	Return Period (Years)
70001	75000	2,520,428.78	72,012.25	102	42.72	786.67
75001	80000	1,784,968.28	77,607.32	66	30.25	1,311.11
80001	90000	1,934,396.86	84,104.21	63	32.79	2,809.52
90001	100000	664,445.31	94,920.76	21	11.26	8,428.57
100001	Maximum	316,330.49	105,443.50	9	5.36	29,500.00
Total		281,667,779.18		52,442		

Form A-8A: Hurricane Probable Maximum Loss for Florida (2012 FHCF Exposure Data)
Part B - Personal and Commercial Residential Hurricane Probable Maximum Loss for Florida (Annual Aggregate)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Return Period (Years)	**Estimated Loss Level (Billion)**	**Uncertainty Interval (Billion)**			**Conditional Tail Expectation (Billion)**
Top Event	$107.77		-	$-	-
1000	$73.50	$72.02	-	$78.06	$83.59
500	$66.70	$65.15	-	$69.62	$77.03
250	$58.56	$57.56	-	$60.57	$69.88
100	$47.74	$46.93	-	$48.91	$59.71
50	$39.35	$38.66	-	$40.09	$51.58
20	$27.10	$26.61	-	$27.57	$40.21
10	$17.60	$17.28	-	$17.95	$31.11
5	$7.12	$6.89	-	$7.42	$21.67

Form A-8A: Hurricane Probable Maximum Loss for Florida (2012 FHCF Exposure Data)
Part C - Personal and Commercial Residential Hurricane Probable Maximum Loss for Florida (Annual Occurrence)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Return Period (Years)	**Estimated Loss Level (Billion)**	**Uncertainty Interval (Billion)**			**Conditional Tail Expectation (Billion)**
Top Event	$94.47		-		-
1000	$60.76	$58.26	-	$64.32	$69.83
500	$53.91	$52.18	-	$55.73	$63.38
250	$48.02	$46.87	-	$49.30	$56.97
100	$39.78	$38.96	-	$40.65	$48.80
50	$33.20	$32.59	-	$33.80	$42.46
20	$23.61	$23.28	-	$24.01	$33.65
10	$16.64	$16.37	-	$16.91	$26.68
5	$9.80	$9.62	-	$10.00	$19.76

Appendix M – Form A-8B: Hurricane Probable Maximum Loss for Florida (2017 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
March 29, 2019

Form A-8B: Hurricane Probable Maximum Loss for Florida (2017 FHCF Exposure Data)
Part A - Personal and Commercial Residential Probable Maximum Loss for Florida
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: November 5, 2018

RangeStart (Millions)	RangeEnd (Millions)	Total Loss (Millions)	Average Loss per Year (Millions)	Number of Hurricanes	Expected Annual Hurricane Losses (Millions)	Return Period (Years)
0	500	1,185,141.93	32.63	9,911	20.09	2.12
501	1000	2,058,083.72	732.15	3,974	34.88	2.78
1001	1500	2,153,901.39	1,228.69	2,754	36.51	3.11
1501	2000	2,017,911.03	1,733.60	1,899	34.20	3.37
2001	2500	1,879,636.92	2,251.06	1,346	31.86	3.57
2501	3000	1,767,831.53	2,736.58	1,085	29.96	3.74
3001	3500	1,623,244.86	3,240.01	870	27.51	3.88
3501	4000	1,875,031.07	3,742.58	845	31.78	4.01
4001	4500	1,877,594.05	4,247.95	779	31.82	4.14
4501	5000	1,942,181.48	4,760.25	710	32.92	4.27
5001	6000	4,370,275.59	5,483.41	1,444	74.07	4.47
6001	7000	4,477,723.95	6,498.87	1,238	75.89	4.74
7001	8000	5,035,128.25	7,492.75	1,233	85.34	5.00
8001	9000	5,024,898.06	8,502.37	1,080	85.17	5.29
9001	10000	5,488,743.96	9,496.10	1,092	93.03	5.59
10001	11000	6,096,763.62	10,511.66	1,111	103.33	5.89
11001	12000	6,597,185.98	11,473.37	1,102	111.82	6.27
12001	13000	6,668,160.08	12,487.19	1,018	113.02	6.66
13001	14000	7,570,776.87	13,471.13	1,126	128.32	7.10
14001	15000	6,988,571.28	14,469.09	936	118.45	7.57
15001	16000	7,499,710.04	15,495.27	972	127.11	8.06
16001	17000	7,366,721.94	16,480.36	912	124.86	8.63
17001	18000	7,177,507.90	17,506.12	847	121.65	9.19
18001	19000	7,553,320.15	18,513.04	844	128.02	9.82
19001	20000	7,963,112.94	19,517.43	839	134.97	10.52
20001	21000	7,643,835.26	20,492.86	796	129.56	11.31
21001	22000	6,823,626.41	21,457.94	653	115.65	12.14
22001	23000	6,972,214.79	22,491.02	639	118.17	12.97
23001	24000	6,985,592.87	23,520.51	600	118.40	13.89
24001	25000	7,488,438.00	24,472.02	655	126.92	14.97
25001	26000	5,534,912.92	25,506.51	447	93.81	15.98
26001	27000	6,252,004.69	26,491.55	532	105.97	17.11
27001	28000	6,353,822.49	27,505.73	510	107.69	18.32
28001	29000	5,957,930.82	28,506.85	460	100.98	19.63
29001	30000	6,521,524.45	29,509.16	490	110.53	21.11
30001	35000	25,440,504.37	32,367.05	1,815	431.19	26.00
35001	40000	20,369,343.55	37,306.49	1,321	345.24	36.94
40001	45000	18,139,985.99	42,284.35	1,105	307.46	52.96
45001	50000	14,178,001.00	47,260.00	777	240.31	77.33
50001	55000	9,714,370.58	52,227.80	505	164.65	113.03
55001	60000	8,987,123.18	57,242.82	433	152.32	168.57
60001	65000	6,034,035.21	62,206.55	282	102.27	261.06
65001	70000	3,502,152.86	67,349.09	145	59.36	393.33

RangeStart (Millions)	RangeEnd (Millions)	Total Loss (Millions)	Average Loss per Year (Millions)	Number of Hurricanes	Expected Annual Hurricane Losses (Millions)	Return Period (Years)
70001	75000	3,476,632.27	72,429.84	139	58.93	584.16
75001	80000	2,382,902.88	76,867.83	87	40.39	1,000.00
80001	90000	2,801,450.92	84,892.45	94	47.48	1,843.75
90001	100000	1,041,940.02	94,721.82	31	17.66	6,555.56
100001	Maximum	324,356.79	108,118.93	9	5.50	29,500.00
Total		**297,185,860.91**		**52,492**		

Form A-8B: Hurricane Probable Maximum Loss for Florida (2017 FHCF Exposure Data)
Part B - Personal and Commercial Residential Hurricane Probable Maximum Loss for Florida (Annual Aggregate)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Return Period (Years)	Estimated Loss Level (Billion)	Uncertainty Interval (Billion)			Conditional Tail Expectation (Billion)
Top Event	$110.78		-		-
1000	$76.67	$75.37	-	$80.69	$86.59
500	$70.81	$68.86	-	$72.83	$80.21
250	$61.69	$60.17	-	$63.30	$72.86
100	$50.52	$49.52	-	$51.76	$62.47
50	$41.60	$40.89	-	$42.30	$54.04
20	$28.80	$28.24	-	$29.24	$42.16
10	$18.76	$18.43	-	$19.13	$32.66
5	$7.47	$7.19	-	$7.77	$22.68

Form A-8B: Hurricane Probable Maximum Loss for Florida (2017 FHCF Exposure Data)
Part C - Personal and Commercial Residential Hurricane Probable Maximum Loss for Florida (Annual Occurrence)
Modeling Organization: Florida International University
Model Name & Version Number: Florida Public Hurricane Loss Model 7.0
Model Release Date: March 29, 2019

Return Period (Years)	Estimated Loss Level (Billion)	Uncertainty Interval (Billion)			Conditional Tail Expectation (Billion)
Top Event	$92.70		-	$	-
1000	$63.78	$59.94	-	$66.96	$72.57
500	$55.96	$54.54	-	$58.34	$65.90
250	$49.92	$49.29	-	$51.68	$59.75
100	$41.82	$40.97	-	$42.87	$51.15
50	$34.87	$34.35	-	$35.47	$44.53
20	$25.14	$24.74	-	$25.56	$35.43
10	$17.75	$17.47	-	$18.04	$28.23
5	$10.40	$10.22	-	$10.62	$20.94

Appendix N – Form G1 – Form G7

Florida International University
Florida Public Hurricane Loss Model 7.0
May 13, 2019

Form G-1

Form G-1: General Standards Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the General Standards (G-1 – G-5) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of FPHLM
(Name of Hurricane Model)
Version 6.3/7.0 for compliance with the 2017 Hurricane Standards adopted by the Florida Commission on Hurricane Loss Projection Methodology and hereby certify that:

1. The hurricane model meets the General Standards (G-1 – G-5);
2. The disclosures and forms related to the General Standards section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession;
4. My review involved ensuring the consistency of the content in all sections of the submission; and
5. In expressing my opinion I have not been influenced by any other party in order to bias or prejudice my opinion.

Shahid S. Hamid	PhD in Economics (Financial)
Name	Professional Credentials (Area of Expertise)
S. Hamid	October 31, 2018
Signature (original submission)	Date
S. Hamid	January 21, 2019
Signature (response to deficiencies, if any)	Date
S. Hamid	January 31, 2019
Signature (revisions to submission, if any)	Date
S. Hamid	May 13, 2019
Signature (final submission)	Date

An updated signature and form are required following any modification of the hurricane model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines shall be added as necessary with the following format:

S. Hamid	April 3, 2019
Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Include Form G-1, General Standards Expert Certification, in a submission appendix.

Form G-2

Form G-2: Meteorological Standards Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Meteorological Standards (M-1 – M-6) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of FPHLM
(Name of Hurricane Model)
Version 6.3/7.0 for compliance with the 2017 Hurricane Standards adopted by the Florida Commission on Hurricane Loss Projection Methodology and hereby certify that:

1. The hurricane model meets the Meteorological Standards (M-1 – M-6);
2. The disclosures and forms related to the Meteorological Standards section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion I have not been influenced by any other party in order to bias or prejudice my opinion.

Steven Cocke	PhD Physics
Name	Professional Credentials (Area of Expertise)
[signature]	October 28, 2018
Signature (original submission)	Date
[signature]	02/04/2019
Signature (response to deficiencies, if any)	Date
[signature]	02/20/2019
Signature (revisions to submission, if any)	Date
[signature]	05/13/2019
Signature (final submission)	Date

An updated signature and form are required following any modification of the hurricane model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines shall be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Include Form G-2, Meteorological Standards Expert Certification, in a submission appendix.

Form G-3

Statistical Standards Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Statistical Standards (S-1 – S-6) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of FPHLM
(Name of Hurricane Model)
Version 6.3/7.0 for compliance with the 2017 Hurricane Standards adopted by the Florida Commission on Hurricane Loss Projection Methodology and hereby certify that:

1. The hurricane model meets the Statistical Standards (S-1 – S-6);
2. The disclosures and forms related to the Statistical Standards section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion, I have not been influenced by any other party in order to bias or prejudice my opinion.

B M Golam Kibria Name	Distribution Theory; Ridge regression; Statistical Inference; Sensitivity Analysis Professional Credentials (Area of Expertise)
[signature] Signature (original submission)	10/25/2018 Date
Signature (response to deficiencies, if any)	Date
[signature] Signature (revisions to submission, if any)	04/3/2019 Date
[signature] Signature (final submission)	05/13/2019 Date

An updated signature and form are required following any modification of the hurricane model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines shall be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Include Form G-3, Statistical Standards Expert Certification, in a submission appendix.

Form G-4

Form G-4: Vulnerability Standards Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Vulnerability Standards (V-1 – V-3) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of the Florida Public Hurricane Loss Model, Version 6.3 for compliance with the 2017 Hurricane Standards adopted by the Florida Commission on Hurricane Loss Projection Methodology and hereby certify that:

1. The hurricane model meets the Vulnerability Standards (V-1 – V-3);
2. The disclosures and forms related to the Vulnerability Standards section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion I have not been influenced by any other party in order to bias or prejudice my opinion.

Jean-Paul Pinelli	PhD, P.E, Structural/Wind Engineer
Name	Professional Credentials (Area of Expertise)
	10/31/2018
Signature (original submission)	Date
	1/21/19
Signature (response to deficiencies, if any)	Date
Signature (revisions to submission, if any)	Date
Signature (final submission)	Date

An updated signature and form are required following any modification of the hurricane model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines shall be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.
Include Form G-4, Vulnerability Standards Expert Certification, in a submission appendix.

Form G-4: Vulnerability Standards Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Vulnerability Standards (V-1 – V-3) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of the Florida Public Hurricane Loss Model, Version 6.3/7.0 for compliance with the 2017 Hurricane Standards adopted by the Florida Commission on Hurricane Loss Projection Methodology and hereby certify that:

1. The hurricane model meets the Vulnerability Standards (V-1 – V-3);
2. The disclosures and forms related to the Vulnerability Standards section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion I have not been influenced by any other party in order to bias or prejudice my opinion.

Jean-Paul Pinelli	PhD, P.E, Structural/Wind Engineer
Name	Professional Credentials (Area of Expertise)
	10/31/2018
Signature (original submission)	Date
	1/21/19
Signature (response to deficiencies, if any)	Date
	4/3/19
Signature (revisions to submission, if any)	Date
	5/3/2019
Signature (final submission)	Date

An updated signature and form are required following any modification of the hurricane model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines shall be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.
Include Form G-4, Vulnerability Standards Expert Certification, in a submission appendix.

Form G-5

Form G-5: Actuarial Standards Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Actuarial Standards (A-1 – A-6) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of FPHLM
(Name of Hurricane Model)
Version 6.3/7.0 for compliance with the 2017 Hurricane Standards adopted by the Florida Commission on Hurricane Loss Projection Methodology and hereby certify that:

1. The hurricane model meets the Actuarial Standards (A-1 – A-6);
2. The disclosures and forms related to the Actuarial Standards section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the Actuarial Standards of Practice and Code of Conduct; and
4. In expressing my opinion I have not been influenced by any other party in order to bias or prejudice my opinion.

GAIL FLANNERY
Name

FCAS, MAAA
Professional Credentials (Area of Expertise)

Signature (original submission) Date 11/1/18

Signature (response to deficiencies, if any) Date 1/21/19

Signature (revisions to submission, if any) Date 1/31/19

Signature (final submission) Date 5/4/19

An updated signature and form are required following any modification of the hurricane model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines shall be added as necessary with the following format:

Signature (revisions to submission) Date 4/3/19

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Include Form G-5, Actuarial Standards Expert Certification, in a submission appendix.

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Form G-6

Form G-6: Computer/Information Standards Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Computer/Information Standards (CI-1 – CI-7) in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of FPHLM
(Name of Hurricane Model)
Version 63/7.0 for compliance with the 2017 Hurricane Standards adopted by the Florida Commission on Hurricane Loss Projection Methodology and hereby certify that:

1. The hurricane model meets the Computer/Information Standards (CI-1 – CI-7);
2. The disclosures and forms related to the Computer/Information Standards section are editorially and technically accurate, reliable, unbiased, and complete;
3. My review was completed in accordance with the professional standards and code of ethical conduct for my profession; and
4. In expressing my opinion I have not been influenced by any other party in order to bias or prejudice my opinion.

Shu-Ching Chen	Ph.D. in Electrical and Computer Engineering & M.S. in Computer Science
Name	Professional Credentials (Area of Expertise)
	October 26, 2018
Signature (original submission)	Date
Signature (response to deficiencies, if any)	Date
	April 3, 2019
Signature (revisions to submission, if any)	Date
	May 13, 2019
Signature (final submission)	Date

An updated signature and form are required following any modification of the hurricane model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines shall be added as necessary with the following format:

Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Include Form G-6, Computer/Information Standards Expert Certification, in a submission appendix.

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Form G-7

Form G-7: Editorial Review Expert Certification

Purpose: This form identifies the signatory or signatories who have reviewed the current submission for compliance with the Notification Requirements and General Standard G-5, Editorial Compliance, in accordance with the stated provisions.

I hereby certify that I have reviewed the current submission of FPHLM
(Name of Hurricane Model)

Version 6.3/7.0 for compliance with the "Process for Determining the Acceptability of a Computer Simulation Hurricane Model" adopted by the Florida Commission on Hurricane Loss Projection Methodology in its *Hurricane Standards Report of Activities as of November 1, 2017*, and hereby certify that:

1. The hurricane model submission is in compliance with the Notification Requirements and General Standard G-5, Editorial Compliance;
2. The disclosures and forms related to each hurricane standards section are editorially accurate and contain complete information and any changes that have been made to the submission during the review process have been reviewed for completeness, grammatical correctness, and typographical errors;
3. There are no incomplete responses, charts or graphs, inaccurate citations, or extraneous text or references;
4. The current version of the hurricane model submission has been reviewed for grammatical correctness, typographical errors, completeness, the exclusion of extraneous data/information and is otherwise acceptable for publication; and
5. In expressing my opinion I have not been influenced by any other party in order to bias or prejudice my opinion.

Diana Machado	MS Computer Science
Name	Professional Credentials (Area of Expertise)
[signature]	November 2, 2018
Signature (original submission)	Date
[signature]	January 21, 2019
Signature (response to deficiencies, if any)	Date
[signature]	January 31, 2019
Signature (revisions to submission, if any)	Date
[signature]	May 13, 2019
Signature (final submission)	Date

An updated signature and form are required following any modification of the hurricane model and any revision of the original submission. If a signatory differs from the original signatory, provide the printed name and professional credentials for any new signatories. Additional signature lines shall be added as necessary with the following format:

[signature]	April 3, 2019
Signature (revisions to submission)	Date

Note: A facsimile or any properly reproduced signature will be acceptable to meet this requirement.

Include Form G-7, Editorial Review Expert Certification, in a submission appendix.

Appendix O – Form M-1: Annual Occurrence Rates

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

A. Provide a table of annual occurrence rates for hurricane landfall from the dataset defined by marine exposure that the hurricane model generates by hurricane category (defined by maximum windspeed at hurricane landfall in the Saffir-Simpson Hurricane Wind Scale) for the entire state of Florida and additional regions as defined in Figure 3. List the annual occurrence rate per hurricane category. Annual occurrence rates shall be rounded to two decimal places.

The historical frequencies below have been derived from the Base Hurricane Storm Set as defined in Standard M-1, Base Hurricane Storm Set. If the modeling organization Base Hurricane Storm Set differs from that defined in Standard M-1, Base Hurricane Storm Set, (for example, using a different historical period), the historical rates in the table shall be edited to reflect this difference (see below). As defined, a by-passing hurricane is a hurricane which does not make landfall, but produces minimum damaging windspeeds or greater on land in Florida. For the by-passing hurricanes included in the table only, the hurricane intensity entered is the maximum windspeed at closest approach to Florida as a hurricane, not the windspeed over Florida.

A report detailing the how the counts were determined will be available for review.

Statewide counts are determined using two different methods. Under the heading "Entire State," we provide the counts using the most intense landfall for each storm affecting Florida; that is, there is only one landfall per storm. Under the heading "Entire State Landfalls," we provide the counts of all landfalls for each storm, using only one landfall per region. This table is the sum of the counts for Regions A–D. See Table 31.

B. Describe hurricane model variations from the historical frequencies.

The modeled frequencies are consistent with the historical record, to the extent that we may consider the historical record reliable. Statewide, the model produces 75.3 Florida landfalls (66.9 storms) in 118 years, compared to 74 landfalls (67 storms) historically. For major (Category 3–5) storms, the model produces 25.6 landfalls, compared to about 27 landfalls historically.

On a regional basis, the model is also consistent with the historical record. In Part C below we show bar charts for each region. The bar charts show reasonable agreement between the modeled and historical frequencies. Goodness of fit tests have been performed and indicate that the model results are consistent with the historical record. These tests will be available for review.

C. Provide vertical bar graphs depicting distributions of hurricane frequencies by category by region of Florida (Figure 3), for the neighboring states of Alabama/Mississippi and Georgia, and for by-passing hurricanes. For the neighboring states, statistics based on the closest coastal segment to the state boundaries used in the hurricane model are adequate.

Vertical bar charts are shown in the figure below. These charts show the number of hurricanes in a 118-year period. Note that there are two charts for Florida statewide hurricanes. The "FL Landfalls" chart shows the total number of landfalls in the state (basically the sum of Regions A–D), whereas the "FL Hurricanes" chart shows only the number of hurricanes making at least one landfall, and the intensity is the maximum intensity landfall in the case of multiple landfalls.

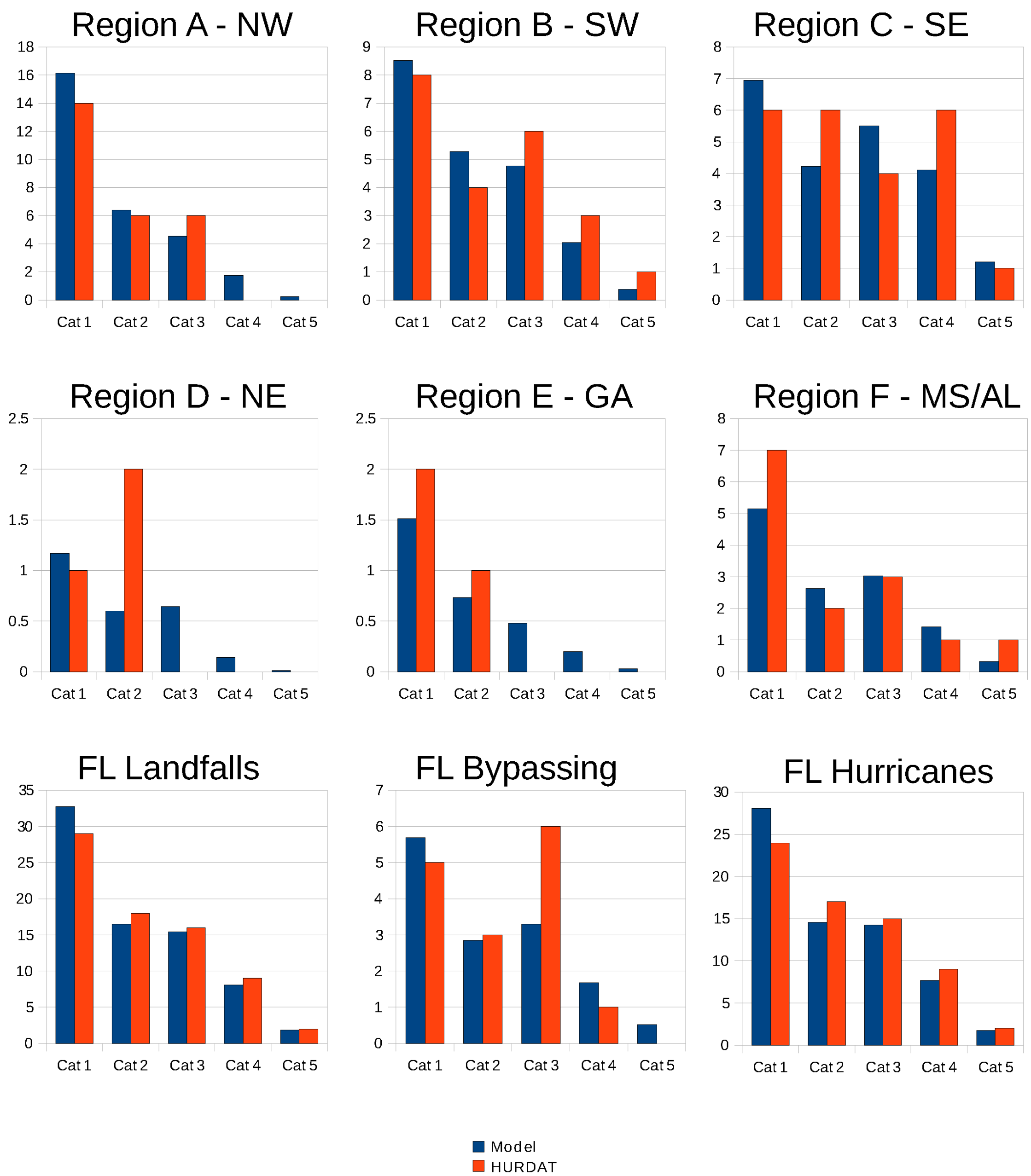


Figure 100. Form M-1 comparison of modeled and historical landfalling hurricane frequency (storms occurring in 118 years) for Regions A–F, FL statewide landfalls (one per FL region), FL bypassing storms, and FL state-wide hurricanes.

