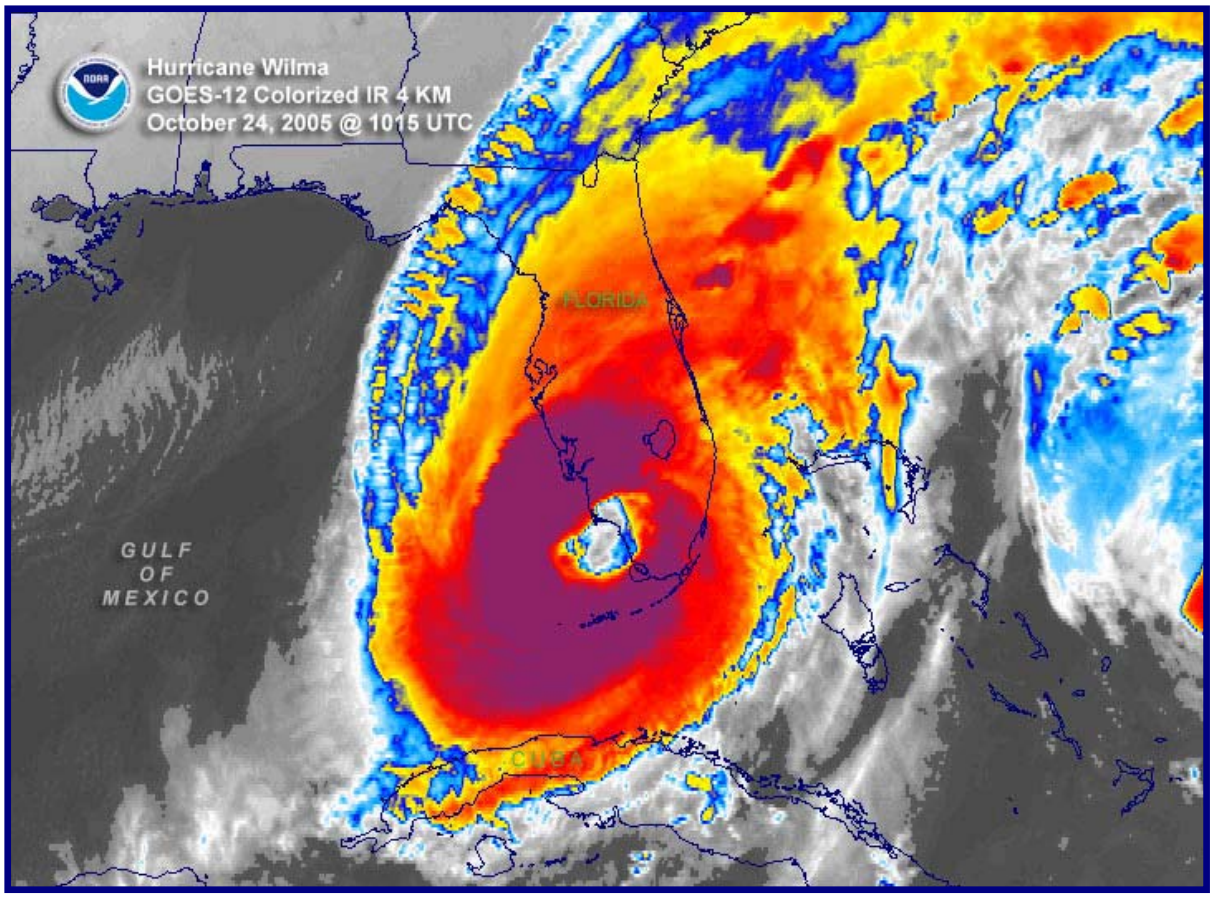
Florida Commission on Hurricane Loss Projection Methodology



Professional Team Report
2006 Standards

AIR Worldwide Corporation

On-Site Review
April 2 – 4, 2007

On April 2-4, 2007 the Professional Team visited on-site at AIR Worldwide Corporation (AIR) in Boston, Massachusetts. The following individuals participated in the review.

AIR

Tonya Bedore, Technical Writer
Jason Butke, Research Scientist, Meteorology Division
Joe Cleveland, Consulting Group
Dennis Costello, Manager, Property Products Research & Modeling
Justin A.W. Cox, Ph.D., Research Scientist/Meteorologist
Peter Dailey, Ph.D., Director, Atmospheric Science
Glen Daraskevich, AVP, Research and Modeling
Yi Deng, Ph.D., Research Scientist/Meteorologist
Ioana Dima, Ph.D., Research Scientist/Meteorologist
Jayanta Guin, Ph.D., Vice President, Research and Modeling
Cheryl Hayes, Senior Research Analyst
Hua He, Ph.D., Research Engineer
Mary Healy, Ph.D., Research Statistician
Vineet Jain, Ph.D., Research Engineer
Connie Kang, Consulting Services
David Lalonde, FCAS, FCIA, MAAA, Senior Vice President, Consulting Services
Greta Ljung, Ph.D., Senior Research Statistician
Sudhir Kumar Potharaju, Senior Software Engineer
John Rowe, Exposures Manager
Larry Trudeau, Software Engineering Director

Professional Team

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

The review began with introductions and an overview of the audit process. A discussion followed on the error discovered in completing Forms A-2 and S-2 last year, including how the error occurred and how AIR intends to prevent this type of error from happening in the future. Next the Professional Team reviewed AIR's responses to the deficiencies noted at the March 13, 2007 Commission meeting.

AIR gave a brief presentation highlighting refinements made in the 2007 model (Atlantic Tropical Cyclone Model V9.0) and the resulting impact on the statewide loss costs.

- Updated the ZIP Code database. Impact: -0.1%
- Updated the historical catalog through 2006 and updated the annual frequency distribution, the probability distribution for landfall location, and the probability

distribution for hurricane intensity to reflect the new data in the stochastic catalog. Impact: +1.4%
- Updated relationship of contents damage to building damage for single-family homes and mobile homes. Impact: -3.6%
- Inclusion of demand surge in modeled loss costs. Impact: +12.6%

The overall change in the statewide industry residential average loss cost is 10.3%.

Reviewed the following corrections to be included in the revised submission provided to the Commission prior to the May 8-11, 2007 meetings in addition to the editorial corrections noted in the Professional Team pre-visit letter.

1. Page 51, M-2.1, provide years being used for Rmax, Pmin, and other hurricane characteristics where years have not been provided
2. Page 62, M-5.A, reference to Figures 7 and 8 to be included
3. Page 147, Form A-6.C, Table 16, duplicate ZIP Codes to be removed
4. Page 195, S-1.2, Table 17, updated to include Rmax, best track data, and correct NMW-38
5. Page 198, S-1.6, Figure 52, correct year of simulated storms
6. Page 201, S-2.1, rephrase statement on distribution of Rmax
7. Page 203, S-2.5, attest output ranges were not produced using the near term catalog
8. Page 209, S-5.1, modeled losses corrected

Report on Deficiencies

The Professional Team reviewed the following deficiencies cited by the Commission at the March 13, 2007 meeting. The deficiencies were corrected by the established time frame and the corrections have been verified.

1. Standard M-5, Disclosure 4 (page 65)
   Non-responsive to justify the timeliness of the land use land cover database.

2. Standard M-5, Disclosure 6 (page 66)
   Non-responsive as there is no demonstration of consistency with observed winds.

3. Form V-1.B (pages 91-92)
   Modeler did not confirm that the structures used in completing the form are identical to those in the table provided.

4. Form A-5.D (page 144)
   The x-axis of Figure 39 is unclear.

Pre-Visit Letter

The following editorial corrections are noted. The Professional Team will need to review the corrected pages before completing the on-site review.

1. Page 24, response under B., "indicted" should be indicated.
2. Page 39, response under 3.A.2, delete period after 2005 and insert comma.
3. Page 39, response under 3.A.5, "reviewd" should be reviewed.
4. Page 64, fifteenth line, "dependant" should be dependent.
5. Page 186, Figure 41 is missing legend.
6. Page 195, final sentence is missing word.
7. Page 217, Comparison #1 and Comparison #2, values under Modeled Loss missing comma separators.

Provide for the Professional Team's review, all insurance company claims data received since the review by the Professional Team in 2004 (three years prior). Be prepared to describe any processes used to amend or validate the model that incorporates this data.

Provide for the Professional Team's review, all engineering data (post event surveys, tests, etc.) received since the review by the Professional Team in 2004 (three years prior). Be prepared to describe any processes used to amend or validate the model that incorporates this data.

The Professional Team reviewed the editorial corrections noted above during the course of the audit. Corrections will be included in the revised submission provided to the Commission prior to the May 8-11, 2007 meetings.

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

GENERAL STANDARDS – Mark Johnson, Leader

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

*(*Significant Revision due to new Audit language)*

The computer model shall project loss costs for personal lines residential property from hurricane events.

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 loss costs. Copies of all representative or primary technical papers that describe the underlying model theory shall be made available.

2. All software located within the model, used to compile data used by the model, used to validate the model, and used to project model loss costs (1) fall within the scope of the Computer Standards, and (2) will be reviewed interactively (viewed simultaneously by all Professional Team members in conjunction with the review of each Standard).

3. Databases or data files relevant to the modeler's submission will be reviewed.

Pre-Visit Letter

1. G-1, Disclosure 3, page 18 – How is the over land decay of the storm incorporated into the flow chart in Figure 3?

Verified: YES

Professional Team Comments:

Reviewed how the over land decay of a storm is incorporated into the flowchart process provided in Figure 3 on page 18 of the submission.

Reviewed the changes in the model from the prior year's submission and the resulting impact on loss costs.

G-2 Qualifications of Modeler Personnel and Consultants

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

B. The model or any modifications to an accepted model shall be reviewed by either modeler 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 be signatories on Forms G-1 through G-6 as applicable and shall abide by the standards of professional conduct if adopted by their profession.

Audit

1. The professional vitae of modeler 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, G-2, G-3, G-4, G-5, G-6, 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 modeler personnel or consultants have been found to have failed to abide by the standards of professional conduct adopted by their profession.

Pre-Visit Letter

2. G-2, Disclosure 2.B, pages 36-37 – Provide resumes for the new employees listed.

Verified: YES

Professional Team Comments:

Reviewed resumes of new personnel:

- Tanya Bedore, B.S. Scientific and Technical Communication, Michigan Technological University
- Jason Butke, M.S. Geography, University of Delaware; B.A. Geography minor Quantitative Analysis, Bowling Green State University
- Joe Cleveland, M.S. Applied Statistics, Villanova University; B.A. Mathematics, Specialty in Statistics, Boston University

- Dennis M. Costello, B.S. School of Civil and Environmental Engineering, Cornell University
- Justin A.W. Cox, Ph.D., Meteorology, University of Utah; Dissertation: *The Sensitivity of Thermally Driven Mountain Flows to Land Cover Change*; M.S. Meteorology; B.S. Meteorology, Cornell University
- Yi Deng, Ph.D., Atmospheric Sciences, University of Illinois at Urbana-Champaign; M.S. in Atmospheric Sciences, University of Illinois at Urbana-Champaign; M.S. in Statistics, University of Illinois at Urbana-Champaign; B.S. in Atmospheric Sciences, Peking University, Beijing; B.S. in Economics, Peking University, Beijing
- Ioana M. Dima, Ph.D., Atmospheric Sciences, University of Washington; Dissertation: *An Observational Study of the Tropical Tropospheric Circulation;* M.S. in Atmospheric Sciences, University of Washington; M.S. in Atmospheric Physics, University of Bucharest; B.S. in Physics, University of Bucharest
- Mary Louie Healy, Ph.D. Statistics, Boston University; Dissertation: *A Multiscale Approach to Disease Mapping*; B.A., M.A. in Statistics, Boston University
- Jonathan B. Holden, MCP, M.S., University of New Hampshire; B.A. Franklin and Marshall College
- Sudhir K. Potharaju, Bachelor of Technology (Electronics & Telecommunications), Institution of Electronics and Telecommunication Engineers, Hyderabad, India; Diploma in Advanced Software Technology from CMC, India
- Tharini Senthil, B.S. in Computer Science, University of Windsor, Ontario, Canada
- Ivelin M. Zvezdov, Masters in European Studies, University of Oxford, M.A. in Economics, St. Andrews University

Verified that no former employees left for violation of professional ethical standards.

G-3 Risk Location

A. ZIP Codes used in the model shall be updated at least every 24 months using information originating from the United States Postal Service. The United States Postal Service issue date of the updated information shall be reasonable.

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

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

Audit

1. Provide geographic displays for all ZIP Codes. The location of specific centroids will be reviewed.

2. Provide the third party vendor, if applicable, and a complete description of the process used to validate ZIP Code information.

Pre-Visit Letter

3. G-3.C, page 41 – Describe the process used to validate the ZIP Code data.

Verified: YES

Professional Team Comments:

Reviewed the ZIP Code database update and the process of re-estimating distance from coastline, elevation and surface roughness. This technical update resulted in minor changes to population weighted centroids with a 0.1% decrease in losses.

Reviewed the process for ZIP Code verification on data provided by vendor. Reviewed comparisons between database releases. Reviewed examples of ZIP Code centroid movements greater than one mile between database releases. Specific examples were considered both provided by AIR and a specific ZIP Code suggested by the Professional Team.

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 and loss costs). 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:

No bias detected among the meteorological, vulnerability, and actuarial components of the model.

METEOROLOGICAL STANDARDS – Jenni Evans, Leader

M-1 Base Hurricane Storm Set*

*(*Significant Revision)*

For validation of landfall and by-passing storm frequency in the stochastic storm set, the modeler shall use the latest updated Official Hurricane Set or the National Hurricane Center HURDAT as of June 1, 2006 or later. Complete additional season increments based on updates to HURDAT 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.

Audit

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

Verified: YES

Professional Team Comments:

Verified the base hurricane storm set is the latest updated Official Hurricane Set for landfalling storms, updated for 2006 landfalls from NHC reports and supplemented with HURDAT for bypassing storms. This hurricane set spans the years 1900-2006 inclusive.

M-2 Hurricane Characteristics

Methods for depicting all modeled hurricane characteristics, including but not limited to wind speed, radial distributions of wind and pressure, minimum central pressure, radius of maximum winds, strike probabilities, tracks, the spatial and time variant wind fields, and conversion factors, shall be based on information documented by currently accepted scientific literature.

Audit

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

2. Prepare graphical depictions of hurricane characteristics as used in the model. Describe and justify:
   - the data set basis for the fitted distributions,
   - the modeled dependencies among correlated characteristics in the wind field component and how they are represented,
   - the asymmetric nature of hurricanes,
   - the fitting methods used and any smoothing techniques employed.

3. The goodness-of-fit of distributions to historical data will be reviewed.

4. For wind and/or pressure fields not previously reviewed, the modeler will present time-based contour animations (capable of being paused) to demonstrate scientifically reasonable wind field characteristics.

5. The treatment of uncertainties associated with the conversion of gradient winds to surface winds will be compared with currently accepted literature. Variation of the conversion factor with storm intensity will be reviewed.

6. All modeler-specific scientific literature provided in Standard G-1 will be reviewed to determine acceptability.

7. Identify all external data sources that affect model generated wind fields.

Pre-Visit Letter

4. M-2, Disclosure 1, page 51 – Specify the years used for the radii given in the Extended Best Track. Provide the data sources for the characteristics given after the table.

5. M-2, Disclosure 3, page 52 – Discuss how the wind profile in NWS-23 compares to recent storms and more recent analyses of hurricane wind fields (e.g., Willoughby and Rahn 2004; Willoughby et al. 2006).

6. M-2, Disclosure 6, page 53 – Justify tracks based on the period 1900-2001.

7. M-2, Disclosure 7, page 54 – Has the formula for obtaining smoothed frequencies changed?

8. M-2, Disclosure 8, page 56 – Justify the Weibull distribution for intensity.

9. M-2, Disclosure 10, page 57 – Provide the parameters used for these three storms.

Verified: YES

Professional Team Comments:

Reviewed the historical data used for the hurricane characteristics used in the model. Response to M-2.1, page 51, will be revised to clarify the years being used for Rmax, Pmin, and other hurricane characteristics where years have not been provided.

Reviewed how the wind profiles in NWS-23 compare to recent analyses of hurricane wind fields. Reviewed plots of the radial decay functions from NWS-23, Holland B, and Willoughby et al. (2006) for Hurricanes Charley, Dennis, Ivan, Frances, Jeanne, Katrina, and Wilma. Discussed the relative merits of each approach compared to observations.

Discussed the method for determining the shape factor of the wind profile.

Discussed additional research and uncertainty analyses on the conversion factor for gradient winds to surface winds.

Verified that the formula for obtaining smoothed frequencies has not changed.

Reviewed maximum surface modeled and observed wind speed footprints for the distribution of winds across the storm for Hurricanes Charley, Dennis, Ivan, Wilma, Jeanne, Frances, and Katrina.

Reviewed plots comparing the model's wind field consistency with actual, low and high observed 1-minute maximum sustained surface wind speeds for Hurricanes Charley, Dennis, Ivan, Wilma, Jeanne, Frances, and Katrina.

Reviewed the landfall parameters of latitude, longitude, central pressure, Rmax, and forward speed for Hurricanes Charley, Wilma, and Katrina.

Reviewed animation of Hurricane Charley's surface wind field as it crossed the Florida peninsula.

M-3 Landfall Intensity

Models shall use maximum one-minute sustained 10-meter wind speed when defining hurricane landfall intensity. This applies both to the Base Hurricane Storm Set used to develop landfall strike probabilities 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 wind speed shall be within the range of wind speeds (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 – 130	Extensive
4	131 – 155	Extreme
5	Over 155	Catastrophic

Audit

1. Demonstrate that the hurricane intensity at landfall is consistent with the Saffir-Simpson wind range for the stochastic storm set.

Verified: YES

Professional Team Comments:

Reviewed landfall intensity for the stochastic storms and the process for determining landfall frequencies. Reviewed the computer code that determines landfall intensity for the stochastic storms.

Reviewed the computer code for calculating maximum over water wind speed at landfall and the application of the filling rate.

Verified all reporting of landfall intensity is based on 1-minute, 10-meter maximum wind speed.

M-4 Hurricane Probabilities

A. Modeled probability distributions for hurricane intensity, forward speed, radii for maximum winds, and storm heading shall be consistent with historical hurricanes in the Atlantic basin.

B. Modeled hurricane probabilities 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).

Audit

1. Modeled probabilities are compared with observed hurricane frequency using methods documented in currently accepted scientific literature. The goodness-of-fit of modeled to historical hurricane frequencies for the four regions of Florida and overall as provided in Form M-1 will be reviewed.

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

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

4. 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.

5. Provide any modeler specific research performed to develop the functions used for simulating model variables or to develop databases.

6. Describe any short term and long term variations in annual storm frequencies incorporated in the model.

Verified: YES

Professional Team Comments:

Reviewed the goodness-of-fit tests performed on the frequency of each category in the four regions for Florida and for the entire U.S. coastline.

Reviewed the stochastic storm track generation approach and verified that only hurricanes at landfall are in the stochastic storm set.

Reviewed landfall distribution histogram of simulated versus historical frequencies for 50 mile coastal segments. Reviewed the process of smoothing of landfall frequencies in the historical counts.

Verified that the annual storm frequencies incorporated in version 9.0 of the model are derived from the complete Base Hurricane Storm Set.

Reviewed Form M-1 and the apparent flat distribution of storms in SW and SE Florida. Reviewed Weibull distributions by coastal segments.

Reviewed the blending of the filling rate equations for transitioning across regions.

M-5 Land Friction and Weakening

A. The magnitude of land friction coefficients shall be consistent with currently accepted scientific literature relevant to current geographic surface roughness distributions and shall be implemented with appropriate geographic information system data.

B. The hurricane overland weakening rate methodology used by the model shall be consistent with historical records.

Audit

1. Identify other variables in the model that affect over land wind speed estimation.

2. Maps depicting land friction effects are required. Describe the representation of land friction effects in the model. Describe the variation in decay rate over land used in the model.

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

4. Transition of winds from over water to over land (i.e. landfall) will be reviewed.

5. Form M-2 will be reviewed.

Pre-Visit Letter

10. M-5, pages 62-63 – Reference to Figures 7 or 8 is not provided in the text. Discuss the wind speed decay for the Florida Panhandle storm and the apparent lack of asymmetry.

11. M-5.B, page 63 – Define "compare favorably" and provide evidence.

12. M-5, Disclosure 5, page 65 – Describe how this figure was produced. What are the observational data used in this comparison? Present this figure representing each storm individually since 2003.

13. Form M-2, pages 70-71 – Discuss differences in Figures 11 and 12 from the previous submission.

Verified: YES

Professional Team Comments:

Reviewed the adjustments made for estimating wind speeds over land and the methodology for calculating the roughness factor used for ZIP Code and county-wide damaging winds determination.

Reviewed the variation in decay rate over land based on NWS-23. No change in this component of the model.

Reviewed the wind speeds and friction factors for a landfalling simulated storm in the Florida panhandle provided in Figure 7. Reviewed the asymmetry associated with the storm. Response to M-5.A, page 62, will be revised to include a reference to Figures 7 and 8.

Reviewed comparison plots of the filling function for historical storms versus AIR's filling function for Hurricanes Charley, Dennis, Ivan, Wilma, Jeanne, Frances, and Katrina.

Reviewed the process for producing Figure 9. Reviewed actual filling versus modeled filling at various hours after landfall for Hurricanes Charley, Frances, Ivan, Jeanne, Dennis, Katrina, and Wilma.

Reviewed results provided in Form M-2 and the differences between 2006 and 2007. Reviewed this year's definition of the ZIP Codes boundary lines updated by the vendor.

Reviewed the process of blending across regions for the filling rate.

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 wind speed shall decrease with increasing surface roughness (friction), all other factors held constant.

Audit

1. Form M-3 and the modeler's sensitivity analyses provide the information used in auditing this Standard.

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

Verified: YES

Professional Team Comments:

Reviewed the probability distribution for Rmax being a function of central pressure and latitude.

Examined asymmetry in the context of actual and hypothetical storms (with increased translation speed).

VULNERABILITY STANDARDS – Fred Stolaski, Leader

V-1 Derivation of Vulnerability Functions

A. Development of the vulnerability functions is to be based on a combination of the following: (1) historical data, (2) tests, (3) structural calculations, (4) expert opinion, or (5) site inspections. Any development of the vulnerability functions based on structural calculations or expert opinion shall be supported by tests, site inspections, or historical data.

B. The method of derivation of the vulnerability functions shall be theoretically sound.

C. Any modification factors/functions to the vulnerability functions or structural characteristics and their corresponding effects shall be clearly defined and be theoretically sound.

D. Construction type and construction characteristics shall be used in the derivation and application of vulnerability functions.

E. In the derivation and application of vulnerability functions, assumptions concerning building code revisions and building code enforcement shall be justified.

F. Vulnerability functions shall be separately derived for building structures, mobile homes, appurtenant structures, contents, and additional living expense.

G. The minimum wind speed that generates damage shall be reasonable.

Audit

1. Historical data should be available in the original form with explanations for any changes made and descriptions of how missing or incorrect data were handled. To the extent that historical data are used to develop vulnerability functions, demonstrate the goodness-of-fit of the data to fitted models. Complete reports detailing loading conditions and damage suffered are required for any test data used. Complete structural calculations shall be presented so that a variety of different structure types and construction characteristics may be selected for review. The basis for expert opinion and original site inspection reports should be available for review.

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

3. Multiple samples of vulnerability functions for building structures, mobile homes, appurtenant structures, contents, and additional living expense should be available. The magnitude of logical changes among these items for a given wind speed shall be explained and validation materials should be available.

4. Justify the construction types and characteristics used, and provide validation of the range and direction of the variations in damage.

5. Document and justify all modifications to the vulnerability functions due to building codes and their enforcement.

6. Provide validation material for the disclosed minimum wind speed. Provide the computer code showing the inclusion of the minimum wind speed at which damage occurs.

7. Form V-1 will be reviewed.

Pre-Visit Letter

14. V-1.E, page 78 – Define the six building categories referred to in the second paragraph.

15. V-1, Disclosure 2, page 80 – Referring to paragraph, "More recently AIR has begun…," provide and discuss all insurance claims data from the storms in 2004 and 2005.

16. V-1, Disclosure 3, page 85 – Referring to paragraph, "While exploring the damage…," have available all details, notes, field logs, reports, etc. dealing with site inspections of damage from Hurricane Georges and Tropical Storm Frances relative to the effect of storm duration on damage.

17. Form V-1, Part A, page 91 – Discuss the decrease in the damage percentages for wind speed over the range 121 – 170 mph from the previous submission.

Verified: YES

Professional Team Comments:

Reviewed the changes to the contents vulnerability function for single family homes. Reviewed the underlying data and analyses as the basis for updating the contents damage function. Reviewed reasons for the decrease in contents damage. Reviewed "screen shot" of computer output for change to contents coverage.

Reviewed the process for implementing the change to the contents vulnerability function in the model. Reviewed how data from site surveys was used for validation.

Reviewed high resolution map of the six building categories provided in Attachment D, page 307 in the submission. Reviewed the six building categories vulnerability functions derived using building features and mitigation measures that meet the minimum requirements of the Florida Building Code 2001.

Reviewed the details and documentation of damage observations from site inspections. Reviewed AIR's determination of the importance of storm duration in building damageability. Reviewed comparisons of the mean damage ratios between Hurricanes Charley and Frances and comparisons of wind speed and duration. Reviewed damage photos showing damage at different wind speeds due to duration.

Reviewed samples of vulnerability functions for wood and masonry building structures, and mobile homes.

Verified no change in the assumptions made concerning building codes and their enforcement.

Dr. Joseph Minor described his independent peer review of the Vulnerability Standards and the vulnerability functions within the model. Confirmed there are no outstanding issues with the vulnerability functions and the factors that alter the functions. Dr. Minor discussed his comfort with AIR's independent use of separate claims data for development and validation of the vulnerability functions.

Reviewed damage surveys for pool enclosures considered part of Coverage A and reasons for failure. Reviewed sample claims study for Hurricane Wilma as the basis for adding pool enclosure as a secondary risk modifier.

Reviewed summary of actual insurance data for storms in 2004 and 2005.

Documentation reviewed:

- Hurricane George Damage Survey details, notes, logs, reports, and so forth
- AIR Damage Survey notes and reports for Hurricane Katrina from Team 1, Team 2, Team 3, and Team 4
- AIR Damage Survey notes and reports for Hurricane Wilma from Team 1, Team 2, and Team 3
- AIR Damage Survey notes and reports for Hurricane Rita from Team 3.
- Revised claims forms

V-2 Mitigation Measures*

*(*Significant Revision due to new Audit language)*

A. Modeling of mitigation measures to improve a structure's wind resistance and the corresponding effects on vulnerability shall be theoretically sound. These measures shall include fixtures or construction techniques that enhance:

- ***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 shall be empirically justified both individually and in combination.

Audit

1. Forms V-2 and V-3 provide the information used in auditing this Standard.
2. Individual mitigation measures as well as total effect on damage due to use of multiple mitigation measures will be reviewed. Any variation in the change over the range of wind speeds for individual and multiple mitigation measures will be reviewed.
3. 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

18. Form V-3, page 99 – Please complete the REFERENCE STRUCTURE row in Form V-3. Provide a copy of Form V-3 when the Professional Team arrives, and also provide 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.)

Verified: YES

Professional Team Comments:

Reviewed results provided in Form V-2 and Form V-3 (Trade Secret List).

Reviewed the mean damage ratio for a building with mitigation features. Verified that masonry and wood frame shingle impacts were reasonable.

Reviewed the process for completing Forms V-2 and V-3, and the calculations for the mitigation measures. Verified that the Excel spreadsheet calculations were done appropriately using manual process with several checks.

ACTUARIAL STANDARDS – Marty Simons, Leader

A-1 Modeled Loss Costs

Modeled loss costs shall reflect all damages from storms that reach hurricane strength and produce minimum damaging wind speeds or greater on land in Florida.

Audit

1. The model will be reviewed to determine that the definition of an event in the model is consistent with Standard A-1.

2. The model will be reviewed to determine that by-passing storms and their effects are considered in a manner that is consistent with Standard A-1.

Verified: YES

Professional Team Comments:

Verified that loss costs include losses from all Florida landfalling and by-passing hurricanes.

Verified model definition of hurricane events and by-passing storms.

A-2 Underwriting Assumptions

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

B. For loss cost estimates derived from or validated with historical insured hurricane losses, the assumptions in the derivations concerning (1) construction characteristics, (2) policy provisions, (3) claim payment practices, and (4) relevant underwriting practices underlying those losses, as well as any actuarial modifications, shall be appropriate.

Audit

1. Demonstrate how the claim practices of insurance companies are accounted for when claims data for those insurance companies are used to develop or to verify model calculations. For example, the level of damage the insurer considers a loss to be a "total loss." Provide the methods used to delineate among the insurer claim practices in the use of historical claims data to verify model outputs.

Pre-Visit Letter

19. A-2, Disclosure 4, page 102 – Provide a detailed description (including examples) of how the model incorporates insurer "specific assumptions for any depreciation adjustments that reduce replacement value to actual cash value."

Verified: YES

Professional Team Comments:

Reviewed 2004 claims data from several insurance companies and correspondence between AIR and clients regarding the claims data. Reviewed the process for documenting assumptions made including claims payment practices.

Reviewed how depreciation, actual cash value, replacement value, coverage limit, and missing claims data are handled.

Reviewed AIR correspondence to clients requesting data call on the 2005 losses.

A-3 Loss Cost Projections*

*(*Significant Revision)*

A. Loss cost projections produced by hurricane loss projection models shall not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin.

B. Loss cost projections shall not make a prospective provision for economic inflation.

Audit

1. Describe how the model handles expenses, risk load, investment income, premium reserves, taxes, assessments, profit margin, and economic inflation.

Verified: YES

Professional Team Comments:

Verified modeled loss costs do not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin, and the model does not make a provision for economic inflation.

A-4 Demand Surge*

*(*New Standard)*

A. Demand surge shall be included in the model's calculation of loss costs.

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

Audit

1. Provide the data and methods used to determine the effects of demand surge.

Pre-Visit Letter

20. A-4, pages 105-106 – Provide a detailed description of the process used in the model to account for demand surge, including any analyses performed to determine that the resulting demand surge adjustments are actuarially reasonable. Have available any data, reports, expert opinions, etc. used in developing this process.

21. A-4.B, page 105 – Discuss the uncertainty associated with the demand surge function.

Verified: YES

Professional Team Comments:

AIR presented their demand surge methodology and the results of statistical analyses by coverage. Reviewed the potential sources of demand surge. Reviewed changes made to improve demand surge calculations and changes in the methods compared to those reviewed during the "Future Issues" review last year.

Reviewed mean damage ratios applied for individual building components based on modeled losses.

Reviewed the methodology for determining the demand surge for each county in Florida and for each event.

Reviewed the process for handling geographic inconsistencies with the data and the method for determining when those inconsistencies are present.

Reviewed plots of demand surge functions.

Documentation reviewed:

Xactware informational packet
AIR Demand Surge Methodology, Support Documentation Binder
AIR Loss Aggregation for Demand Surge Methodology

Material Labor Prices
Katrina Specific – Common Labor Index, Skilled Labor Index
Loss of Use/Construction Delays

Reviewed ALE data and assumptions, Contents, and Other Structures, and the methodology for accounting for claim payments.

Reviewed uncertainty in demand surge based on lack of available data, minimal published studies available, limited historical events, and a lack of resolution in the available data.

Reviewed results of sensitivity analysis on all coverage types for demand surge and the affect on modeled losses by varying the demand surge factor.

Reviewed graphical representations of the sensitivity analysis on the demand surge functions for Coverage A & B, Coverage C, and Coverage D and the impact on AAL.

A-5 User Inputs

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

Audit

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

2. All insurer inputs and assumptions will be reviewed.

Pre-Visit Letter

22. A-5, Disclosure 2, pages 108-109 – Provide the cited material to Professional Team.

Verified: YES

Professional Team Comments:

Reviewed UNICEDE®/px Data Exchange Format Preparer's Guide documenting the process used to transfer client exposure and claims data into the model.

Reviewed CLASIC/2™ User's Guide manual documenting the analysis options available for generating modeled losses.

A-6 Logical Relationship to Risk

A. 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.

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

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

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

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

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

G. The relationship of loss costs for individual coverages, (e.g., structures and appurtenant structures, contents, and loss of use/additional living expense) shall be consistent with the coverages provided.

Audit

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

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

3. Individual loss cost relationships will be reviewed. Forms A-1, A-2, A-3, A-4, and A-5 will be used to assess coverage relationships.

Pre-Visit Letter

23. A-6.G, page 111 – Discuss the data used to construct Table 10.

24. [This question is under Standard A-10]
25. [This question is under Standard A-10]

26. Form A-3, page 138 – Discuss large change from previous submission for the following storms: 1926 – NoName 6, 1945 – NoName 9, and 1946 – NoName 5.

27. From A-5.D, page 144 – Describe the process used to produce Figure 39, including computer code or other means used to generate Figure 39.

28. Form A-5, page 145 – Discuss the increase from the previous submission in Total Loss and Number of Hurricanes for the ranges from 80,001 to $maximum.

Verified: YES

Professional Team Comments:

Reviewed the validation data used to construct Table 10 on page 111 of the submission including comparison between actual and modeled losses for different coverages.

Reviewed Form A-3 and the changes in the historical storms with and without demand surge.

Reviewed the process and computer code used to complete Form A-5.

Reviewed verification of total loss value and number of hurricanes provided in Form A-5 with demand surge included and demand surge not included.

A-7 Deductibles and Policy Limits

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. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for handling deductibles and policy limits. To the extent that historical data are used to develop mathematical depictions of deductibles and policy limit functions, demonstrate the goodness-of-fit of the data to fitted models. Justify changes from the prior submission in the relativities among corresponding deductible amounts for the same coverage.

Verified: YES

Professional Team Comments:

Reviewed how policy limits are handled.

Verified no change in the process for calculating and applying the annual deductible.

A-8 Contents

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

B. The relationship between the modeled structure and contents loss costs shall be reasonable, based on the relationship between historical structure and contents losses.

Audit

1. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for calculating loss costs for contents coverage. To the extent that historical data are used to develop mathematical depictions of contents functions, demonstrate the goodness-of-fit of the data to fitted models. Justify changes from the prior submission in the relativities between loss costs for structures and the corresponding loss costs for contents.

Verified: YES

Professional Team Comments:

Reviewed no change in handling contents losses.

Reviewed specific changes in contents loss costs from prior submission.

Reviewed specific application of demand surge criteria related to contents.

A-9 Additional Living Expense (ALE)

A. The methods used in the development of Additional Living Expense (ALE) loss costs shall be actuarially sound.

B. ALE loss cost derivations shall consider the estimated time required to repair or replace the property.

C. The relationship between the modeled structure and ALE loss costs shall be reasonable, based on the relationship between historical structure and ALE losses.

D. ALE loss costs produced by the model shall appropriately consider ALE claims arising from damage to the infrastructure.

Audit

1. The actuary for the modeler may be asked to attest to the actuarial soundness of the procedure for calculating loss costs for ALE coverage. Documentation and justification of the following will be reviewed:
   a. The method of derivation and data on which the ALE vulnerability function is based;
   b. Validation data specifically applicable to ALE;
   c. Assumptions regarding the coding of ALE losses by insurers;
   d. The effects of demand surge on ALE for Hurricane Andrew;
   e. Assumptions regarding the variability of ALE by size of property;
   f. Statewide application of ALE assumptions;
   g. Assumptions regarding ALE 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 ALE costs.

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

3. Justify the differences in the relationship of structure and ALE loss costs from those previously found acceptable.

Verified: YES

Professional Team Comments:

Verified no change in the process and calculations used to develop ALE loss costs.

Reviewed specific application of demand surge and other criteria related to ALE.

A-10 Output Ranges

A. Output ranges shall be logical and any deviations supported.

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

1. masonry construction versus frame construction,

2. residential risk exposure versus mobile home risk exposure,

3. in general, inland counties versus coastal counties, and

4. in general, northern counties versus southern counties.

Audit

1. Forms A-6, A-7, and A-8 will be reviewed.

2. The modeler will be required to justify the following:
   a. Changes from the prior submission of greater than five percent in weighted average loss costs for any county.
   b. Changes from the prior submission of five percent or less in weighted average loss costs for any county.

3. Output ranges will be reviewed to ensure appropriate differentials among deductibles, coverage, and construction types.

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

Pre-Visit Letter

24. A-10, Disclosure 1, page 130 – Expand on the process used to develop Table 12.

25. A-10, Disclosure 3, page 131 – Discuss the large increases and large decreases in loss costs in the counties listed caused by a change in the stochastic catalog.

26. [This question is under Standard A-6]
27. [This question is under Standard A-6]
28. [This question is under Standard A-6]

29. Form A-6, page 147 – Explain the multiple instances of repeated ZIP Codes in Table 16 and compare this situation to last year's table.

30. Form A-6, pages 175-184 – Explain the 0.0% weighted average loss cost where values are given for low and high for Condo Owners Frame and Condo Owners Masonry.

31. Form A-7, page 187 – Provide a description of the individual causes for the changes, specifically for zero deductible output ranges for each of the following listed below. Include in the description the effects on each of the output ranges of the changes in contents/building relationships listed on page 130 (third bullet item under A-10, Disclosure 2).
    - Frame Owners – Structure
    - Frame Owners – Contents
    - Frame Owners – ALE
    - Masonry Owners – ALE
    - Frame Renters – Contents
    - Frame Renters – ALE

Verified: YES

Professional Team Comments:

Reviewed individual changes in the model contributing to the changes in loss costs.

Verified zero weighted average ZIP Codes. Reviewed the process used to generate Table 12, page 130, county weighted average loss costs for masonry and frame.

Reviewed the multiple instances of repeated ZIP Codes with zero weight in the output ranges provided in Table 16, page 147. A revised table will be provided with the duplicates removed.

Reviewed counties having an increase of greater than 10% due to the change in the distribution of landfall frequency. Reviewed all counties in one area in the Florida panhandle. Reviewed plot of the central pressure distribution for segments 19-20, 2007 versus 2006.

Reviewed counties having a decrease of greater than 10% due to the change in landfall frequency or severity.

Reviewed the 0% weighted average loss costs given for low and high for condo owners frame and condo owners masonry due to no exposure in the ZIP Code.

Reviewed comparisons of Form A-7, Percentage Change in Output Ranges, with demand surge included and without demand surge included.

Reviewed comparison of frequency by intensity 2007 versus 2006 for major storms and the percentage difference in output ranges and reasons for the differences.

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 agreement using currently accepted scientific and statistical methods.

Audit

1. Forms S-1 and S-2 will be reviewed.

2. The modeler's characterization of uncertainty for wind speed, damage estimates, annual loss, and loss costs will be reviewed.

Pre-Visit Letter

32. S-1, Disclosure 3, page 195 – Describe how Figure 49 relates to this Disclosure and to other relevant information.

33. S-1, Disclosure 5, pages 196-197 – Elaborate on the response to this Disclosure.

Verified: YES

Professional Team Comments:

Reviewed sources of historical data. Table 17 on page 195 will be updated to include Rmax and best track data sets.

Reviewed data sets in support of Rmax model.

Reviewed three updates to stochastic model (annual frequency, location, and intensity) and the absence of updates to Rmax. Reviewed fits for central pressure at various landfall segments.

Reviewed wind field validation examples.

Reviewed insurance company data.

Reviewed uncertainty in output ranges. Reviewed the coefficient of variation plotted by region.

Reviewed results in Figure 52 of historical and simulated hurricanes landfalling in SE Florida. The year for simulated storms in Figure 52 on page 198 will be corrected.

S-2 Sensitivity Analysis for Model Output

The modeler 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 and have taken appropriate action.

Audit

1. The modeler'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-5 will be reviewed for models submitted by modeling organizations which have not previously provided the Commission with this analysis.

Pre-Visit Letter

34. S-2, Disclosure 5, page 203 – Provide evidence (i.e., computer code, etc.) to assure that the model version used to produce the output ranges does not incorporate the near term stochastic catalog referenced under Disclosure 5.

Verified: YES

Professional Team Comments:

Reviewed Rmax model. Wording on the distribution of Rmax winds in S-2.1, page 201, will be rephrased.

Verified that the near term stochastic catalog is not included for Commission results. A statement attesting that the output ranges were not produced using the near term stochastic catalog will be added to the response for S-2.5 on page 203.

S-3 Uncertainty Analysis for Model Output

The modeler shall have performed an uncertainty analysis on the temporal and spatial outputs of the model using currently accepted scientific and statistical methods 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 modeler'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-5 will be reviewed for models submitted by modeling organizations which have not previously provided the Commission with this analysis.

Verified: YES

Professional Team Comments:

Reviewed uncertainty associated with gradient wind conversion factor and recent research in this area.

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

35. S-4, Disclosure 1, page 207 – What is meant by "constrained"?

Verified: YES

Professional Team Comments:

Reviewed constrained Monte Carlo simulation approach.

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 modeler. This Standard applies separately to personal residential and, to the extent data are available, to mobile homes. 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.

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 wind field applied to a particular hurricane for the purpose of validation and the wind field used in the model under consideration,
   h. The type of property used in each hurricane to address:
      i. Personal versus commercial
      ii. Residential structures
      iii. Mobile homes
      iv. Condominiums
      v. Structures only
      vi. 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-3 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.

Pre-Visit Letter

36. S-5, Disclosure 1, page 208 – Are there some comparisons with the recent storms? Storms from 2004 were mentioned last year.

37. S-5, Disclosure 1, page 209 – Discuss changes in the Modeled Loss column of Table 18 considering demand surge has been added.

Verified: YES

Professional Team Comments:

Reviewed changes to modeled losses in light of inclusion of demand surge.

Reviewed comparisons of actual to modeled losses from 2004 storms.

Reviewed validation comparisons provided in Form S-3.

Reviewed results provided in revised Table 18 (page 209), actual versus modeled losses for eight storms and five companies that will be included in the revised submission. Reviewed results provided in Table 19 (page 210) of actual versus modeled losses by Coverage. Reviewed additional comparisons not provided in this year's submission to the Commission.

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-4 will be reviewed.

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

Verified: YES

Professional Team Comments:

Reviewed changes in Form S-4 from last year.

COMPUTER STANDARDS – Paul Fishwick, Leader

C-1 Documentation

A. The modeler shall maintain a primary document binder, containing a complete set of documents specifying the model structure, detailed software description, and functionality. Development of each section shall be indicative of accepted software engineering practices.

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

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

Audit

1. The primary document binder, in either electronic or physical form, and its maintenance process will be reviewed. The binder shall contain fully documented sections for each Computer Standard.

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

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

4. Modeler personnel, or their designated proxies, responsible for each aspect of the software (i.e. user interface, quality assurance, engineering, actuarial) 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 the source code.

Pre-Visit Letter

38. Provide material cited as available for review by the Professional Team under C-1 (page 223), C-2 (page 224), C-3 (page 225), C-5 (pages 228-229), and C-6 (page 231).

39. C-1, page 223 – Provide documentation on all code and data relating to G-1, Disclosure 5.

Verified: YES

Professional Team Comments:

Reviewed the following documentation:

- Primary document binder
- CLASIC/2™ Manual – Version 8.0
- UNICEDE®/px Data Exchange Format – Preparer's Guide

- Glossary
- CLASIC/2™ User's Guide

Reviewed an embedded objects document explaining the 3-step creation of Form A-5 using SQL and Excel.

Reviewed documentation on the demand surge implementation and the update to the contents vulnerability function.

C-2 Requirements

The modeler shall maintain a complete set of requirements for each software component as well as for each database or data file accessed by a component.

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

38. