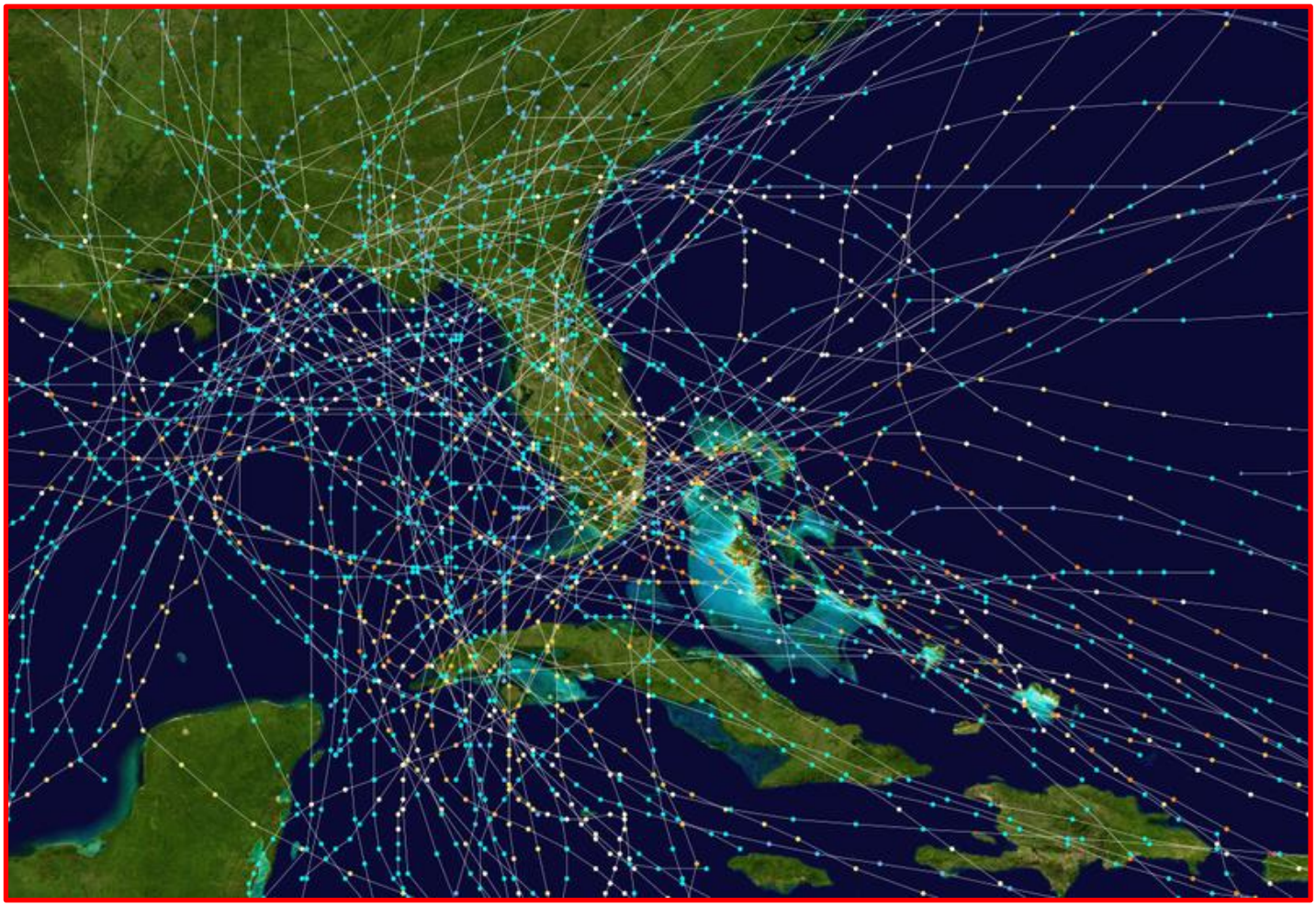
Florida Commission on Hurricane Loss Projection Methodology

Professional Team Report
2013 Standards



EQECAT, Inc.

On-Site Review
March 9-11, 2015

On March 9-11, 2015, the Professional Team visited on-site at EQECAT, Inc. in Oakland, California. The following individuals participated in the review:

EQECAT
Branimir Betov, M.S., Director
Justin M. Brolley, Ph.D., Senior Research Scientist
Omar Khemici, Ph.D., P.E., Vice President, Model Development
John Mangano, Senior Atmospheric Scientist
Laura Maxwell, FCAS, MAAA, Consulting Actuary
Kamban Parasuraman, Ph.D., Principal Research Scientist
Sergey Pasternak, Distinguished Software Architect
David F. Smith, Senior Vice President, Technology Development and Consulting
Amanuel S. Tecle, Ph.D., Research Scientist

Professional Team
Jenni Evans, Ph.D., Meteorologist
Paul Fishwick, Ph.D., Computer Scientist
Mark Johnson, Ph.D., Statistician, Team Leader
Marty Simons, ACAS, Actuary
Masoud Zadeh, Ph.D., P.E., Structural Engineer
Donna Sirmons, Staff

The review began with introductions and an overview of the audit process. EQECAT provided an explanation for the two errors discovered since the November 2014 submission as reported to the Commission on February 20, 2015:

1) A processing error in the stochastic events scripts where 15 stochastic events were incorrectly counted twice, and
2) A separate processing error where one of the files used in the demand surge calculations for stochastic events was incorrectly populated.

Error 1) was caused by an incorrect implementation of a parallel computing calculation while error 2) occurred due to a user interface anomaly. EQECAT discussed how the errors were discovered, why the errors occurred, and the procedures implemented to prevent the errors from reoccurring. Color-coded maps by county comparing the percentage changes in zero deductible loss costs after corrections individually and in combination were reviewed. Revised Forms M-2, S-2A, S-2B, S-5, A-1, A-4A, A-4B, A-5, A-7, and A-8 were received on February 27, 2015.

The audit then followed with a discussion of the following significant model changes:

- Probabilistic hurricane database regenerated to be consistent with HURDAT2 as of August 15, 2013
- Land use land cover database updated to most recent 2011 National Land Cover Database
- Storm parameters Rmax, Forward Speed, and Profile Factor updated to include all storms through 2012
- ZIP Code database updated to May 2014
- Structural mapping updated to treat all masonry structures built after 1995 as reinforced masonry structures, the height of building, and the ISO structural mapping.
- Vulnerability model updated to differentiate 1-story, 2-story, and 3-story buildings
- Updated secondary structural modifiers (SSM) quality factor for higher accuracy

- Added zone for the year band 1996-2002 for Miami-Dade and Broward Counties, modified a few default SSM for year bands 1996-2002 and Post-2002, and added a new year band 2013-present for all of Florida
- Added new options for roof sheathing and design code
- Added a new feature for sliding glass door
- Mitigation measures added to address new mitigation measures in Forms V-2 and V-3.

The Professional Team recommends EQECAT present the following information to the Commission during the Trade Secret session of the meeting to review the model for acceptability:

1. Method for completion of Form A-6
2. Method for completion of Form V-3
3. Method for excluding storm surge losses from the modeled losses
4. Radial profile fits for Hurricane Andrew (1992) and Hurricane Dennis (2005)
5. Updates to land use/land cover illustrated with Baker County
6. Resolution of potential anomalies in Form A-1 for frame owners versus mobile homes.

The Professional Team reviewed the following corrections to be included in the revised submission which is to be provided to the Commission no later than 10 days prior to the meetings for reviewing models for acceptability. Page numbers correspond to the February 25, 2015 revised submission.

- Page 7 – revised to remove "All trade secret items identified will be documented in the Professional Team report to the Commission."
- Page 14, G-1.A – revised to include probable maximum losses
- Page 22, G-1 Disclosure 3 – revised flowchart to remove USWIND
- Page 28, G-1 Disclosure 4 – additional references added
- Page 29, G-1 Disclosure 5 – revised to include all vulnerability model updates
- Page 30, G-1 Disclosure 5 – removed statement "options were included following the recommendation of the Professional Team during the last visit"
- Page 31, G-1 Disclosure 5 – revised to include landfall track direction and additional vulnerability model changes
- Page 45, G-2 Disclosure 2 – revised to reflect Laura Maxwell as consultant in Table 7
- Page 55, G-3 Disclosures 4 & 5 – expanded to reflect actual databases involving ZIP Codes
- Page 72, M-4 Disclosure 11 – revised to clarify Rmax treatment in historical and stochastic events
- Page 78, S-1 Disclosure 2 – revised to correct Table number in text
- Page 97, V-1 Disclosure 5 – revised to remove ABS Consulting
- Page 100, V-1 Disclosure 12 – revised to address year of construction unknown
- Page 105, V-2 Disclosure 1 – revised for new content damage functions
- Page 115, V-3 Disclosure 1 – removed statement "options were included following the recommendation of the Professional Team during the last visit"
- Page 131, A-1 Disclosure 5 – revised to add the Site Facultative (SF) group and to clarify Table 16 title
- Page 144, A-5 – revised to correct title of standard
- Page 147, A-5 Disclosure 2 – revised to correct Table number in text
- Page 176, Form M-1.D – revised to reflect modification of by-passing hurricanes
- Page 176, Form M-1.E – revised to correct storms removed or modified
- Page 188, Form M-3.B – revised to clarify statistically dependent on landfall location
- Page 213, Form V-2 – revised to correct garage door and sliding glass door percentages
- Pages 330-331, Form A-5 – revised to correct model release date

- Pages 350-364, Form A-7 – revised to correct model release date

Report on Deficiencies

The Professional Team reviewed the following deficiencies cited by the Commission at the December 16, 2014 meeting. The deficiencies were eliminated by the established time frame, and the modifications have been verified.

1. Several Tables throughout the submission do not include table numbers; non-responsive to Acceptability Process II.A.5.c requirement (page 47) in the *Report of Activities.*

2. A general description of any trade secret information that will be presented to the Professional Team is not included; non-responsive to Acceptability Process II.A.3 requirement (page 46) in the *Report of Activities*.

3. Standard G-1, Disclosure 5.A.1 (pages 27-28)
   Response is incomplete as all mitigation measures that have been modified as given in V-3, Disclosure 1 (pages 102-103) are not included.

4. Standard G-1, Disclosure 5.A.2 (page 28)
   Response is non-responsive as a list of all other changes is not included.

5. Standard G-1, Disclosure 5.C (pages 30-33)
   Maps in Figures 4-9 are non-responsive to the Acceptability Process II.A.5.e.2 requirements (page 47) in the *Report of Activities*.

6. Standard G-2, Disclosure 3.B (page 42)
   Response is incomplete as the independent reviews are not included in the Appendix.

7. Standard M-2, Disclosure 1 (page 51)
   Response is unclear as the description provided for the functional dependence of Rmax on other variables is inconsistent with the response given on Form M-3.B (page 171).

8. Form M-1 (page 164)
   Response is non-responsive as the Florida By-Passing historical number and rate have changed but no explanation is given.

9. Form M-2 (page 168)
   Response is incomplete as the legend for Figure 29.b is missing.

10. Standard V-1.D (page 83)
    Standard and response are incomplete as they were not updated from the 2011 *Report of Activities* or submission.

11. Standard V-1, Disclosure 1 (page 84)
    Response is unclear as the statement is inconsistent with the response given to Standard G-1, Disclosure 5.A, items 5-7 (page 27).

12. Standard V-1, Disclosures 9 & 10 (page 89)
    Responses are unclear as the statements are inconsistent with the response given on Standard V-1.E (page 83).

13. Standard V-1, Disclosure 13 (page 89)
    Response is non-responsive as it does not address construction types for renters and condo-unit owners.

14. Standard V-2, Disclosure 5 (page 97)
    Response is incomplete as a flowchart is not included.

15. Standard C-5, Disclosure 3 (page 149)
    Response is unclear as the first sentence of the disclosure is unintelligible.

16. Form A-3A (pages 218 & 221)
    Maps in Figures 44 and 47 are non-responsive to the instructions provided for the form.

17. Form A-3B (pages 235 & 238)
    Maps in Figures 49 and 52 are non-responsive to the instructions provided for the form.

Report on Issues

The Professional Team discussed the following issues identified by the Commission at the December 16, 2014 meeting. The modeler is to address these issues with the Commission during the meeting to review the model for acceptability.

1. How Florida Building Code enforcement of reinforced and unreinforced masonry is handled in the model. What is the default condition in the model post 2002? If the data is available, does the model take this into account, and if so, how?

2. How screen enclosures for both attached and unattached are handled in the model.

Professional Team Pre-Visit Letter

The Professional Team's pre-visit letter questions are provided in the report under the corresponding standards.

Pre-Visit Letter

The purpose of the pre-visit letter is to outline specific issues unique to the modeler's submission, and to identify lines of inquiry to be followed during the on-site review to allow adequate preparation by the modeler. Aside from due diligence with respect to the full submission, various questions that the Professional Team is certain to ask the modeler during the on-site review are provided in this letter. This letter does not preclude the Professional Team from asking for additional information during the on-site review that is not given below or discussed during an upcoming conference call that will be held if requested by the modeler. One goal of the potential conference call is to address

modeler questions related to this letter or other matters pertaining to the on-site review. The overall intent is to expedite the on-site review and to avoid last minute preparations that could just as easily have been handled earlier.

Some of this material may have been shown or may have been available on a previous visit by the Professional Team. The Professional Team will also be considering material in response to deficiencies and issues designated by the Florida Commission on Hurricane Loss Projection Methodology (Commission).

The goal of the Professional Team on-site review is to provide the Commission with a clear and thorough report of the model, subject to non-disclosure restrictions on proprietary information. All modifications, adjustments, assumptions, or other criteria that were included in producing the information requested by the Commission in the submission should be disclosed and will be reviewed.

It is important that all material prepared for presentation during the on-site review be presented using a medium that is readable by all members of the Professional Team simultaneously. The Professional Team will review selected computer code in conjunction with the reviews performed for each section. Computer code should be readily available in a format that will allow simultaneous visualization by the entire Professional Team. Access to critical articles or materials referenced in the submission or during the on-site review should be available on-site for the Professional Team. The Professional Team should be provided access to internet connections through the Professional Team members' laptops for reference work that may be required while on-site.

The on-site schedule is tentatively planned to proceed in the following sequence: (1) presentation by the modeler of new or extensively updated material related to the model; (2) section by section review commencing within each section with pre-visit letter responses; (3) responses to new or significantly changed standards in the 2013 Report of Activities, and (4) responses to the audit items for each standard in the Report of Activities.

We note that the submission document does not include a date and time in the footnote which could be construed as non-responsive to the requirements in the Acceptability Process (II.A.5.b, page 47). In lieu of reprinting the entire document to abide by this requirement, we will accept page changes that do abide by the requirement during the on-site review.

Be prepared to have available for the Professional Team's consideration, all insurance company claims data received or newly processed since the previous submission. Be prepared to describe any processes used to amend or validate the model that incorporates this data.

Provide an explanation for each loss cost change of more than 5% from the loss costs produced in the previous submission using the 2007 Florida Hurricane Catastrophe Fund (FHCF) exposure data to the corresponding loss costs produced in the current submission using the 2007 FHCF exposure data.

When the Professional Team arrives on-site, provide five (5) printed copies of all figures with scales for the X and Y axes labeled that are not so labeled in the submission. Label the figures with the same figure number as given in the submission. Also, provide five (5) printed copies of Form V-3 and the electronic file used to complete Form V-3 on a removable drive medium. This material will be used during the on-site review and will be returned when the on-site review is complete. Additionally, provide five (5) printed copies of Form A-6 (all 8 worksheets) and the electronic file(s) used to complete Form A-6 and Form A-7. The electronic files will be examined only on-site and will be deleted from the Professional Team member's laptop at the conclusion of the review.

Be prepared to provide for the Professional Team's review all engineering data (post event surveys, tests, etc.) received since the previous review by the Professional Team. Be prepared to describe any processes used to amend or validate the model that incorporates this data.

If any changes have been made in any part of the model or the modeling process from the descriptions provided in the original 2013 submission, provide the Professional Team with a complete and detailed description of those changes, the reasons for the changes (e.g., an error was discovered), and all revised Forms where any output of the form changed.

For your information, the Professional Team will arrive in business casual attire.

The pre-visit comments are grouped by standards sections.

GENERAL STANDARDS – Mark Johnson, Leader

G-1 Scope of the Computer Model and Its Implementation*

*(*Significant Revision)*

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

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.

Audit

1. The main intent of the audit is to determine the capabilities of the model and to assess its implementation for purposes of Florida projected insured loss costs and probable maximum loss levels. Copies of all representative or primary technical papers that describe the underlying model theory shall be made available.

2. The process defined in Standard G-1.B will be: (1) reviewed for its inclusion of all stages of the modeling process, and (2) traced using the Computer Standards for one or more items listed in the response to Disclosure 5.

3. All software and data (1) located within the model, (2) used to validate the model, (3) used to project model loss costs and probable maximum loss levels, and (4) used to create forms required by the *Report of Activities*:
    a. Shall fall within the scope of the Computer Standards,
    b. Shall be located in centralized, model-level file areas, and
    c. Shall be reviewable interactively (viewed simultaneously by all Professional Team members in conjunction with the review of each standard).

4. Modeling organization specific publications cited must be available in hard or soft copy or via a web link.

5. Maps, databases, or data files relevant to the modeling organization's submission will be reviewed.

6. Provide the following information related to changes in the model from the initial submission this year to each subsequent revision.

    A. Model changes:
        1. A summary description of changes that affect, or believe to affect, the personal or commercial residential loss costs or probable maximum loss levels,
        2. A list of all other changes, and
        3. The rationale for each change.

B. Percentage difference in average annual zero deductible statewide loss costs based on the 2007 Florida Hurricane Catastrophe Fund's aggregate personal and commercial residential exposure data found in the file named *"hlpm2007c.exe"* for:
   1. All changes combined, and
   2. Each individual model component and subcomponent change.

C. For any modifications to Form A-4A (Output Ranges, 2007 FHCF Exposure Data) since the initial submission, additional versions of Form A-5 (Percentage Change in Output Ranges, 2007 FHCF Exposure Data):
   1. With the initial submission as the baseline for computing the percentage changes, and
   2. With any intermediate revisions as the baseline for computing the percentage changes.

D. Color-coded maps by county reflecting the percentage difference in average annual zero deductible statewide loss costs based on the 2007 Florida Hurricane Catastrophe Fund's aggregate personal and commercial residential exposure data found in the file named *"hlpm2007c.exe"* for each model component change:
   1. Between the previously accepted submission and the revised submission,
   2. Between the initial submission and the revised submission, and
   3. Between any intermediate revisions and the revised submission.

Pre-Visit Letter

1. G-1, Disclosure 5.B.2, page 29: Explain how the updates to the storm parameters have such a large effect (decrease 11.4%).

2. G-1, Disclosure 5.C, page 30: Explain the situation with Liberty and Lafayette Counties in Figure 5.

3. G-1, Disclosure 5.C, page 31: Explain the situation with Brevard County in Figure 7.

Verified: YES

Professional Team Comments:

Reviewed color-coded maps by county comparing the changes in zero deductible loss cost due to the profile factor, Rmax, and forward speed storm parameter updates, individually and in combination. Discussed the majority of the decrease in loss cost is due to the profile factor updates of historical events.

Discussed the loss cost changes in Liberty and Lafayette Counties is due to the LULC update. Reviewed graphical comparisons of the LULC changes and the ZIP Code centroid changes for both counties.

Discussed the loss cost changes in Brevard County due to the ZIP Code centroid changes. Reviewed graphical comparison of the movement in ZIP Code centroids.

Reviewed graphical comparison of LULC changes and ZIP Code centroids for Baker County.

G-2 Qualifications of Modeling Organization Personnel and Consultants

A. 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.

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

Audit

1. The professional vitae of modeling organization personnel and consultants responsible for the current model and information on their predecessors if different than current personnel will be reviewed. Background information on individuals providing testimonial letters in the submission shall be provided.

2. Forms G-1 (General Standards Expert Certification), G-2 (Meteorological Standards Expert Certification), G-3 (Statistical Standards Expert Certification), G-4 (Vulnerability Standards Expert Certification), G-5 (Actuarial Standards Expert Certification), G-6 (Computer Standards Expert Certification), and all independent peer reviews of the model under consideration will be reviewed. Signatories on the individual forms will be required to provide a description of their review process.

3. Discuss any incidents where modeling organization personnel or consultants have been found to have failed to abide by the standards of professional conduct adopted by their profession.

Verified: YES

Professional Team Comments:

Discussed that there were no departures of personnel attributable to violations of professional standards.

G-3 Risk Location*

*(*Significant Revision)*

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

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

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

D. If any hazard or any 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.

E. Geocoding methodology shall be consistent and justifiable.

Audit

1. Provide geographic displays for all ZIP Codes.
2. Provide geographic comparisons of previous to current locations of ZIP Code centroids.
3. Provide the third party vendor, if applicable, and a complete description of the process used to validate ZIP Code information.
4. The treatment of ZIP Code centroids over water or other uninhabitable terrain will be reviewed.
5. Examples of geocoding for complete and incomplete street addresses will be reviewed.
6. Examples of latitude-longitude to ZIP Code conversions will be reviewed.
7. Model ZIP Code-based databases will be reviewed.

Pre-Visit Letter

4. G-3.C, page 43: Provide maps of previous and current ZIP Code centroid locations (as has been done in previous reviews).
5. G-3, Disclosure 3, page 45: Explain the methodology and process for conversion from latitude and longitude to street address or ZIP Code.

Verified: YES

Professional Team Comments:

Reviewed geographic displays of ZIP Codes and comparisons of new centroid locations to previous locations for the entire state.

Reviewed the methodology and process ensuring consistency between street address, latitude and longitude, and ZIP Codes. Discussed the process when ZIP Code data is provided in a portfolio and when latitude and longitude data is provided in the portfolio.

Reviewed ZIP Code dependent databases and methodology to update them.

Reviewed exhibits documenting locations of a set of ZIP Codes compared to changes in land use land cover.

G-4 Independence of Model Components

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

Audit

1. Demonstrate that the model components adequately portray hurricane phenomena and effects (damage, loss costs, and probable maximum loss levels). Attention will be paid to an assessment of (1) the theoretical soundness of each component and (2) the basis of their integration. For example, a model would not meet this standard if an artificial calibration adjustment had been made to improve the match of historical and model results for a specific hurricane.

2. Describe all changes in the model since the previous submission that might impact the independence of the model components.

Verified: YES

Professional Team Comments:

There was no evidence to suggest that one component of the model was artificially adjusted to compensate for another component.

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 Certification that the submission has been personally reviewed and is editorially correct.

Audit

1. Demonstrate that the person or persons who have reviewed the submission has had experience in reviewing technical documentation and such person or persons is familiar with the submission requirements as set forth in the Commission's *Report of Activities as of November 1, 2013*.

2. Describe all changes to the submission document since the previously accepted submission that might impact the final document submission.

3. Demonstrate that the submission has been reviewed for grammatical correctness, typographical accuracy, completeness, and inclusion of extraneous data or materials.

4. Demonstrate that the submission has been reviewed by the signatories on Forms G-1 through G-6 (Standards Expert Certification forms) for accuracy and completeness.

5. The modification history for submission documentation will be reviewed.

6. A flowchart defining the process for form creation will be reviewed.

7. Form G-7 (Editorial Certification) will be reviewed.

Verified: YES

Professional Team Comments:

Editorial items noted by the Professional Team were satisfactorily addressed during the audit. The Professional Team has reviewed the submission per Audit item 3, but cannot guarantee that all editorial difficulties have been identified. The modeler is responsible for eliminating such errors.

Reviewed the submission document modification history since the initial November 2014 submission. Discussed the underlying reasons for each revised submission.

Reviewed the flowchart defining the process for completing the submission forms.

Meteorological Standards – Jenni Evans, Leader

M-1 Base Hurricane Storm Set*

*(*Significant Revision)*

A. Annual frequencies used in both model calibration and model validation shall be based upon the National Hurricane Center HURDAT2 starting at 1900 as of August 15, 2013 (or later). Complete additional season increments based on updates to HURDAT2 approved by the Tropical Prediction Center/National Hurricane Center are acceptable modifications to these storm sets. Peer reviewed atmospheric science literature can be used to justify modifications to the Base Hurricane Storm Set.

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

Audit

1. The modeling organization's Base Hurricane Storm Set will be reviewed.

2. Provide a flowchart illustrating how changes in the HURDAT2 database are used in the calculation of landfall distribution.

3. Changes to the modeling organization Base Hurricane Storm Set from the previously accepted submission will be reviewed. Any modification by the modeling organization to the information contained in HURDAT2 will be reviewed.

4. Reasoning and justification underlying any short-term and long-term variations in annual hurricane frequencies incorporated in the model will be reviewed.

5. Modeled probabilities will be compared with observed hurricane frequency using methods documented in currently accepted scientific literature. The goodness-of-fit of modeled to historical statewide and regional hurricane frequencies as provided in Form M-1 (Annual Occurrence Rates) will be reviewed.

6. Form M-1 (Annual Occurrence Rates) will be reviewed for consistency with Form S-1 (Probability and Frequency of Florida Landfalling Hurricanes per Year).

7. Comparisons of modeled probabilities and characteristics from the complete historical record will be reviewed. Modeled probabilities from any subset, trend, or fitted function will be reviewed, compared, and justified against the complete historical record. In the case of partitioning, modeled probabilities from the partition and its complement will be reviewed and compared with the complete historical record.

Pre-Visit Letter

6. Form M-1, pages 163-166: Provide rationale for changes in the frequencies of historical by-passing hurricanes.

7. Form M-1.E, page 163: The complete list of storms varying from the previous submission will be reviewed.

8. Form M-1.E, page 163: Describe how changes in HURDAT2 due to the reanalyses and additions of new hurricane seasons are incorporated into the Base Hurricane Storm Set. Individual cases may be reviewed.

Verified: YES

Professional Team Comments:

Reviewed the updates to the base storm set reflecting the HURDAT2 reanalysis on the 1936-1953 hurricanes and the storms updated due to the inclusion of landfall location intensities in the August 2013 HURDAT2 release. Discussed the list of storms added, subtracted, and modified.

Reviewed comparisons of storm track and intensity changes at landfall made to the historical storm set.

Reviewed color-coded map by county of zero deductible loss cost comparisons due to the base storm set frequency updates.

Reviewed the historical storms database comparing the old and new values for intensity, Rmax, forward speed, and profile factor.

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 currently accepted scientific literature.

Audit

1. All hurricane parameters used in the model will be reviewed.

2. Prepare graphical depictions of hurricane parameters as used in the model. Describe and justify:
   a. The data set basis for the fitted distributions,
   b. The modeled dependencies among correlated parameters in the windfield component and how they are represented,
   c. The asymmetric nature of hurricanes,
   d. The fitting methods used and any smoothing techniques employed.

3. The treatment of the inherent uncertainty in the conversion factor used to convert the modeled vortex winds to surface winds will be reviewed and compared with currently accepted scientific literature. Treatment of conversion factor uncertainty at a fixed time and location within the windfield for a given hurricane intensity will be reviewed.

4. Scientific literature cited in Standard G-1 (Scope of the Computer Model and Its Implementation) may be reviewed to determine applicability.

5. All external data sources that affect model generated windfields will be identified and their appropriateness will be reviewed.

6. Describe and justify the value(s) of the far-field pressure used in the model.

Pre-Visit Letter

9. M-2, page 50: Explain how EQECAT analyses differ from the published literature.

10. M-2, Disclosure 1, item 3, pages 50-51: Provide definition for “storm strength” and how it differs from “storm intensity.”

11. M-2, Disclosure 1, page 51: Provide details on the updates to the storm parameters Rmax, Forward Speed, and Profile Factor.

Verified: YES

Professional Team Comments:

Reviewed the Rmax and forward speed updates to storms in the historical storm set.

Reviewed the methodology for calculating the profile factor.

Reviewed color-coded map by county comparing the changes in zero deductible loss cost due to the profile factor updates.

Reviewed color-coded map by county comparing the changes in zero deductible loss costs due to the Rmax data update.

Reviewed color-coded map by county comparing the changes in zero deductible loss cost due to the forward speed updates.

Reviewed process to adjust stochastic frequency for track direction.

Reviewed contour maps of peak gust windspeeds for Hurricane Andrew (1992), Hurricane Erin (1995), Hurricane Opal (1995), Hurricane Georges (1998), Hurricane Charley (2004), Hurricane Frances (2004), Hurricane Ivan (2004), Hurricane Jeanne (2004), Hurricane Dennis (2005), and Hurricane Wilma (2005).

Reviewed scatter plots comparing historical to modeled windspeeds for Hurricane Andrew (1992), Hurricane Erin (1995), Hurricane Opal (1995), Hurricane Georges (1998), Hurricane Charley (2004), Hurricane Frances (2004), Hurricane Ivan (2004), Hurricane Jeanne (2004), Hurricane Dennis (2005), and Hurricane Wilma (2005).

M-3 Hurricane Probabilities*

*(*Significant Revision)*

A. Modeled probability distributions of hurricane parameters and characteristics shall be 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).

C. 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 Scale.

Saffir-Simpson Hurricane 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

Audit

1. Demonstrate that the quality of fit extends beyond the Florida border by showing results for appropriate coastal segments in Alabama, Georgia, and Mississippi.

2. Describe and support the method of selecting stochastic storm tracks.

3. Describe and support the method of selecting storm track strike intervals. If strike locations are on a discrete set, show the landfall points for major metropolitan areas in Florida.

4. Provide any modeling organization specific research performed to develop the functions used for simulating model variables or to develop databases.

5. Form S-3 (Distributions of Stochastic Hurricane Parameters) will be reviewed for the probability distributions and data sources.

Verified: YES

Professional Team Comments:

Reviewed graphical comparison of historical versus stochastic profile factor changes.

Reviewed plot of the historical and stochastic profile factor cumulative distribution and goodness-of-fit test results.

Reviewed graphical comparison of historical versus stochastic Rmax values.

Reviewed plot of the historical and stochastic Rmax cumulative distribution and goodness-of-fit test results.

Reviewed graphical comparison of historical versus stochastic forward speed changes.

Reviewed plot of the historical and stochastic forward speed cumulative distribution and goodness-of-fit test results.

Reviewed plots of the historical, current stochastic, and previous stochastic track direction cumulative distribution and goodness-of-fit test results.

M-4 Hurricane Windfield Structure*

*(*Significant Revision)*

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

B. The land use and land cover database shall be consistent with National Land Cover Database (NLCD) 2006 or later. Use of alternate data sets shall be justified.

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.

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

Audit

1. Provide any modeling organization-specific research performed to develop the windfield functions used in the model. Identify the databases used.

2. Provide any modeling organization-specific research performed to derive the roughness distributions for Florida and adjacent states.

3. The spatial distribution of surface roughness used in the model will be reviewed.

4. Provide the previous and current hurricane parameters used in calculating the loss costs for the LaborDay03 (1935) and NoName09 (1945) landfalls, and justify the choices used. Provide the resulting spatial distribution of winds. These will be reviewed with Form A-2 (Base Hurricane Storm Set Statewide Losses).

5. For windfields not previously reviewed, provide detailed comparisons of the model windfield with Hurricane Charley (2004), Hurricane Jeanne (2004), and Hurricane Wilma (2005).

6. For windfield and pressure distributions not previously reviewed, present time-based contour animations (capable of being paused) to demonstrate scientifically reasonable windfield characteristics.

7. The effects of vertical variation of winds as used in the model where applicable will be reviewed.

8. Form M-2 (Maps of Maximum Winds) will be reviewed.

Pre-Visit Letter

12. M-4, Disclosure 8, page 61: Demonstrate how the new LULC database has been incorporated into the model. Individual cases may be reviewed.

13. M-4, Disclosure 10, page 62: The method for updating the historical windfield footprints will be examined. Updates to Hurricane NoName09 from 1945 (AL091945) will be compared with the same hurricane as presented in the previous submission.

14. Form M-2, pages 168-170: Discuss the relative variation of the windspeed minima versus maxima between the three temporal sampling periods.

Verified: YES

Professional Team Comments:

Reviewed the model update to the NLCD 2011 LULC data released in 2014. Reviewed in detail geographic comparisons of the NLCD 2011 data changes from the NLCD 2001 data.

Reviewed geographic comparisons of the model friction factor changes resulting from the changes to the LULC data.

Reviewed flowchart for generation of historical windfields.

Reviewed contour maps of windspeed for LaborDay03 (1945), NoName09 (1945), Hurricane Andrew (1992), Hurricane Erin (1995), Hurricane Charley (2004), and Hurricane Dennis (2005) for the previous and current sets of storm parameters.

Reviewed comparisons of historical maximum and minimum windspeeds to the 100-year stochastic maximum and minimum and 250-year stochastic maximum and minimum windspeeds for actual terrain and for open terrain.

Reviewed friction factor in detail for the Keys.

Reviewed in detail the change in friction at Baker County ZIP Codes.

Reviewed plots of the modeled peak gust surface wind profile with observed gusts for Hurricane Andrew (1992) and Hurricane Erin (2005).

The Professional Team recommends that the modeler present their radial profile fits for Hurricane Andrew (1992) and Hurricane Dennis (2005) in the Trade Secret session.

M-5 Landfall and Over-Land Weakening Methodologies*

*(*Significant Revision)*

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

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

Audit

1. Describe the variation in over-land decay rates used in the model.

2. Comparisons of the model's weakening rates to weakening rates for historical Florida hurricanes will be reviewed.

3. The detailed transition of winds from over-water to over-land (i.e., landfall, boundary layer) will be reviewed. The region within 5 miles of the coast will be emphasized. Provide color-coded snapshot maps of roughness length and spatial distribution of over-land and over-water windspeeds for Hurricane Jeanne (2004), Hurricane Dennis (2005), and Hurricane Andrew (1992) at the closest time after landfall.

Pre-Visit Letter

15. M-5, Disclosure 4, page 66: Discuss the variation of Rmax with central pressure after landfall.

Verified: YES

Professional Team Comments:

Reviewed plot of the windspeed adjustment from over-water to over-land by distance from coast.

Reviewed roughness length map by ZIP Code.

Discussed Rmax does not change after landfall for the stochastic storm set.

M-6 Logical Relationships of Hurricane Characteristics

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

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

Audit

1. Form M-3 (Radius of Maximum Winds and Radii of Standard Wind Thresholds) and the modeling organization's sensitivity analyses provide the information used in auditing this standard.

2. Justify the relationship between central pressure and radius of maximum winds.

3. Justify the variation of the asymmetry with the translation speed.

Pre-Visit Letter

16. M-6, Disclosure 3, page 67: The method for validation of the modeled wind radii reported in Form M-3 against the modeler database for observationally-determined wind radii will be reviewed.

Verified: YES

Professional Team Comments:

Reviewed scatter plots of modeled versus observed 40 mph wind radii and 74 mph wind radii.

Reviewed table comparing historical to modeled values for the radii for 73 mph and 40 mph wind thresholds.

STATISTICAL STANDARDS – Mark Johnson, Leader

S-1 Modeled Results and Goodness-of-Fit

A. The use of historical data in developing the model shall be supported by rigorous methods published in currently accepted scientific literature.

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

Audit

1. Forms S-1 (Probability and Frequency of Florida Landfalling Hurricanes per Year), S-2A (Examples of Loss Exceedance Estimates, 2007 FHCF Exposure Data), S-2B (Examples of Loss Exceedance Estimates, 2012 FHCF Exposure Data), and S-3 (Distributions of Stochastic Hurricane Parameters) will be reviewed. Provide justification for the distributions selected including, for example, citations to published literature or analyses of specific historical data.

2. The modeling organization's characterization of uncertainty for windspeed, damage estimates, annual loss, and loss costs will be reviewed.

Pre-Visit Letter

17. S-1, Disclosure 2, page 69: Explain what is driving the differences in Table 2 from the previous submission.

18. S-1, Disclosure 6, pages 70-71: Verify the updates to the distribution fits of the storm parameters and their implementation in the stochastic storm set simulations.

Verified: YES

Professional Team Comments:

Reviewed the changes to the updated Table 11 driven by land use and land cover and hurricane parameter updates.

Reviewed plot of the forward speed cumulative distribution function and goodness-of-fit test results. Discussed the method used for performing the goodness-of-fit tests and calculating the p-values.

Reviewed goodness-of-fit test results on Rmax.

Reviewed goodness-of-fit test results for profile factor.

Reviewed goodness-of-fit test results on hurricane category frequency.

S-2 Sensitivity Analysis for 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 currently accepted scientific and statistical methods in the appropriate disciplines and have taken appropriate action.

Audit

1. The modeling organization's sensitivity analysis will be reviewed in detail. Statistical techniques used to perform sensitivity analysis shall be explicitly stated. The results of the sensitivity analysis displayed in graphical format (e.g., contour plots with temporal animation) will be reviewed.

2. Form S-6 (Hypothetical Events for Sensitivity and Uncertainty Analysis) will be reviewed, if applicable.

Verified: YES

Professional Team Comments:

Verified no changes in model methodology from the previous submission and no new sensitivity tests were required.

S-3 Uncertainty Analysis for Model Output

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

Audit

1. The modeling organization's uncertainty analysis will be reviewed in detail. Statistical techniques used to perform uncertainty analysis shall be explicitly stated. The results of the uncertainty analysis displayed in graphical format (e.g., contour plots with temporal animation) will be reviewed.

2. Form S-6 (Hypothetical Events for Sensitivity and Uncertainty Analysis) will be reviewed, if applicable.

Verified: YES

Professional Team Comments:

Verified no changes in model methodology from the previous submission and no new uncertainty tests were required.

S-4 County Level Aggregation

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

Audit

1. Provide a graph assessing the accuracy associated with a low impact area such as Nassau County. We would expect that if the contribution error in an area such as Nassau County is small, the error in the other areas would be small as well. Assess where appropriate, the contribution of simulation uncertainty via confidence intervals.

Pre-Visit Letter

19. S-4, page 78: Explain the adequacy of the number of storm simulations.

Verified: YES

Professional Team Comments:

Reviewed convergence test results for Nassau, Taylor, and Monroe Counties and state wide.

S-5 Replication of Known Hurricane Losses

The model shall estimate incurred 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 experience may be used to replicate structure-only and contents-only losses. The replications shall be produced on an objective body of loss data by county or an appropriate level of geographic detail and shall include loss data from both 2004 and 2005.

Audit

1. The following information for each insurer and hurricane will be reviewed:
    a. The validity of the model assessed by comparing expected losses produced by the model to actual observed losses incurred by insurers at both the state and county level,
    b. The version of the model used to calculate modeled losses for each hurricane provided,
    c. A general description of the data and its source,
    d. A disclosure of any material mismatch of exposure and loss data problems, or other material consideration,
    e. The date of the exposures used for modeling and the date of the hurricane,
    f. An explanation of differences in the actual and modeled hurricane parameters,
    g. A listing of the departures, if any, in the windfield applied to a particular hurricane for the purpose of validation and the windfield used in the model under consideration,
    h. The type of property used in each hurricane to address:
        (1) Personal versus commercial
        (2) Residential structures
        (3) Mobile homes
        (4) Commercial residential
        (5) Condominiums
        (6) Structures only
        (7) Contents only,
    i. The inclusion of demand surge, storm surge, loss adjustment expenses, or law and ordinance coverage in the actual losses or the modeled losses.

2. The following documentation will be reviewed:
    a. Publicly available documentation referenced in the submission,
    b. The data sources excluded from validation and the reasons for excluding the data from review by the Commission (if any),
    c. An analysis that identifies and explains anomalies observed in the validation data,
    d. User input sheets for each insurer and hurricane detailing specific assumptions made with regard to exposed property.

3. The confidence intervals used to gauge the comparison between historical and modeled losses will be reviewed.

4. Form S-4 (Validation Comparisons) will be reviewed.

5. The results of one hurricane event for more than one insurance company and the results from one insurance company for more than one hurricane event will be reviewed to the extent data are available.

Verified: YES

Professional Team Comments:

Reviewed graph of Kolmogorov-Smirnov test results for the negative binomial hurricane frequency model.

Discussed changes in Hurricane Ivan (2004) losses in Form S-4 compared to the previous submission.

Discussed changes in Hurricane Andrew (1992). Tables 25 and 27 in Form S-4 were revised accordingly.

S-6 Comparison of Projected Hurricane Loss Costs

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

Audit

1. Form S-5 (Average Annual Zero Deductible Statewide Loss Costs – Historical versus Modeled) will be reviewed for consistency with Standard G-1 (Scope of the Computer Model and Its Implementation), Disclosure 5.

2. Justify the following:
    a. Meteorological parameters,
    b. The effect of by-passing hurricanes,
    c. The effect of actual hurricanes that had two landfalls impacting Florida,
    d. The departures, if any, from the windfield, vulnerability functions, or insurance functions applied to the actual hurricanes for the purposes of this test and those used in the model under consideration,
    e. Exposure assumptions.

Verified: YES

Professional Team Comments:

Reviewed validation comparisons and their relationship to the results in the previously accepted model.

VULNERABILITY STANDARDS – Masoud Zadeh, Leader

V-1 Derivation of Vulnerability Functions*

*(*Significant Revision)*

A. Development of the building vulnerability functions shall be based on at least one of the following: (1) historical data, (2) tests, (3) rational structural analysis, and (4) site inspections. Any development of the building vulnerability functions based on rational structural analysis, site inspections, and tests shall be supported by historical data.

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

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

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 vulnerability functions.

E. Vulnerability functions shall be separately derived for commercial residential building structures, personal residential building structures, mobile homes, and appurtenant structures.

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

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

Audit

1. Modifications to the building vulnerability component in the model since the previously accepted model will be reviewed in detail, including the rationale for the modifications, the scope of the modifications, the process, the resulting modifications and their impacts on the building vulnerability component. Comparisons with the previously accepted model will be reviewed.

2. Historical data shall be available in the original form with explanations for any changes made and descriptions of how missing or incorrect data were handled. For historical data used to develop building vulnerability functions, demonstrate the goodness-of-fit of the data. Complete reports detailing loading conditions and damage suffered are required for any test data used. Complete

rational structural analyses shall be presented so that a variety of different building types and construction characteristics may be selected for review. Tests and original site inspection reports shall be available for review.

3. Copies of any papers, reports, and studies used in the development of the building vulnerability functions shall be available for review. Copies of all public record documents used may be requested for review.

4. Multiple samples of building vulnerability functions for commercial residential building structures, personal residential building structures, mobile homes, and appurtenant structures shall be available. The magnitude of logical changes among these items for a given windspeed shall be explained and validation materials shall be available.

5. Justify the construction types and characteristics used.

6. Provide validation of the mean building vulnerability functions and associated uncertainties.

7. Document and justify all modifications to the building vulnerability functions due to building codes and their enforcement. If age of building is used as a surrogate for building code and code enforcement, provide complete supporting information for the number of age groups used as well as the year(s) of construction that separates particular group(s).

8. Provide validation material for the disclosed minimum windspeed. Provide the computer code showing the inclusion of the minimum windspeed at which damage occurs.

9. The effects on building vulnerability from local and regional construction characteristics and building codes will be reviewed.

10. Describe how the claim practices of insurance companies are accounted for when claims data for those insurance companies are used to develop or to verify building vulnerability functions. Examples include the level of damage the insurer considers a loss to be a total loss, claim practices of insurers with respect to concurrent causation, or the impact of public adjusting.

11. Provide the percentage of damage at or above which the model assumes a total loss.

12. Form V-1 (One Hypothetical Event) will be reviewed.

Pre-Visit Letter

20. V-1, Disclosure 7, page 88: Explain how the year of construction and regions within Florida are addressed in the model.

21. V-1, Disclosures 11 & 12, page 89: Explain how the building vulnerability functions are developed for unknown residential construction type and for when some of the primary characteristics are unknown.

22. V-1, Disclosure 14, page 90: Provide the documentation of vulnerability functions development, including data and methods used for 1-story, 2-story, and 3-story constructions and the goodness of fit test results.

23. Form V-1, page 193: Compare the results in Form V-1 with the previous submission.

Verified: YES

Professional Team Comments:

Reviewed the vulnerability model update to treat all masonry structures built after 1995 as reinforced masonry structures.

Discussed the introduction of a building height check during importing portfolio data and the process for identifying and handling improbable combinations of structures and heights.

Reviewed ISO structural mapping introduced to interpret ISO fire classes and match to the appropriate corresponding model wind vulnerability functions.

Reviewed in detail the vulnerability model update to differentiate between 1-story, 2-story and 3-story buildings. Discussed the supporting claims data analysis from Hurricanes Charley (2004), Frances (2004), Ivan (2004), Jeanne (2004), Katrina (2005), and Wilma (2005). Reviewed the average relative damage ratios for 2-story versus 1-story and 3-story versus 1-story.

Reviewed supporting reference, Assessment of Damage to Single-Family Homes Caused by Hurricanes Andrew and Iniki, U.S. Department of Housing and Urban Development, October 1993. Reference added to the list of references in G-1 Disclosure 4 during the on-site review.

Reviewed the refinement in the quality factor for better accuracy. Reviewed the method of calculation for the quality factor in the source code.

Discussed the new year band 2013-Present added based on the Florida Building Code 2010 issued in March 2012. Reference added to the list of references in G-1 Disclosure 4 during the on-site review.

Discussed the two vulnerability regions in Florida are 1) Miami-Dade and Broward Counties and 2) all other counties.

Discussed the development of vulnerability functions for unknown residential construction type. Discussed the methodology for applying the appropriate vulnerability function when some of the primary characteristics are unknown.

Discussed the changes in Form V-1, Part B from the previous submission.

V-2 Derivation of Contents and Time Element Vulnerability Functions*

*(*Significant Revision)*

A. Development of the contents and time element vulnerability functions shall be based on at least one of the following: (1) historical data, (2) tests, (3) rational structural analysis, and (4) site inspections. Any development of the contents and time element vulnerability functions based on rational structural analysis, site inspections, and tests shall be supported by historical data.

B. The relationship between the modeled building and contents vulnerability functions and historical building and contents losses shall be reasonable.

C. Time element vulnerability function derivations shall consider the estimated time required to repair or replace the property.

D. The relationship between the modeled building and time element vulnerability functions and historical building and time element losses shall be reasonable.

E. Time element vulnerability functions used by the model shall include time element coverage claims associated with wind, flood, and storm surge damage to the infrastructure caused by a hurricane.

Audit

1. Modifications to the contents and time element vulnerability component in the model since the previously accepted model will be reviewed in detail, including the rationale for the modifications, the scope of the modifications, the process, the resulting modifications and their impact on the contents and time element vulnerability component. Comparisons with the previously accepted model will be reviewed.

2. To the extent that historical data are used to develop mathematical depictions of contents vulnerability functions, demonstrate the goodness-of-fit of the data to fitted models.

3. Justify changes from the previously accepted submission in the relativities between vulnerability functions for building and the corresponding vulnerability functions for contents.

4. Documentation and justification of the following will be reviewed:
   a. The method of derivation and data on which the time element vulnerability functions are based;
   b. Validation data specifically applicable to time element coverages;
   c. Assumptions regarding the coding of time element losses by insurers;
   d. The effects of demand surge on time element for the 2004 and 2005 hurricane seasons;
   e. Assumptions regarding the variability of time element losses by size of property;
   f. Statewide application of time element coverage assumptions;
   g. Assumptions regarding time element coverage for mobile homes, tenants, and condo unit

owners exposure;

h. The methods used to incorporate the estimated time required to repair or replace the property;

i. The methodology and available validation for determining the extent of infrastructure damage and its effect on time element costs.

5. Justify changes from the previously accepted submission in the relativities between vulnerability functions for building and the corresponding vulnerability functions for time element.

6. To the extent that historical data are used to develop mathematical depictions of time element vulnerability functions, demonstrate the goodness-of-fit of the data to fitted models.

Pre-Visit Letter

24. V-2, Disclosures 11 & 12, pages 100-101: Explain how the contents and time element vulnerability functions are developed for unknown residential construction type and for when some of the primary characteristics are unknown.

Verified: YES

Professional Team Comments:

Discussed the development of contents and time element vulnerability functions for unknown residential construction type.

Discussed the new contents vulnerability functions for 1-story, 2-story, and 3-story structures. Response to Disclosure 1 was revised accordingly.

V-3 Mitigation Measures*

*(*Significant Revision)*

A. Modeling of mitigation measures to improve a building's wind resistance and the corresponding effects on vulnerability shall be theoretically sound and consistent with fundamental engineering principles. These measures shall include fixtures or construction techniques that enhance the performance of the building and its 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.***

B. Application of mitigation measures that enhance the performance of the building and its contents shall be justified as to the impact on reducing damage whether done individually or in combination.

Audit

1. Modifications to mitigation measures in the model since the previously accepted model will be reviewed in detail, including the rationale for the modifications, the scope of the modifications, the process, the resulting modifications, and their impacts on the vulnerability component. Comparisons with the previously accepted model will be reviewed.

2. Form V-2 (Mitigation Measures – Range of Changes in Damage) and Form V-3 (Mitigation Measures – Mean Damage Ratios and Loss Costs, Trade Secret item) provide the information used in auditing this standard.

3. Individual mitigation measures as well as their effect on damage due to use of multiple mitigation measures will be reviewed. Any variation in the change over the range of windspeeds for individual and multiple mitigation measures will be reviewed.

4. Mitigation measures used by the model that are not listed as required in this standard will be disclosed and shown to be theoretically sound and reasonable.

Pre-Visit Letter

25. Form V-2, pages 195-196: Compare the results in Form V-2 with the previous submission.

Verified: YES

Professional Team Comments:

Discussed the addition of a separate region for Miami-Dade and Broward Counties in the year band 1996-2002 category due to strict enforcement of the 1994 South Florida Building Code. Reviewed the changes to the secondary modifiers for roof sheathing, roof overhang, skylight type, roof equipment, overhead doors, glazing type, and door reinforcement for Miami-Dade and Broward Counties. Discussed no changes were made to secondary modifiers for the remainder of the state.

Reviewed the addition of four options to the secondary structural modifiers for roof sheathing when the nailing type is unknown.

Reviewed the three new design code mitigation options for International Building Code/International Residential Code (IBC/IRC), Code Plus by Federal Alliance for Safe Homes (FLASH), and Fortified for Safe Living, Institute of Building and Home Safety (IBHS).

Reviewed the following references that were added to the list of references under G-1 Disclosure 4 during the on-site review.

- Federal Alliance for Safe Homes (FLASH): Blueprint for Safety News, Special Edition on Disaster-Resistant Roofing, Spring 2005.
- Building Codes: The Foundation for Resilience, FLASH, BuildStrong's 2nd Annual National Thought Leaders Forum, Building Codes for a Stronger and Safer America, L. Chapman-Henderson and A. Rierson, May 1, 2014.
- FLASH: Blueprint for Safety News, Journey to Storm-Resistant Building, Vol. 3 Issue 2.
- FLASH: Blueprint for Safety News, What to do About Windstorms, Vol. 4 Issue 1.
- FLASH: Blueprint for Safety News, The Three Deadliest Hurricane Myths, Special Edition on Home Openings Protection, Summer 2005.
- FLASH: Blueprint for Safety News, Do-It-Yourself Wind inspection, Vol. 4 Issue 2.
- FLASH: Blueprint for Safety News, A Tale of Two Houses Update, Fall 2005.
- Institute for Business and Home Safety (IBHS): Fortified for Safer Living Builder's Guide, 2008 edition.
- IBHS: Guidelines for Hurricane Resistant Residential Construction, 2005 edition.

Reviewed the new secondary structural modifier for sliding glass doors.

Reviewed the results provided in Form V-2. Discussed no impact given for garage doors or frame sliding glass doors. An error in the input file for garage doors and sliding glass doors was discovered. Corrected Forms V-2 and V-3 were prepared during the audit and reviewed. Discussed the rationale for the results given in the revised forms for entry doors, garage doors, and sliding glass doors. Confirmed consistency between the revised Form V-2 and revised Form V-3.

ACTUARIAL STANDARDS – Marty Simons, Leader

A-1 Modeling Input Data

A. When used in the modeling process or for verification purposes, adjustments, edits, inclusions, or deletions to insurance company input data used by the modeling organization shall be based upon accepted actuarial, underwriting, and statistical procedures.

B. All modifications, adjustments, assumptions, inputs and input file identification, and defaults necessary to use the model shall be actuarially sound and shall be included with the model output report. Treatment of missing values for user inputs required to run the model shall be actuarially sound and described with the model output report.

Audit

1. Quality assurance procedures shall include methods to assure accuracy of insurance data. Compliance with this standard will be readily demonstrated through documented rules and procedures.

2. All model inputs and assumptions will be reviewed to determine that the model output report appropriately discloses all modifications, adjustments, assumptions, and defaults used to produce the loss costs.

Verified: YES

Professional Team Comments:

Discussed the effect on loss costs with the Multiple Layer Flag set to on and set to off.

Discussed the types of warnings and errors included in the summary log provided at the end of importing insurer data and the process for subsequent remedial action if necessary.

Discussed the sanity check rules applied to verify the accuracy of insurance claims data analyzed and the discussions with insurance companies relative to data anomalies.

A-2 Event Definition

A. Modeled loss costs and 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.

B. Time element loss costs shall reflect losses due to infrastructure damage caused by a hurricane.

Audit

1. The model will be reviewed to determine that the definition of an event in the model is consistent with this standard.

2. The model will be reviewed to determine that by-passing storms and their effects are considered in a manner that is consistent with this standard.

3. The model will be reviewed to determine whether (if so, how) the model takes into account flood or hurricane storm surge.

Verified: YES

Professional Team Comments:

Discussed no change in the definition of an event or in the handling of by-passing storms in the model.

Discussed that the model loss costs do not include flood or storm surge other than the effects of storm surge damage on the infrastructure.

A-3 Coverages*

*(*Significant Revision)*

A. The methods used in the development of building loss costs shall be actuarially sound.

B. The methods used in the development of appurtenant structure loss costs shall be actuarially sound.

C. The methods used in the development of contents loss costs shall be actuarially sound.

D. The methods used in the development of time element coverage loss costs shall be actuarially sound.

Audit

1. The methods used to produce building, appurtenant structure, contents and time element loss costs and probable maximum loss levels will be reviewed.

Verified: YES

Professional Team Comments:

Discussed no change in the methodology for calculating building, appurtenant structure, contents, and time element losses.

A-4 Modeled Loss Cost and Probable Maximum Loss Considerations

A. Loss cost projections and probable maximum loss levels shall not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin.

B. Loss cost projections and probable maximum loss levels shall not make a prospective provision for economic inflation.

C. Loss cost projections and probable maximum loss levels shall not include any explicit provision for direct hurricane storm surge losses.

D. Loss cost projections and probable maximum loss levels shall be capable of being calculated from exposures at a geocode (latitude-longitude) level of resolution.

E. Demand surge shall be included in the model's calculation of loss costs and probable maximum loss levels using relevant data.

F. The methods, data, and assumptions used in the estimation of demand surge shall be actuarially sound.

Audit

1. Describe how the model handles expenses, risk load, investment income, premium reserves, taxes, assessments, profit margin, economic inflation, and any criteria other than direct property insurance claim payments.

2. The method of inclusion of secondary uncertainty in the probable maximum loss levels will be examined.

3. Provide the data and methods used to incorporate individual aspects of demand surge on personal and commercial residential coverages, inclusive of the effects from building material costs, labor costs, contents costs, repair time, etc.

4. Provide a detailed description of how the model accounts for hurricane storm surge losses.

5. All referenced literature will be reviewed to determine applicability.

Pre-Visit Letter

26. A-4.C, page 127: Describe the process used to ensure that storm surge losses are excluded from the model's loss cost outputs.

Verified: YES

Professional Team Comments:

Discussed the methodology for calculating and applying demand surge to modeled losses. Reviewed the process for handling multiple stochastic storm landfalls.

Discussed the process for excluding direct storm surge losses from the model loss output.

The Professional Team recommends the modeler present their methodology for excluding storm surge losses from the modeled losses to the Commission during the Trade Secret session.

A-5 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.

B. The relationship among the modeled deductible loss costs shall be reasonable.

C. Deductible loss costs shall be calculated in accordance with s. 627.701(5)(a), F.S.

Audit

1. Describe the process used to determine the accuracy of the insurance-to-value criteria in data used to develop or validate the model results.

2. To the extent that historical data are used to develop mathematical depictions of deductibles and policy limits, demonstrate the goodness-of-fit of the data to fitted models.

3. To the extent that historical data are used to validate the model results, the treatment of the effects of deductibles, policy limits, and coinsurance in the data will be reviewed.

4. Justify changes from the previously accepted submission in the relativities among corresponding deductible amounts for the same coverage.

Verified: YES

Professional Team Comments:

Discussed no change in the process for calculating and applying deductibles and policy limits from the previously accepted model.

A-6 Loss Output*

*(*Significant Revision)*

A. The methods, data, and assumptions used in the estimation of probable maximum loss levels shall be actuarially sound.

B. Loss costs shall not exhibit an illogical relation to risk, nor shall loss costs exhibit a significant change when the underlying risk does not change significantly.

C. Loss costs produced by the model shall be positive and non-zero for all valid Florida ZIP Codes.

D. Loss costs cannot increase as the quality of construction type, materials and workmanship increases, all other factors held constant.

E. Loss costs cannot increase as the presence of fixtures or construction techniques designed for hazard mitigation increases, all other factors held constant.

F. Loss costs cannot increase as the quality of building codes and enforcement increases, all other factors held constant.

G. Loss costs shall decrease as deductibles increase, all other factors held constant.

H. The relationship of loss costs for individual coverages, (e.g., buildings and appurtenant structures, contents, and time element) shall be consistent with the coverages provided.

I. Output ranges shall be logical for the type of risk being modeled and deviations supported.

J. All other factors held constant, output ranges produced by the model shall in general reflect lower loss costs for:

1. masonry construction versus frame construction,

2. personal residential risk exposure versus mobile home risk exposure,

3. inland counties versus coastal counties, and

4. northern counties versus southern counties.

A-6 Loss Output (Continued)

K. For loss cost and probable maximum loss level estimates derived from or validated with historical insured hurricane losses, the assumptions in the derivations concerning (1) construction characteristics, (2) policy provisions, (3) coinsurance, (4) contractual provisions, and (5) relevant underwriting practices underlying those losses, as well as any actuarial modifications, shall be appropriate based on the type of risk being modeled.

Audit

1. Provide the data and methods used for probable maximum loss levels for Form A-8 (Probable Maximum Loss for Florida). Describe the hurricane associated with the Top Event.

2. All referenced literature will be reviewed to determine applicability.

3. Graphical representations of loss costs by ZIP Code and county will be reviewed.

4. Color-coded maps depicting the effects of land friction on loss costs by ZIP Code will be reviewed.

5. The procedures used by the modeling organization to verify the individual loss cost relationships will be reviewed. Forms A-1 (Zero Deductible Personal Residential Loss Costs by ZIP Code), A-2 (Base Hurricane Storm Set Statewide Losses), A-3A (2004 Hurricane Season Losses, 2007 FHCF Exposure Data), A-3B (2004 Hurricane Season Losses, 2012 FHCF Exposure Data), A-6 (Logical Relationship to Risk, Trade Secret item), and A-7 (Percentage Change in Logical Relationship to Risk) will be used to assess coverage relationships.

6. Demonstrate that loss cost relationships among deductible, construction type, policy form, coverage, building code/enforcement, building strength, condo unit floor, number of stories, territory, and region are consistent and reasonable.

7. The total personal and commercial residential insured losses provided in Forms A-2 (Base Hurricane Storm Set Statewide Losses), A-3A (2004 Hurricane Season Losses, 2007 FHCF Exposure Data), and A-3B (2004 Hurricane Season Losses, 2012 FHCF Exposure Data) will be reviewed individually for total personal residential and total commercial residential insured losses.

8. Forms A-4A (Output Ranges, 2007 FHCF Exposure Data), A-4B (Output Ranges, 2012 FHCF Exposure Data), and A-5 (Percentage Change in Output Ranges, 2007 FHCF Exposure Data) will be reviewed, including geographical representations of the data when applicable.

9. Justify all changes in loss costs from the previously accepted submission.

10. Forms A-4A (Output Ranges, 2007 FHCF Exposure Data) and A-4B (Output Ranges, 2012 FHCF Exposure Data) will be reviewed to ensure appropriate differentials among deductibles, coverage, and construction types.

11. Anomalies in the output range data will be reviewed and shall be justified.

Pre-Visit Letter

27. Form A-4B, page 258: Describe how the file hlpm2012c.txt was processed for use in completing Form A-4B.

28. Form A-5.C, page 271: Explain the percentage increase results for Liberty County.

29. Form A-5.C, page 278: Explain the percentage increase results for Suwanee and Calhoun Counties.

Verified: YES

Professional Team Comments:

Discussed potential anomalies in Form A-1 relating to frame owners, masonry owners, and mobile homes. Discussed the reasons for frame owners losses being greater than mobile homes losses in several ZIP Codes. Reviewed color coded map by ZIP Code to compare year built vintages. Discussed the historic winds associated with these ZIP Codes.

Discussed the procedure for processing the aggregate FHCF 2012 exposure data in completing Form A-4B.

Discussed the percentage increases in loss costs in Liberty, Suwanee, and Calhoun Counties.

Discussed the methodology for calculating probable maximum loss levels for Form A-8. Reviewed the per occurrence flowchart.

Reviewed color-coded maps of loss costs by ZIP Code for frame, masonry, and mobile homes.

Reviewed color-coded roughness length map by ZIP Code and the effects on loss costs.

Reviewed plot of average annual loss compared to distance from coast.

Reviewed a color-coded contour map of the loss costs for strong owners frame produced in From A-6 for each of the points in Location Grid B.

Reviewed the results in Trade Secret Form A-6 in detail.

References reviewed:

- Federal Emergency Management Association (FEMA): Third Party Analysis of Manufactured Home Retrofit Tie Downs, Assessment & Analysis – State of Florida Residential Construction Mitigation Retrofit Program, June 2005.

- International Hurricane Research Center, Florida International University: Hurricane Loss Reduction for Housing in Florida, Mobile Home Replacement Program in Florida, What We Know Today and Where We Should Go in the Future.

COMPUTER STANDARDS – Paul Fishwick, Leader

C-1 Documentation

A. Model functionality and technical descriptions shall be documented formally in an archival format separate from the use of letters, slides, and unformatted text files.

B. The modeling organization shall maintain a primary document repository, containing or referencing a complete set of documentation specifying the model structure, detailed software description, and functionality. Development of the documentation shall be indicative of accepted software engineering practices.

C. All computer software (i.e., user interface, scientific, engineering, actuarial, data preparation, and validation) relevant to the submission shall be consistently documented and dated.

D. The modeling organization shall maintain (1) a table of all changes in the model from the previously accepted submission to the initial submission this year and (2) a table of all substantive changes since this year's initial submission.

E. Documentation shall be created separately from the source code.

Audit

1. The primary document repository, in either electronic or physical form, and its maintenance process will be reviewed. The repository shall contain or reference full documentation of the software.

2. All documentation shall be easily accessible from a central location.

3. Complete user documentation, including all recent updates, will be reviewed.

4. Modeling organization personnel, or their designated proxies, responsible for each aspect of the software (i.e., user interface, quality assurance, engineering, actuarial, verification) shall be present when the Computer Standards are being audited. Internal users of the software will be interviewed.

5. Provide verification that documentation is created separately from and is maintained consistently with the source code.

6. The tables specified in C-1.D that contain the items listed in Standard G-1(Scope of the Computer Model and Its Implementation), Disclosure 5 will be reviewed. The tables shall contain the item number in the first column. The remaining five columns shall contain specific document or file references for affected components or data relating to the following Computer Standards: C-2 (Requirements), C-3 (Model Architecture and Component Design), C-4 (Implementation), C-5 (Verification), and C-6 (Model Maintenance and Revision).

7. Trace the model changes specified in Standard G-1 (Scope of the Computer Model and Its Implementation), Disclosure 5 through all Computer Standards.

Pre-Visit Letter

30. C-1.B, page 143: Relate the primary binder table of contents with the response to Standard G-1, Disclosure 5 by demonstrating individual table item compliance with Computer Standards C-1 through C-7.

Verified: YES

Professional Team Comments:

Reviewed the two errors reported to the Commission, in a letter dated February 20, 2015 by the modeler (CoreLogic/EQECAT). Both errors were related to human interventions that resulted in problems either with the model or with specific forms within the submission. The first error resulted from parallel processing of data where the indexing was incorrect for 15 out of 32,582 stochastic events. The second error resulted from a manual procedure for generating a submission form. The errors were corrected, and measures were created to mitigate the occurrence of future errors. Flowcharts for revised processes were reviewed.

Reviewed the primary document binder and associated sub-documents relating to Standards C-1 through C-7 as required by Audit items 1 through 6.

Reviewed the process for comparing stochastic distribution and historical values for forward speed.

Reviewed the two tables required by Standard C-1.D for the model version under review: the table for changes to the model resulting in the original submission (original November 2014 Submission), and the table for changes subsequent to the original submission resulting in Florida Hurricane Model 2015a, dated February 25, 2015.

Verified enhanced documentation for the process used by the modeler to ensure correspondence among different types of media (e.g., design documents versus design code). Reference Standard G-1.B.

Traced model changes from Standard G-1, Disclosure 5 through the Computer Standards as required in Standard C-1, Audit Item 7.

C-2 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 model.

Audit

1. Provide confirmation that a complete set of requirements for each software component, as well as for each database or data file accessed by a component, has been maintained and documented.

Pre-Visit Letter

31. C-2, page 144: Provide requirements documentation that specifically relates to each model change identified in Standard G-1, Disclosure 5.

Verified: YES

Professional Team Comments:

Reviewed the requirements, specified in tabular form, for all items in Standard G-1, Disclosure 5 from the modeler's submission.

C-3 Model Architecture and Component Design*

*(*Significant Revision)*

The modeling organization shall maintain and document (1) detailed control and data flow diagrams and interface specifications for each software component, (2) schema definitions for each database and data file, and (3) diagrams illustrating model-related flow of information and its processing by modeling organization personnel or team. Documentation shall be to the level of components that make significant contributions to the model output.

Audit

1. The following will be reviewed:
    a. Detailed control and data flow diagrams, completely and sufficiently labeled for each component,
    b. Interface specifications for all components in the model,
    c. Documentation for schemas for all data files, along with field type definitions,
    d. Each network diagram including components, sub-component diagrams, arcs, and labels, and
    e. Diagrams illustrating model-related information flow among modeling organization personnel or team (e.g., using Unified Modeling Language (UML), Business Process Model and Notation (BPMN), or equivalent technique including a modeling organization internal standard).

2. A model component custodian, or designated proxy, shall be available for the review of each component.

Verified: YES

Professional Team Comments:

Discussed with the modeler the need to document the processes used related to the two errors noted in the February 20, 2015 letter to the Commission. Reviewed four flowcharts addressing this need. Two flowcharts were provided for each error: one flowchart on the original (pre-error) process, and the revised post-error process.

Reviewed flowcharts associated with modeling processes for formulating hurricane parameters and characteristics (reference Standard M-2) and with hurricane probabilities (reference Standard M-3).

Discussed the need to edit the title of the flowchart in Figure 1 of the submission. Verified that the title was modified.

Discussed that one flowchart had an infinite loop with insufficient conditional branching, and required modification. Verified that the flowchart was corrected.

Reviewed the flowchart defining how the file hlpm2012c.txt was processed in completing Form A-4B.

Reviewed pseudocode defining how the structure types are processed for completing Form A-4B.

Reviewed flowchart for specifying per occurrence probable maximum loss.

C-4 Implementation

A. The modeling organization shall maintain a complete procedure of coding guidelines consistent with accepted software engineering practices.

B. The modeling organization shall maintain a complete procedure used in creating, deriving, or procuring and verifying databases or data files accessed by components.

C. All components shall be traceable, through explicit component identification in the flow diagrams, down to the code level.

D. The modeling organization shall maintain a table of all software components affecting loss costs, 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.

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.

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 Computer Model and Its Implementation), Disclosure 5:

1. A list of all equations and formulas used in documentation of the 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.

Audit

1. The interfaces and the coupling assumptions will be reviewed.

2. Provide the documented coding guidelines and confirm that these guidelines are uniformly implemented.

3. The procedure used in creating, deriving, or procuring and verifying databases or data files accessed by components will be reviewed.

4. The traceability among components at all levels of representation will be reviewed.

5. The following information shall be available and will be reviewed for each component, either in a header comment block, source control database, or the documentation:
    a. Component name,
    b. Date created,

c. Dates modified and by whom,
d. Purpose or function of the component,
e. Input and output parameter definitions.

6. The table of all software components as specified in C-4.D will be reviewed.

7. Model components and the method of mapping to elements in the computer program will be reviewed.

8. Comments within components will be examined for sufficiency, consistency, and explanatory quality.

Verified: YES

Professional Team Comments:

Reviewed two C++ implementations for processing stochastic hurricane events: (1) the implementation prior to Error #1, and (2) the implementation after having addressed Error #1.

Reviewed a data file associated with Standard A-2.A where minimum damaging wind speeds occur in Florida.

Reviewed code implementation related to the numerical precision modification of the quality factor to include tenths.

Reviewed code to calculate Probable Maximum Loss (PML) and compared the logic with documentation for correspondence checking.

Discussed with the modeler the need to review the quality assurance process to mitigate future errors due to manual procedures used in processing data and forms. Reviewed the modeler's approach to ensure that the other manual processes have been re-checked for accuracy.

Verified that the modeler's documented process for coding guidelines has not changed since the prior submission.

Reviewed the code that added an additional digit of precision to the quality factor associated with vulnerability.

Informed the modeler that various blocks of C++ code in the model had insufficient commenting. Verified additional comments were added to improve readability. Verified that the modeler uses comments in the header files to document specific methods and functions.

Discussed with the modeler the need to add utility-based software to the software metrics table required by Standard C-4.D. Verified that the modeler produced the table.

Reviewed the equation table (C-4.F) for Demand Surge calculations from 2008.

C-5 Verification*

*(*Significant Revision)*

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.

B. Component Testing

1. The modeling organization shall use testing software to assist in documenting and analyzing all components.

2. Unit tests shall be performed and documented for each component.

3. Regression tests shall be performed and documented on incremental builds.

4. Aggregation tests shall be performed and documented to ensure the correctness of all model components. Sufficient testing shall be performed to ensure that all components have been executed at least once.

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.

2. The modeling organization shall perform and document integrity, consistency, and correctness checks on all databases and data files accessed by the components.

Audit

1. The components will be reviewed for containment of sufficient logical assertions, exception-handling mechanisms, and flag-triggered output statements to test the correct values for key variables that might be subject to modification.

2. The testing software used by the modeling organization will be reviewed.

3. The component (unit, regression, aggregation) and data test processes and documentation will be reviewed including compliance with independence of the verification procedures.

4. Fully time-stamped, documented cross-checking procedures and results for verifying equations, including tester identification, will be reviewed. Examples include mathematical calculations versus source code implementation, or the use of multiple implementations using different languages.

5. Flowcharts defining the processes used for manual and automatic verification will be reviewed.

6. The response to Disclosure 1 will be reviewed.

7. Verification approaches used for externally acquired data, software, and models will be reviewed.

Pre-Visit Letter

32. C-5, pages 148-150: Provide complete and thorough verification procedures and output from the model changes identified in Standard G-1, Disclosure 5. In particular, provide a description of the reviews and verification spot checks for the change to NLCD2011.

33. C-5, Disclosure 3, page 150: The paragraph starting “External Data” appears to address general external data sets. The final sentence of the paragraph refers to elevations which would only apply to specific external data sets. Provide an explanation.

Verified: YES

Professional Team Comments:

Reviewed general testing and verification procedures used by the modeler.

Discussed with the modeler the potential for other errors to occur similar to those that were listed by the modeler in the February 20, 2015 letter to the Commission. The modeler reviewed their methodology and noted that there were three forms that involved manual cut/paste methodology. These forms were verified for accuracy.

C-6 Model Maintenance and Revision*

*(*Significant Revision)*

A. The modeling organization shall maintain a clearly written policy for model revision, including verification and validation of revised components, databases, and data files.

B. A revision to any portion of the model that results in a change in any Florida residential hurricane loss cost or probable maximum loss level shall result in a new model version identification.

C. The modeling organization shall use tracking software 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 model versions since the initial submission for this year. Each model description shall have a unique version identification, and a list of additions, deletions, and changes that define that version.

Audit

1. All policies and procedures used to maintain the code, data, and documentation will be reviewed. For each component in the system decomposition, provide the installation date under configuration control, the current version identification, and the date of the most recent change(s).

2. The policy for model revision will be reviewed.

3. The tracking software will be reviewed and checked for the ability to track date and time.

4. The list of all model revisions as specified in C-6.D will be reviewed.

Pre-Visit Letter

34. C-6.D, page 151: Provide the model version history over the past 5 years, leading up to the version identified in the submission.

Verified: YES

Professional Team Comments:

Reviewed the software tool for tracking software maintenance.

Reviewed the policy for model revision.

Discussed with the modeler that the use of a future date on a subset of the model documentation does not correspond with the release date of the submission dated February 25, 2015. Reviewed a revised release date applied throughout the submission.

Reviewed the Version Change Management Workflows document.

Reviewed the model version history over the past 5 years culminating in the most recent version.

C-7 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 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.

Audit

1. The written policy for all procedures and methods used to ensure the security of code, data, and documentation will be reviewed. Specify all security procedures.

2. Documented security procedures for access, client model use, anti-virus software installation, and off-site procedures in the event of a catastrophe will be reviewed.

Verified: YES

Professional Team Comments:

Discussed that there were no security breaches related to the model since the last accepted model version.

Verified that the policy for security has not changed since the currently accepted model version.