D. If the data are partitioned or modified, provide the historical annual occurrence rates for the applicable partition (and its complement) or modification as well as the modeled annual occurrence rates in additional copies of Form M-1, Annual Occurrence Rates.

Not Applicable.

E. List all hurricanes added, removed, or modified from the previously-accepted hurricane model version of the Base Hurricane Storm Set.

Hurricanes Flossy (1956), Donna (1960), and Ethel (1960) were revised due to the May 1, 2018 HURDAT2 Reanalysis. However, there were no changes in SS Category or region with respect to the last submission, thus no changes in Form M-1 counts as a result for these storms.

The following new storms were added: Hermine (2016), Mathew (2016), Irma (2017) and Nate (2017). Hurricane Nate (2017) did not affect Florida, but is counted as a Region F storm in Form M-1.

F. Provide this form in Excel format. The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form M-1, Annual Occurrence Rates, in a submission appendix.

The form is provided in Excel format. See Table 31.

Form M-1. Modeled Annual Occurrence Rates

	Entire State				Region A – NW Florida			
	Historical		Modeled		Historical		Modeled	
Category	Number	Rate	Number	Rate	Number	Rate	Number	Rate
1	24	0.20	28.32	0.24	14	0.12	16.28	0.14
2	17	0.14	14.70	0.12	6	0.05	6.46	0.05
3	15	0.13	14.40	0.12	6	0.05	4.58	0.04
4	9	0.08	7.72	0.07	0	0.00	1.76	0.01
5	2	0.02	1.77	0.02	0	0.00	0.23	0.00

	Region B – SW Florida				Region C – SE Florida			
	Historical		Modeled		Historical		Modeled	
Category	Number	Rate	Number	Rate	Number	Rate	Number	Rate
1	8	0.07	8.59	0.07	6	0.05	6.99	0.06
2	4	0.03	5.33	0.05	6	0.05	4.27	0.04
3	6	0.05	4.83	0.04	4	0.03	5.56	0.05
4	3	0.03	2.06	0.02	6	0.05	4.14	0.04
5	1	0.01	0.39	0.00	1	0.01	1.21	0.01

	Region D – NE Florida				Florida By-Passing Hurricanes			
	Historical		Modeled		Historical		Modeled	
Category	Number	Rate	Number	Rate	Number	Rate	Number	Rate
1	1	0.01	1.17	0.01	5	0.04	5.74	0.05
2	2	0.02	0.60	0.01	3	0.03	2.88	0.02
3	0	0.00	0.65	0.01	6	0.05	3.34	0.03
4	0	0.00	0.14	0.00	1	0.01	1.69	0.01
5	0	0.00	0.01	0.00	0	0.00	0.51	0.00

	Region E – Georgia				Region F – Alabama/Mississippi			
	Historical		Modeled		Historical		Modeled	
Category	Number	Rate	Number	Rate	Number	Rate	Number	Rate
1	2	0.02	1.53	0.01	7	0.06	5.20	0.04
2	1	0.01	0.73	0.01	2	0.02	2.65	0.02
3	0	0.00	0.49	0.00	3	0.03	3.06	0.03
4	0	0.00	0.20	0.00	1	0.01	1.41	0.01
5	0	0.00	0.03	0.00	1	0.01	0.32	0.00

Table 31. Form M-1 Modeled Annual Occurrence Rates

	Entire State Landfalls			
	Historical		Modeled	
Category	Number	Rate	Number	Rate
1	29	0.25	33.03	0.28
2	18	0.15	16.66	0.14
3	16	0.14	15.62	0.13
4	9	0.08	8.10	0.07
5	2	0.02	1.84	0.02

Appendix P – Form M-2: Maps of Maximum Winds

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Map of Form M2-A

Maximum Winds for the Modeled Version of the Base Hurricane Set (Actual Terrain)

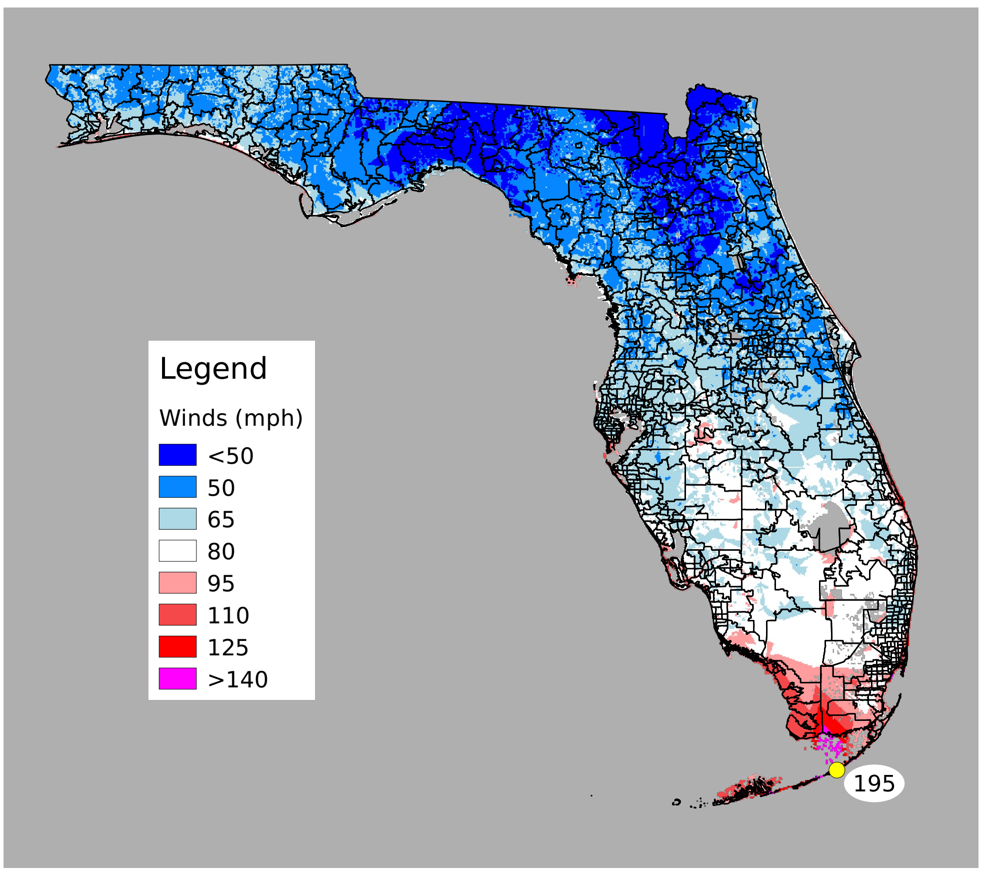


Figure 101. Maximum winds for the modeled version of the base hurricane storm set (actual terrain)

Form M-2A

Maximum Winds of the Modeled Hurricane Base Set
(Open Terrain)

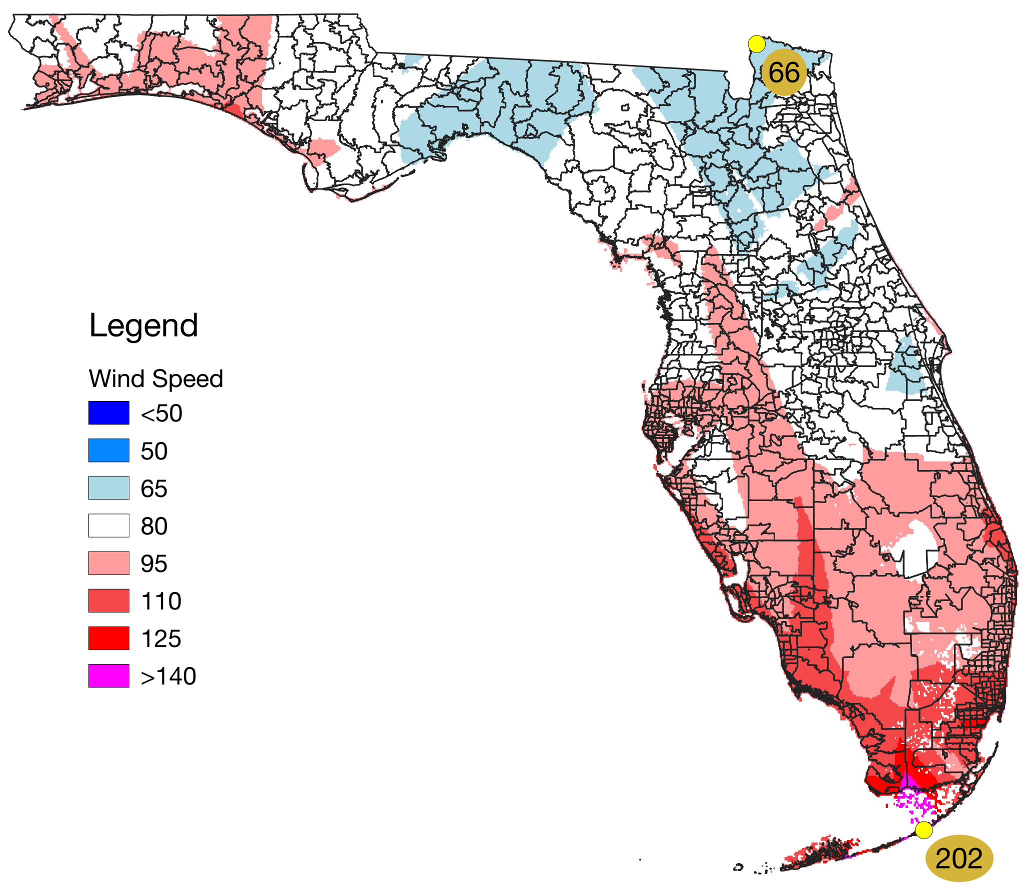
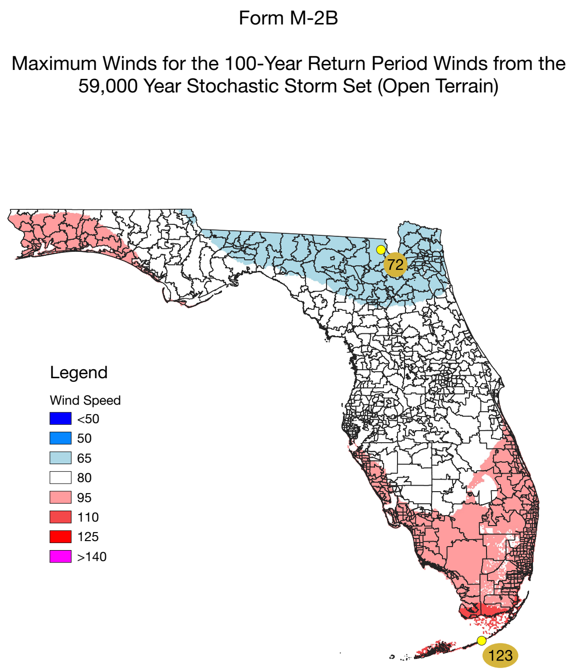


Figure 102. Maximum winds for the modeled version of the base hurricane storm set (open terrain)



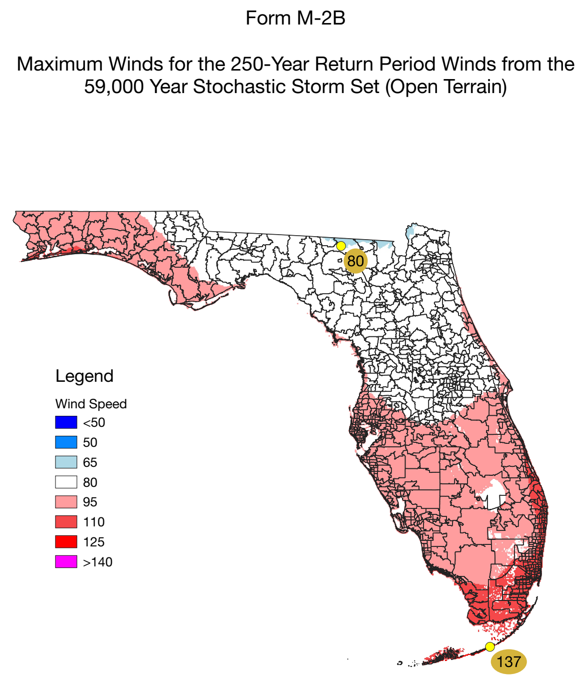


Figure 103. 100- and 250-year return period wind speeds for open terrain wind exposure.

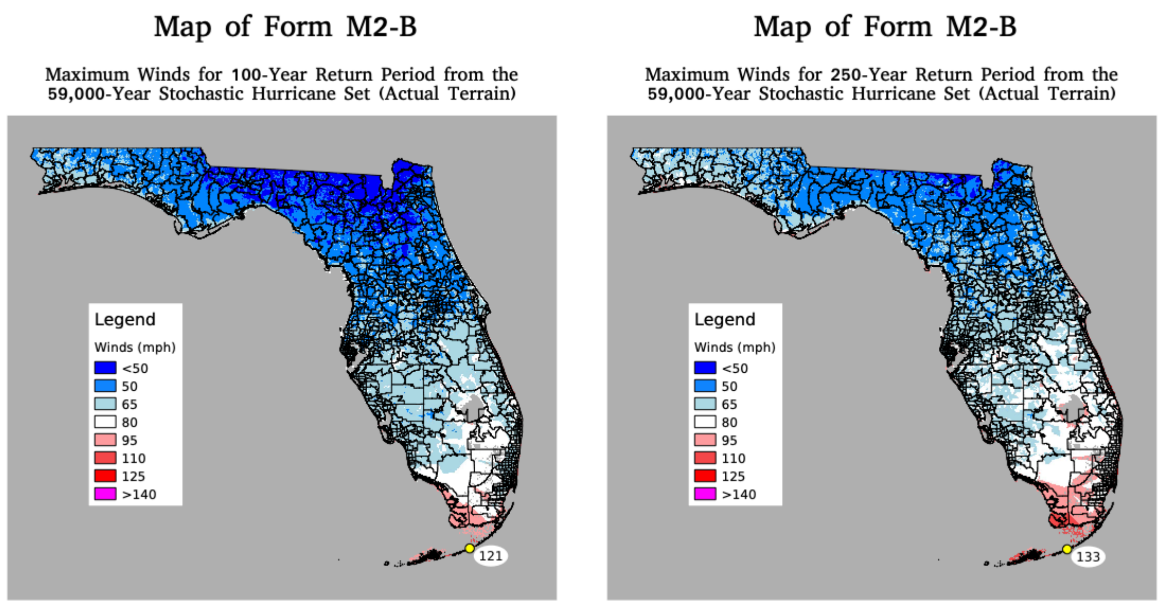


Figure 104. 100- and 250-year return period wind speeds for actual terrain wind exposure. Note that winds below 50 mph were not saved for this calculation, and thus the minimum wind cannot be determined.

Appendix Q – Form M-3: Radius of Maximum Winds and Radii of Standard Wind Thresholds

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

A. For the central pressures in the table below, provide the first quartile (1Q), median (2Q), and third quartile (3Q) values for (1) the radius of maximum winds (Rmax) used by the hurricane model to create the stochastic storm set, and the first quartile (1Q), median (2Q), and third quartile (3Q) values for the outer radii of (2) Category 3 winds (>110 mph), (3) Category 1 winds (>73 mph), and (4) gale force winds (>40 mph).

See Table 32.

B. Describe the procedure used to complete this form.

From the entire set of stochastic track files, 10 sets of track files were extracted; each set was selected on the basis of the central pressure at landfall being within +/- 0.5 mb of the pressure as listed in Form M-3. The input *Rmax* parameter can vary slightly from *Rmax* determined from the gridded wind field because of the effects of translation speed on the wind field and interpolation truncation over the 0.1 R/ *Rmax* model grid.

C. Identify other variables that influence Rmax.

For our input values of *Rmax* that determine the initial boundary layer mean vortex, we sample *Rmax* from a gamma distribution, which only explicitly depends on central pressure. For *Rmax* determined from the wind field, the translation speed (which is added after the steady state boundary layer model solution is obtained) may also influence *Rmax*.

D. Specify any truncations applied to Rmax distributions in the hurricane model, and if and how these truncations vary with other variables.

The *Rmax* input parameter is truncated to be in the range of 4 to 120 sm.

E. Provide a box plot and histogram of Central Pressure (x-axis) versus Rmax (y-axis) to demonstrate relative populations and continuity of sampled hurricanes in the stochastic storm set.

A scatter plot with histograms and box plot is shown below.

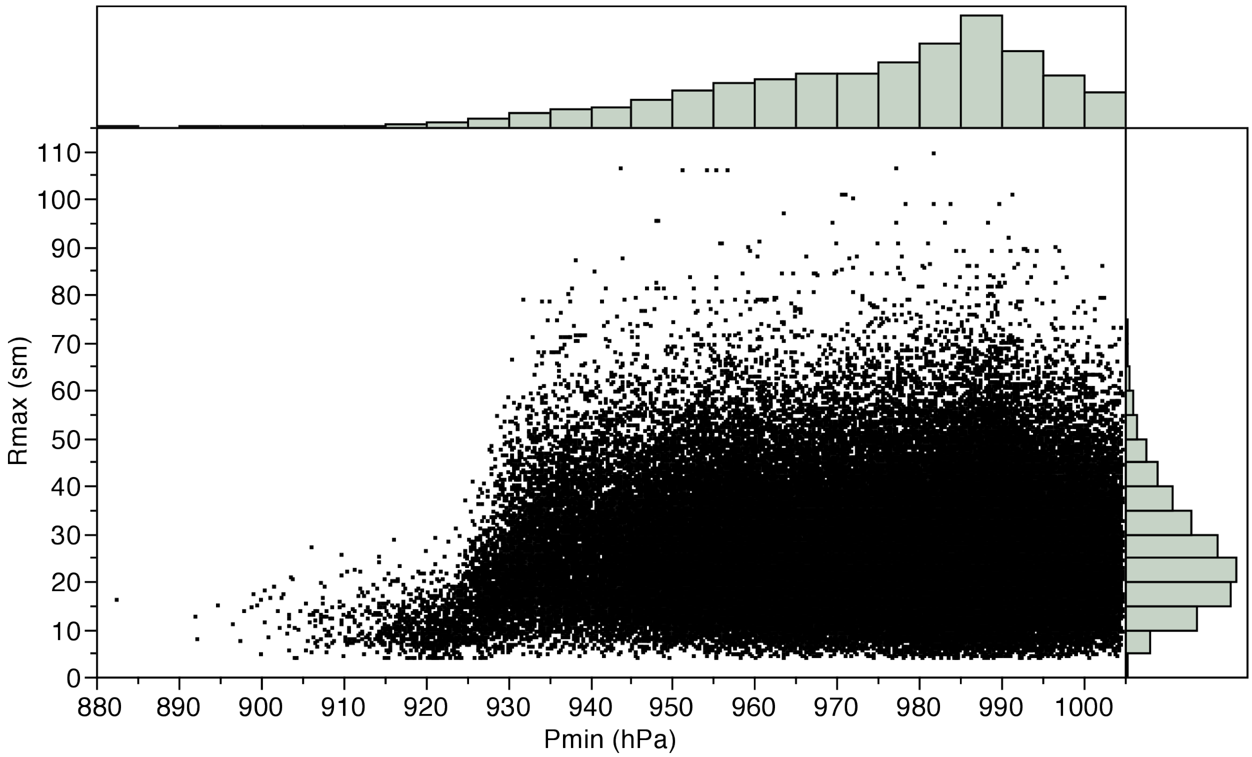


Figure 105. Representative scatter plot of the model input radius of maximum wind (y axis) versus minimum sea-level air pressure at landfall (mb). Relative histograms for each quantity are also shown.

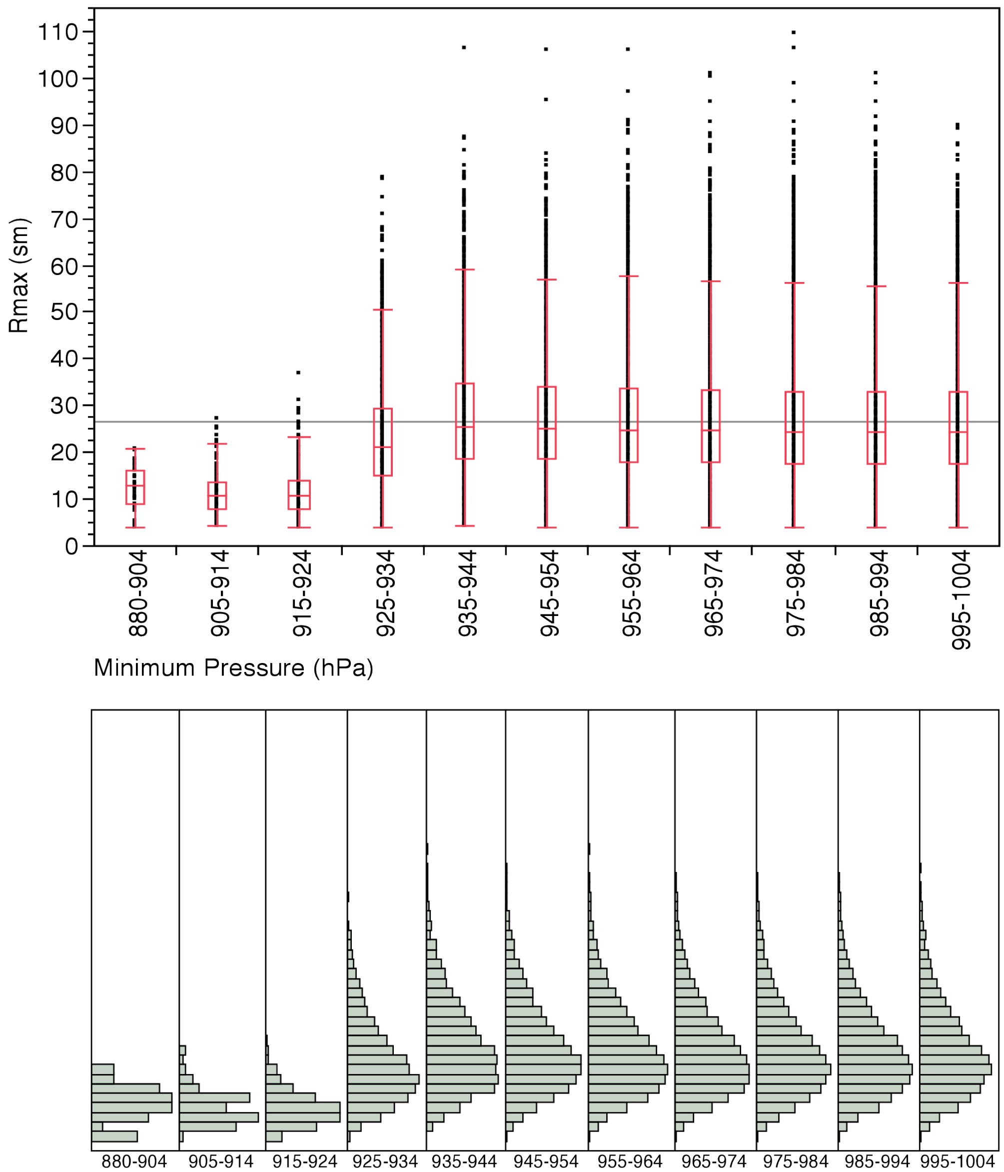


Figure 106. One way box plot (top) of *Rmax* (continuous) response across 10 mb *Pmin* groups. Boxes (and whiskers) are in red; standard deviations are in blue. Histograms (bottom) for each *Pmin* group.

F. Provide this form in Excel using the format given in the file named "2017FormM3.xlsx." The file name shall include the abbreviated name of the modeling organization, the hurricane standards year, and the form name. Also include Form M-3, Radius of Maximum Winds and Radii of Standard Wind Thresholds, in a submission appendix.

The form is provided in Excel format. See Table 32 .

Central Pressure (mb)	*Rmax* (mi)			Outer Radii (>110 mph) (mi)			Outer Radii (>73 mph) (mi)			Outer Radii (>40 mph) (mi)		
	1Q	2Q	3Q	1Q	2Q	3Q	1Q	2Q	3Q	1Q	2Q	3Q
990	18	25	34	NA	NA	NA	17	22	30	50	66	87
980	18	25	34	10	14	18	25	32	42	66	87	114
970	18	24	33	14	19	25	32	42	54	80	107	139
960	18	25	34	18	23	30	40	51	66	94	125	165
950	18	24	33	22	28	36	45	59	75	102	137	181
940	18	24	33	26	33	42	50	66	85	111	151	201
930	15	21	28	26	34	43	49	64	83	106	145	194
920	7	9	12	13	18	25	23	31	44	49	70	101
910	6	9	12	14	19	26	24	33	46	50	73	99
900	6	8	13	14	20	28	23	34	52	49	71	106

Table 32. Form M-3: Radius of Maximum Winds and Radii of Standard Wind Thresholds

Central Pressure (mb)	HURDAT2						Model					
	Outer Radii (>73 mph) (mi)			Outer Radii (>58 mph) (mi)			Outer Radii (> 73 mph) (mi)			Outer Radii (>58 mph) (mi)		
	1Q	2Q	3Q	1Q	2Q	3Q	1Q	2Q	3Q	1Q	2Q	3Q
990	17	23	29	32	46	69	17	22	30	35	46	60
980	20	23	35	43	58	78	25	32	42	47	63	80
970	23	33	43	50	72	118	32	42	54	59	77	99
960	32	43	65	62	89	118	40	51	66	69	91	119
950	36	52	72	65	89	116	45	59	75	76	101	132
940	40	52	70	72	89	114	50	66	85	83	111	147
930	43	52	72	76	89	116	49	64	83	79	107	142

Table 33. Comparison of HURDAT2 and FPHLM outer radii

Appendix R – Form S-1: Probability and Frequency of Florida Landfalling Hurricanes per Year

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Hurricane Model Results
Probability and Frequency of Florida Landfalling Hurricanes per Year

Number of Hurricanes Per Year	Historical Probability	Modeled Probability	Historical Frequency	Modeled Frequency
0	0.6102	0.6203	72	73
1	0.2373	0.2418	28	29
2	0.1271	0.0971	15	11
3	0.0254	0.0324	3	4
4	0.0000	0.0079	0	1
5	0.0000	0.0004	0	0
6	0.0000	0.0000	0	0
7	0.0000	0.0000	0	0
8	0.0000	0.0000	0	0
9	0.0000	0.0000	0	0
10 or more	0.0000	0.0000	0	0

Note: Historical and modeled frequencies are the number of occurrences in a 118 year period.

Appendix S – Form S-2A: Examples of Hurricane Loss Exceedance Estimates (2012 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Part A

Return Period (Years)	Annual Probability of Exceedance	Estimated Hurricane Loss Notional Risk Data Set	Estimated Personal and Commercial Residential Hurricane Loss 2012 FHCF Data Set
Top Event	NA	$67,778,216	$107,769,395,534
10000	0.01%	$55,399,825	$95,455,262,288
5000	0.02%	$52,538,127	$88,174,464,199
2000	0.05%	$46,741,923	$80,605,004,869
1000	0.10%	$42,657,240	$73,498,809,119
500	0.20%	$37,505,192	$66,703,755,988
250	0.40%	$33,244,632	$58,556,954,264
100	1.00%	$26,346,134	$47,740,735,748
50	2.00%	$21,151,260	$39,349,058,321
20	5.00%	$14,160,328	$27,095,280,287
10	10.00%	$8,812,189	$17,603,479,339
5	20.00%	$3,170,980	$7,119,283,722

Part B

Mean (Total Average Annual Hurricane Loss)	$2,445,577	$4,774,030,155
Median	$0	$4,414
Standard Deviation	$5,511,137	$10,272,348,323
Interquartile Range	$1,693,167	$3,577,756,496
Sample Size	59000	59000

Appendix T – Form S-2B: Examples of Hurricane Loss Exceedance Estimates (2017 FHCF Exposure Data)

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Part A

Return Period (Years)	Annual Probability of Exceedance	Estimated Hurricane Loss Notional Risk Data Set	Estimated Personal and Commercial Residential Hurricane Loss 2017 FHCF Data Set
Top Event	NA	$67,778,216	$110,777,351,135
10000	0.01%	$55,399,825	$97,631,739,299
5000	0.02%	$52,538,127	$92,511,230,371
2000	0.05%	$46,741,923	$85,845,404,739
1000	0.10%	$42,657,240	$76,669,749,764
500	0.20%	$37,505,192	$70,811,857,153
250	0.40%	$33,244,632	$61,689,275,988
100	1.00%	$26,346,134	$50,517,247,153
50	2.00%	$21,151,260	$41,596,780,882
20	5.00%	$14,160,328	$28,798,047,916
10	10.00%	$8,812,189	$18,763,087,190
5	20.00%	$3,170,980	$7,472,671,407

Part B

Mean (Total Average Annual Hurricane Loss)	$2,445,577	$5,037,048,490
Median	$0	$823
Standard Deviation	$5,511,137	$10,844,392,771
Interquartile Range	$1,693,167	$3,707,343,211
Sample Size	59000	59000

Appendix U – Form S-3: Distributions of Stochastic Hurricane Parameters

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Stochastic Hurricane Parameter (Function or Variable)	Functional Form of Distribution	Data Source	Year Range Used	Justification for Functional Form
Holland B Error term	Normal	Willoughby and Rahn (2004)	1977-2000	The Gaussian Distribution provided a good fit for the error term. See Standard S-1, Disclosure 1.
Rmax	Gamma	Ho et al. (1987) , supplemented by the extended best track data of DeMaria (Penington 2000), NOAA HRD research flight data, and NOAA-HRD H*Wind analyses (Powell et al. 1996, 1998).	1901-2012	Rmax is skewed, nonnegative and does not have a long tail. So the gamma distribution was tried and found to be a good fit. We limit the range of Rmax to the interval (4, 120). See Standard S-1, Disclosure 1.
Pressure decay Term	Normal	Vickery (2005)	1979-1996	From Vickery (2005)
Storm initial location perturbation	Uniform	N/A	N/A	Plausible variations in initial storm locations are assumed to be uniform
Storm initial motion perturbation	Uniform	N/A	N/A	Plausible variations in initial storm motion are assumed to be uniform
Storm change in motion and intensity distributions	Empirical	HURDAT	1900-2017	Sampling from historical data See Standard G-1, Disclosure 2 for details

Appendix V – Form S-4: Validation Comparisons

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Personal Residential:

Coverage	Company Actual	Modeled	Difference
	Loss/Exposure	Loss/Exposure	
Building	0.00764	0.00927	-0.00163
Contents	0.00007	0.00247	-0.00240
Appurtenant	0.00107	0.01042	-0.00935
ALE	0.00025	0.00174	-0.00149
Total	0.00424	0.00650	-0.00226

Comparison #1: Hurricane Charley and Company O by Coverage

Company	Event	Company Actual	Modeled	Difference
		Loss/Exposure	Loss/Exposure	
J	Jeanne	0.01370	0.01477	-0.00107
N	Wilma	0.01201	0.01294	-0.00093
B	Charley	0.01544	0.01737	-0.00193
O	Frances	0.00245	0.00450	-0.00205
O	Charley	0.00424	0.00650	-0.00226

Comparison #2: Different Companies by Different Hurricanes

Company	Event	Company Actual	Modeled	Difference
		Loss/Exposure	Loss/Exposure	
O	Frances	0.00245	0.00450	-0.00205
O	Charley	0.00424	0.00650	-0.00226
O	Jeanne	0.00143	0.00433	-0.00290

Comparison #3: Company O by Hurricane Frances, Charley, Jeanne

Construction	Company	Company Actual	Modeled	Difference
		Loss/Exposure	Loss/Exposure	
Frame	B	0.01363	0.01695	-0.00332
Masonry	B	0.01584	0.01687	-0.00103
Manufactured	Q	0.05476	0.03724	0.01752
Other	A	0.01803	0.01450	0.00353

Comparison #4: Construction Type for Hurricane Charley

County	Company Actual	Modeled	Difference
	Loss/Exposure	Loss/Exposure	
Lee	0.000019	0.000025	-0.000007
Sarasota	0.000122	0.000259	-0.000137
Collier	0.000031	0.000081	-0.000050
Madison	0.000924	0.000994	-0.000070
Manatee	0.000262	0.000465	-0.000203

Comparison #5: County wise for Company A and Hurricane Frances

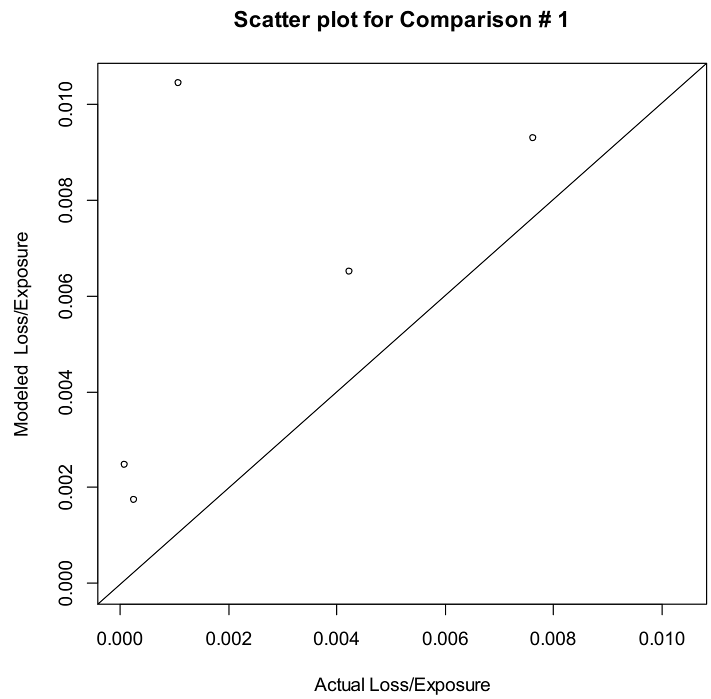


Figure 107. Scatter plot for comparison # 1.

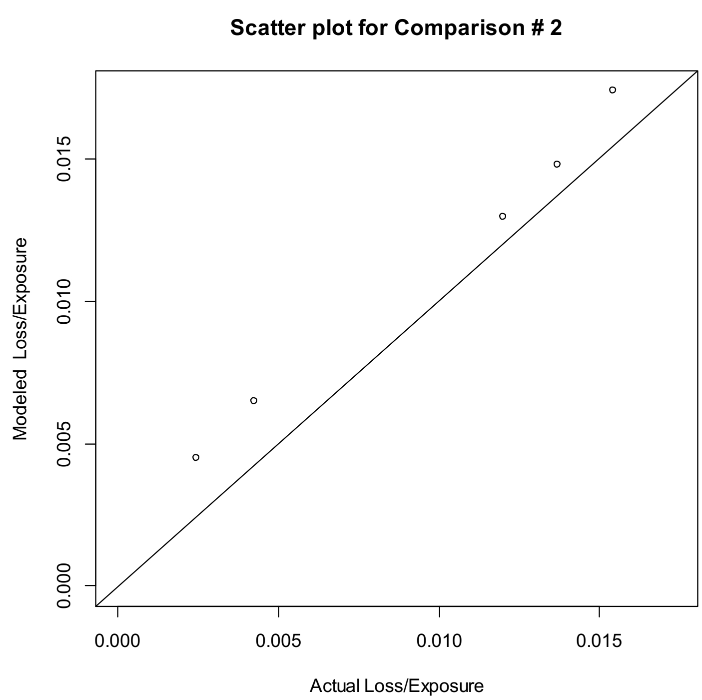


Figure 108. Scatter plot for comparison # 2.

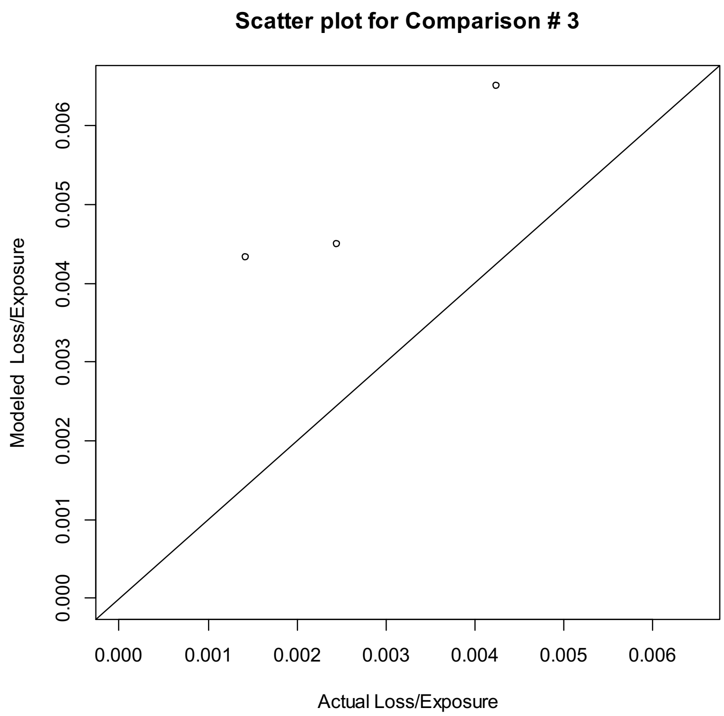


Figure 109. Scatter plot for comparison # 3.

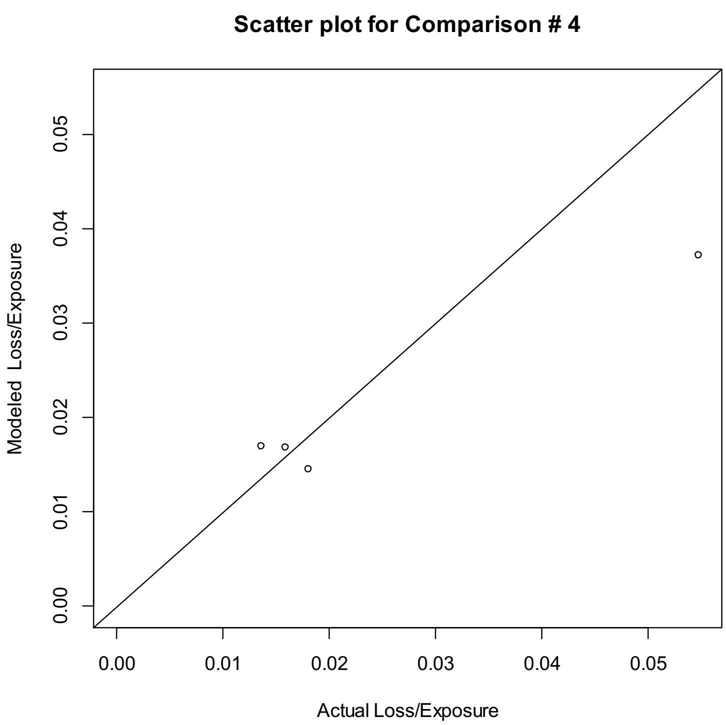


Figure 110. Scatter plot for comparison # 4.

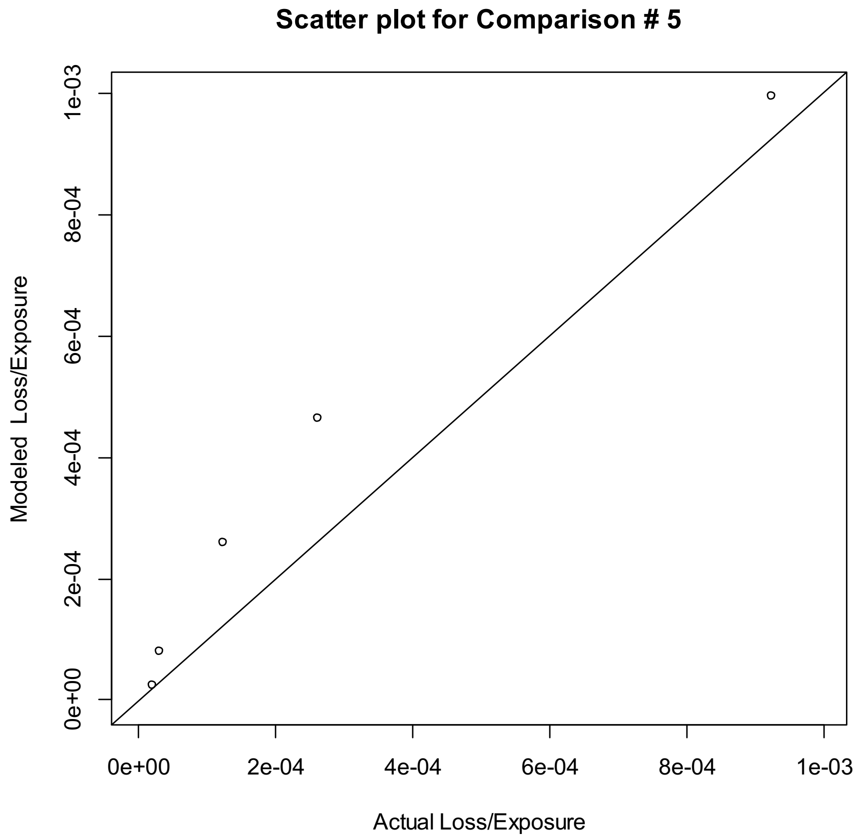


Figure 111. Scatter plot for comparison # 5.

Commercial Residential:

Company	Event	Company Actual Loss/Exposure	Modeled Loss/Exposure	Difference
D	Jeanne	0.00716	0.01470	0.00754
D	Katrina	0.00183	0.00714	0.00531
D	Wilma	0.01555	0.01243	-0.00313
Q	Wilma	0.02579	0.01108	-0.01471

Comparison # 1: Company D and Q by Hurricane Jeanne, Katrina, and Wilma

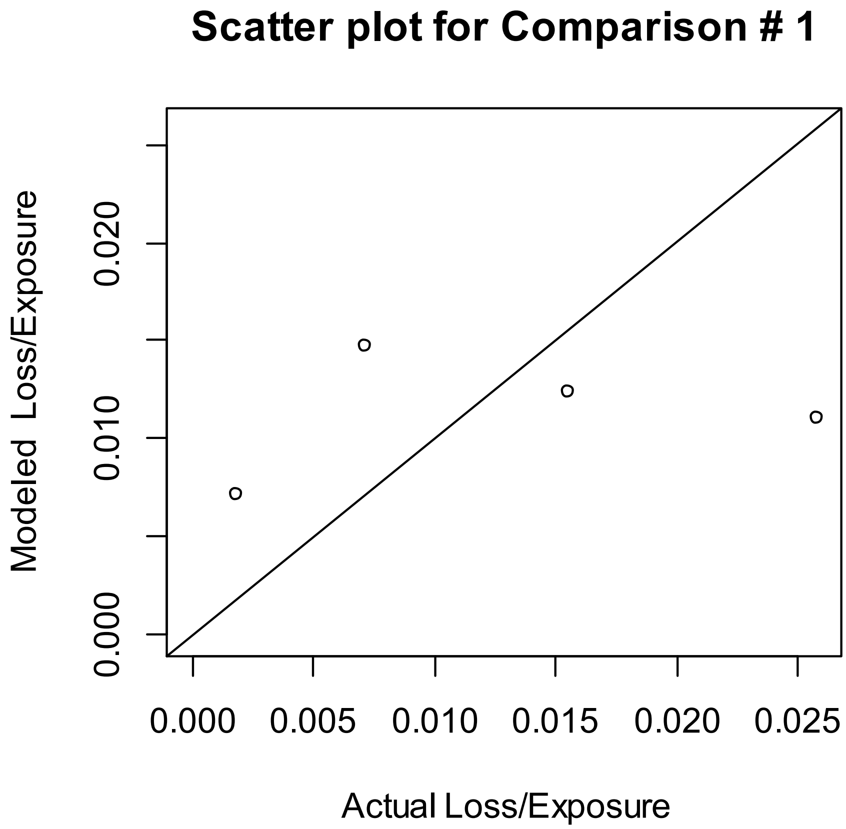


Figure 112. Scatter plot for comparison # 1

Appendix W – Form S-5: Average Annual Zero Deductible Statewide Hurricane Loss Costs – Historical versus Modeled

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Average Annual Zero Deductible Statewide Personal and Commercial Residential Hurricane Loss Costs – 2012 FHCF

Time Period	Historical Hurricanes	Produced by Hurricane Model
Current Submission	$5,479.01	$4,774.03
Previously-Accepted Hurricane Model* (2015 Standards)	$5,388.52	$4,658.62
Percent Change Current Submission/ Previously Accepted Hurricane Model*	1.68	2.48
Second Previously-Accepted Hurricane Model* (2013 Standards)	$5,681.92	$4,921.29
Percent Change Current Submission/ Second Previously-Accepted Hurricane Model*	-3.57	-2.99

*NA if no previously-accepted hurricane model.

Average Annual Zero Deductible Statewide Personal and Commercial Residential Hurricane Loss Costs – 2017 FHCF

Time Period	Historical Hurricanes	Produced by Hurricane Model
Current Submission	$5,792.95	$5,037.05

Appendix X – Form V-1: One Hypothetical Event

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Part A

All reference structures combined.

Wind Speed (mph) 1 min sustained Wind 10-meter	Estimated Damage/ Subject Exposure
41-50	0.00%
51-60	0.05%
61-70	0.38%
71-80	1.12%
81-90	3.30%
91-100	7.31%
101-110	10.75%
111-120	15.80%
121-130	21.76%
131-140	23.61%
141-150	28.22%
151-160	29.62%
161-170	31.60%

Only personal residential reference structures combined (Timber + Masonry + MH).

Wind Speed (mph) 1 min sustained Wind 10-meter	Estimated Damage/ Subject Exposure
41-50	0.00%
51-60	0.87%
61-70	2.57%
71-80	3.84%
81-90	6.16%
91-100	12.30%
101-110	17.34%
111-120	25.34%
121-130	40.90%
131-140	43.82%
141-150	54.41%
151-160	57.48%
161-170	65.64%

Only commercial residential reference structures (Concrete).

Wind Speed (mph) 1 min sustained Wind 10-meter	Estimated Damage/ Subject Exposure
41-50	0.00%
51-60	0.04%
61-70	0.33%
71-80	1.06%
81-90	3.25%
91-100	7.21%
101-110	10.62%
111-120	15.61%
121-130	21.38%
131-140	23.21%
141-150	27.70%
151-160	29.06%
161-170	30.92%

Part B

Construction Type	Estimated Damage/ Subject Exposure
Wood Frame	14.75%
Masonry	12.88%
Manufactured Home	36.57%
Concrete	10.74%

The structures used in completing the form are identical to those in the table provided.

Part C

All reference structures combined.

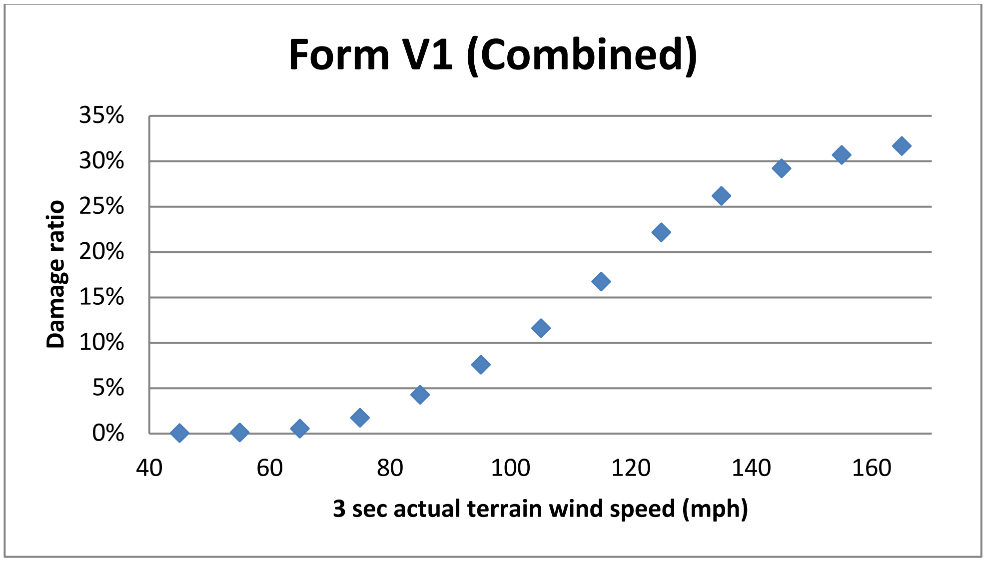


Figure 113. Structure damage vs. 3 sec actual terrain wind speed.

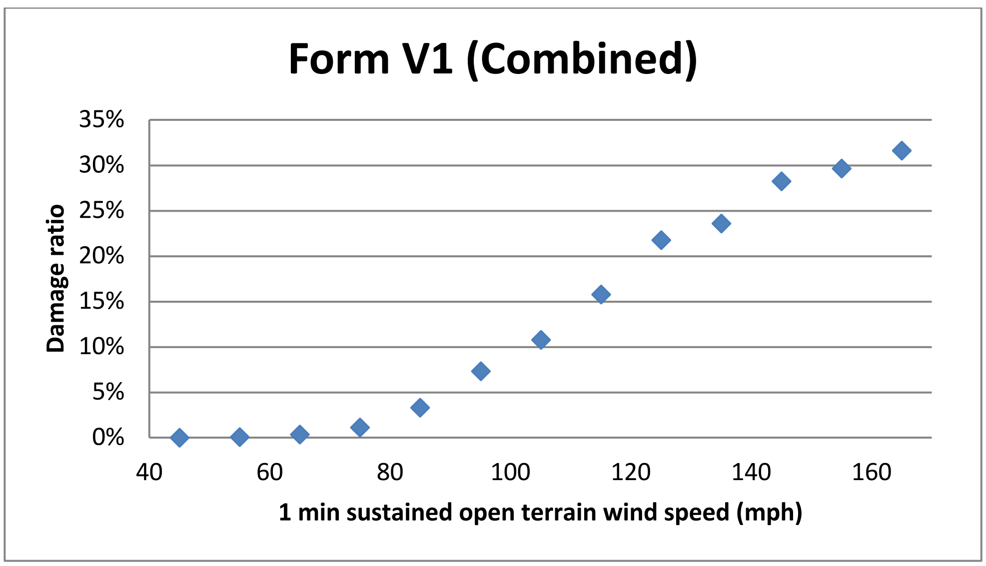


Figure 114. Structure damage vs. 1 minute sustained wind speed.

Only personal residential reference structures combined (Timber + Masonry + MH).

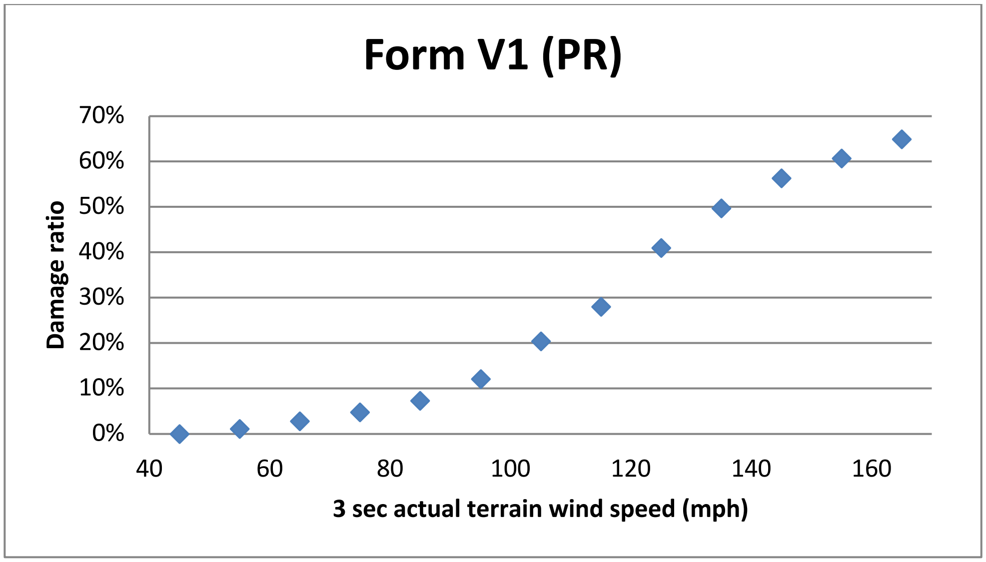


Figure 115. Structure damage vs. 3 sec actual terrain wind speed.

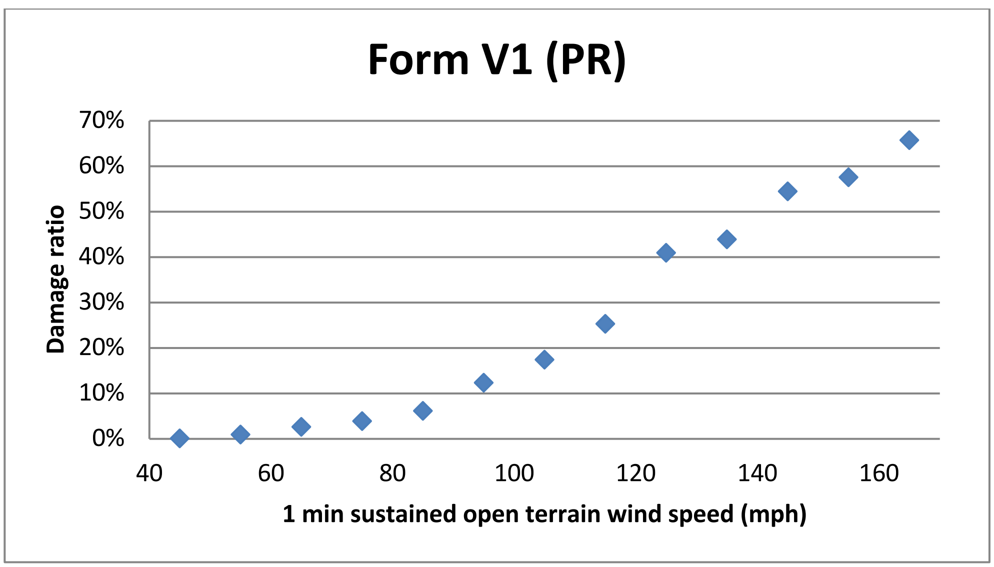


Figure 116. Structure damage vs. 1 minute sustained wind speed.

Only commercial residential reference structures (Concrete).

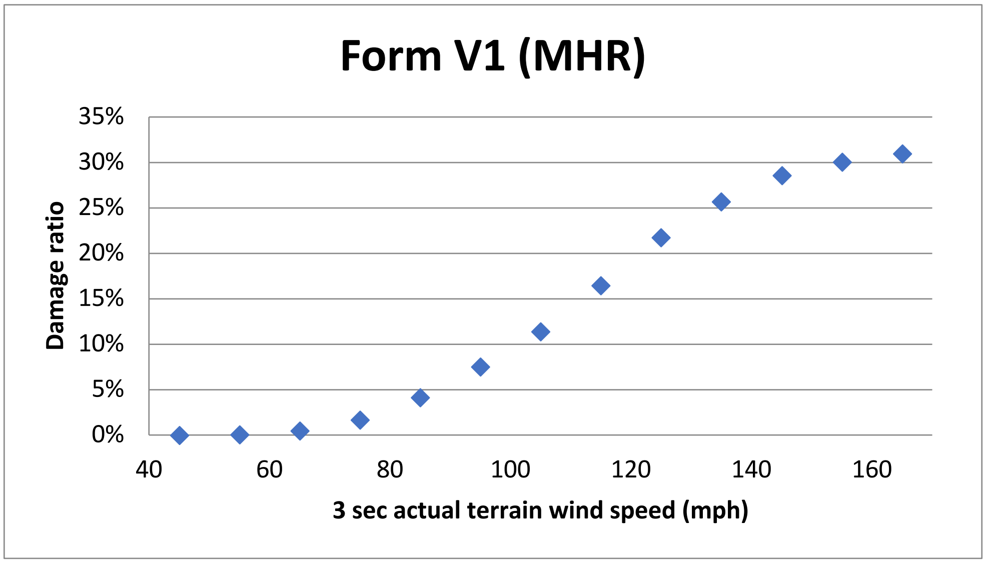


Figure 117. Structure damage vs. 3 sec actual terrain wind speed.

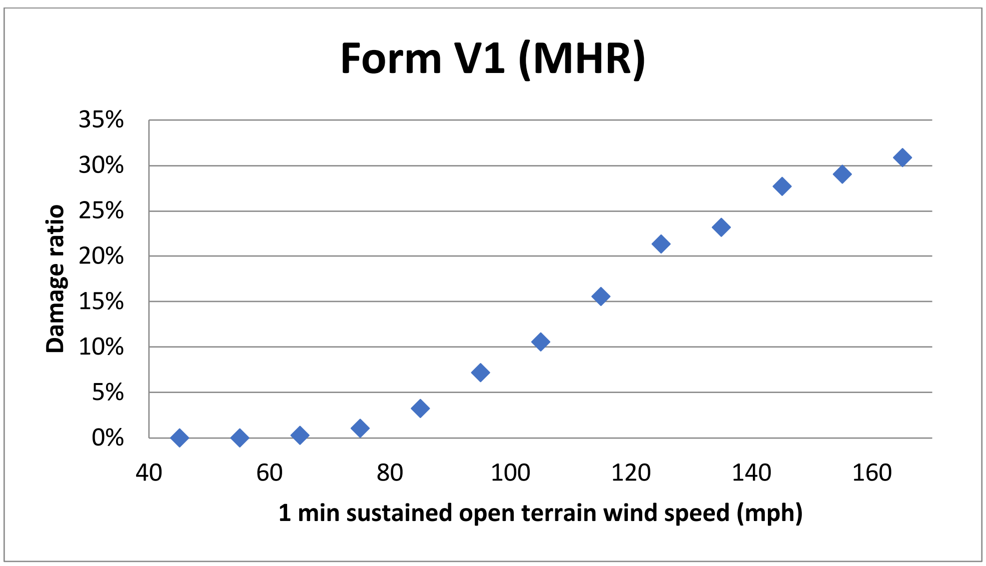


Figure 118. Structure damage vs. 1 minute sustained wind speed.

Appendix Y – Form V-2: Hurricane Mitigation Measures and Secondary Characteristics, Range of Changes in Damage

Florida International University
Florida Public Hurricane Loss Model 7.0
November 5, 2018

Form V-2: Mitigation Measures – Range of Changes in Damage (1 min)

INDIVIDUAL HURRICANE MITIGATION MEASURES AND SECONDARY CHARACTERISTICS			PERCENTAGE CHANGES IN DAMAGE (REFERENCE DAMAGE RATIO - MITIGATED DAMAGE RATE)/(REFERENCE DAMAGE RATIO)*100									
			FRAME BUILDING					MASONRY BUILDING				
			WIND SPEED (MPH)*					WIND SPEED (MPH)*				
			60	85	110	135	160	60	85	110	135	160
	REFERENCE BUILDING		-	-	-	-	-	-	-	-	-	-
ROOF STRENGTH	BRACED GABLE ENDS		0%	0%	0%	0%	1%	0%	0%	0%	0%	1%
ROOF STRENGTH	HIP ROOF		1%	7%	5%	11%	4%	1%	6%	1%	7%	5%
ROOF COVERING	METAL		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROOF COVERING	ASTM D7158 CLASS H SHINGLES		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROOF COVERING	MEMBRANE		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROOF COVERING	NAILING OF DECK 8d		2%	38%	2%	-7%	-1%	2%	39%	15%	-4%	-1%
ROOF-WALL STRENGTH	CLIPS		0%	0%	4%	14%	11%	0%	-1%	0%	7%	12%
ROOF-WALL STRENGTH	STRAPS		0%	0%	5%	19%	23%	0%	-1%	0%	8%	15%
WALL-FLOOR STRENGTH	TIES OR CLIPS		0%	0%	3%	3%	2%	-	-	-	-	-
WALL-FLOOR STRENGTH	STRAPS		0%	0%	4%	6%	4%	-	-	-	-	-
WALL FOUNDATION STRENGTH	LARGER ANCHORS OR CLOSER SPACING		-	-	-	-	-	-	-	-	-	-
WALL FOUNDATION STRENGTH	STRAPS		-	-	-	-	-	-	-	-	-	-
WALL FOUNDATION STRENGTH	VERTICAL REINFORCING		-	-	-	-	-	0%	-1%	0%	10%	22%
OPENING PROTECTION	WINDOW SHUTTERS	STRUCT WOOD	0%	3%	6%	2%	0%	0%	2%	7%	3%	0%
OPENING PROTECTION	WINDOW SHUTTERS	METAL	0%	4%	10%	4%	1%	0%	4%	12%	5%	1%
OPENING PROTECTION	DOOR AND SKYLIGHT COVERS		0%	0%	1%	1%	0%	0%	0%	1%	1%	1%
OPENING PROTECTION	WINDOWS	IMPACT RATED	0%	4%	13%	10%	5%	0%	4%	14%	12%	6%
OPENING PROTECTION	ENTRY DOORS	MEETS WINDBORNE DEBRIS REQUIREMENTS	0%	0%	0%	1%	1%	0%	0%	0%	1%	1%
OPENING PROTECTION	GARAGE DOORS	MEETS WINDBORNE DEBRIS REQUIREMENTS	0%	17%	4%	1%	0%	0%	17%	5%	1%	0%
OPENING PROTECTION	SLIDING GLASS DOORS	MEETS WINDBORNE DEBRIS REQUIREMENTS	0%	0%	1%	1%	1%	0%	0%	1%	1%	1%

HURRICANE MITIGATION MEASURES AND SECONDARY CHARACTERISTICS IN COMBINATION	PERCENTAGE CHANGES IN DAMAGE (REFERENCE DAMAGE RATIO - MITIGATED DAMAGE RATIO)/(REFERENCE DAMAGE RATIO)*100									
	FRAME BUILDING					MASONRY BUILDING				
	WIND SPEED (MPH)					WIND SPEED (MPH)				
	60	85	110	135	160	60	85	110	135	160
MITIGATED BUILDING	2%	41%	28%	26%	25%	2%	40%	25%	16%	16%

*Windspeeds are one-minute sustained 10-meter

Appendix Z – Form V-4: Differences in Hurricane Mitigation Measures and Secondary Characteristics

Florida International University
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Form V-4: Differences in Hurricane Mitigation Measures and Secondary Characteristics

INDIVIDUAL HURRICANE MITIGATION MEASURES AND SECONDARY CHARACTERISTICS			PERCENTAGE CHANGE FROM FORM V-2 RELATIVE TO PREVIOUSLY-ACCEPTED HURRICANE MODEL									
			FRAME BUILDING					MASONRY BUILDING				
			WINDSPEED (MPH)*					WINDSPEED (MPH)*				
			60	85	110	135	160	60	85	110	135	160
	REFERENCE BUILDING		—	—	—	—	—	—	—	—	—	—
ROOF CONFIGUR-ATION	BRACED GABLE ENDS		0	0	0	0	0	0	0	0	0	0
	HIP ROOF		0	0	0	0	0	0	0	0	0	0
ROOF COVERING	METAL		0	0	0	0	0	0	0	0	0	0
	ASTM D7158 CLASS H SHINGLES		0	0	0	0	0	0	0	0	0	0
	MEMBRANE		0	0	0	0	0	0	0	0	0	0
	NAILING OF DECK	8d	0	0	0	0	0	0	0	0	0	0
ROOF-WALL STRENGTH	CLIPS		0	0	0	0	0	0	0		0	0
	STRAPS		0	0	0	0	0	0	0	0	0	0
WALL-FLOOR STRENGTH	TIES OR CLIPS		0	0	0	0	0	0	0	0	0	0
	STRAPS		0	0	0	0	0	0	0	0	0	0
WALL-FOUNDATION STRENGTH	LARGER ANCHORS OR CLOSER SPACING							—	—	—	—	—
	STRAPS							—	—	—	—	—
	VERTICAL REINFORCING		—	—	—	—	—	0	0	0	0	0
OPENING PROTECTION	WINDOW SHUTTERS	STRUCTURAL WOOD PANEL	0	0	0	0	0	0	0	0	0	0
		METAL	0	0	0	0	0	0	0	0	0	0
	DOOR AND SKYLIGHT COVERS		0	0	0	0	0	0	0	0	0	0
WINDOW, DOOR, SKYLIGHT STRENGTH	WINDOWS	IMPACT RATED	0	0	0	0	0	0	0	0	0	0
	ENTRY DOORS	MEETS WIND-BORNE DEBRIS REQUIREMENTS	0	0	0	0	0	0	0	0	0	0
	GARAGE DOORS	MEETS WIND-BORNE DEBRIS REQUIREMENTS	0	0	0	0	0	0	0	0	0	0
	SLIDING GLASS DOORS	MEETS WIND-BORNE DEBRIS REQUIREMENTS	0	0	0	0	0	0	0	0	0	0

HURRICANE MITIGATION MEASURES AND SECONDARY CHARACTERISTICS IN COMBINATION	PERCENTAGE CHANGE FROM FORM V-2 RELATIVE TO PREVIOUSLY-ACCEPTED HURRICANE MODEL									
	FRAME BUILDING					MASONRY BUILDING				
	WINDSPEED (MPH)*					WINDSPEED (MPH)*				
	60	85	110	135	160	60	85	110	135	160
MITIGATED BUILDING	0	0	0	0	0	0	0	0	0	0

*Windspeeds are one-minute sustained 10-meter.

Appendix AA – List of Acronyms

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Acronym	Full Name
ACV	Actual Cash Value
ACV S/ACV C	Structure Actual-Cash-Value, Contents Actual-Cash-Value
ACV S/RC C	Structure Actual-Cash-Value, Contents Replacement-Cost
AFRES	Air Force Reserves
ALE	Additional Living expenses
AOML	Atlantic Oceanographic and Meteorological Laboratory
AP	Appurtenant
APA	American Psychological Association
ASCE	American Society of Civil Engineers
ASHARE	American Society of Heating, Refrigeration and Air Conditioning
CDFs	Cumulative Distribution Functions
CDO	Cost of Damage to Openings
CLR	Commercial Low-rise Model
CNL	C Numerical Library
COV	Coefficient of Variation
CP	Central Pressure
CPTA	County Property Tax Appraiser
CR	Commercial Residential
CVS	Concurrent Versions System
DA	Damage Array
DR	Damage Ratio
EDR	Expected Damage Ratio
EDV	Expected Damage Value
EIDR	Expected Interior Damage Ratio
EL	Equilibrium Layer
EPR	Expected Percentage Reduction
ERS	European Remote Sensing
ESDU	Engineering Sciences Data Unit
FBC	Florida Building Commission
FDFS	Florida Department of Financial Services
FEMA	Federal Emergency Management Agency
FFP	Far Field Pressure
FHCF	Florida Hurricane Catastrophe Fund
FPHLM	Florida Public Hurricane Loss Model
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System
HRA	High Risk Accounts
HRD	Hurricane Research Division
HUD	Housing and Urban Development
HURDAT	Hurricane Database
HVHZ	High Velocity Hurricane Zone
IBHS	Insurance Institute for Business and Home Safety
IBL	Internal Boundary Layer
ID	Interior Damage Ratio
IMSL	International Mathematical and Statistical Library
ISO	Insurance Services Office
JDBC	Java Database Connectivity
JNI	Java Native Interface
JSP	Java Server Pages
LB	Low-rise Commercial Residential Building

Acronym	Full Name
M00	Base Medium Model
M01	Retrofitted Medium Model (Re-roof and Re-nailed decking)
M10	Modified Medium Model. Weaker Decking Connection
MBL	Mean Boundary Layer
MFR	Multi-Family Residential Building
MH	Manufactured Home
MHB	Mid and High-rise Building
MPH	Miles Per Hour
MRLC	Multi-resolution Land Characteristics Consortium
NAHB	National Association of Home Builders
NCEP	National Centers for Environmental Prediction
NHC	National Hurricane Center
NLCD	National Land Classification Database
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OIR	Florida Office of Insurance Regulation
OSB	Oriented Strand Board
PBL	Planetary Boundary Layer
PDF	Probability Density Function
Pmin	Minimum Central Pressure
PML	Probable Maximum Loss
PR	Personal Residential
PRB	Personal Residential Single-Family Home Buildings
R2W	Roof to Wall Connections
R-CLIPER	Tropical Cyclone Rainfall Climatology and Persistence Model
RC S/ACV C	Structure Replacement-Cost, Contents Actual-Cash-Value
RC S/RC C	Structure Replacement-Cost, Contents Replacement-Cost
RES	Residential Building Model
Rmax	Radius to Maximum Winds
S00	Base Strong Model Inland
S00-OP	Base Strong Model with Metal Shutters
S02	Strong Inland Model with Metal Roof
S02-OP	Strong Inland Model with Metal Roof and Metal Shutters
S01	Modified Strong Model for HVHZ
SBC	Standard Building Code
SFBC	South Florida Building Code
SFMR	Stepped Frequency Microwave Radiometer
SQL	Structured Query Language
SSM/I	Special Sensor Microwave Imager
SV S/RC C	Structure Stated-Value, Contents Replacement-Cost
SV S/SV C	Structure Stated-Value, Contents Stated-Value
TE	Time Element
TECDO	Total Expected Cost of Damage to Openings
TRMM	Tropical Rainfall Measuring Mission
UML	Unified Modeling Language
USGC	United States Geological Survey
USPS	United States Postal Service
VT	Translational Velocity
W00	Base Weak Model
W01	Retrofitted Weak Model (Re-roof and Re-nailed Decking)
W10	Modified Weak Model. Stronger Decking Connection
WBDR	Wind-borne Debris Region

Acronym	Full Name
WDR	Wind Driven Rain
WDR1	Wind Driven Rain variable #1
WDR2	Wind Driven Rain variable #2
WSC	Wind Speed Correction
WMD	Water Management District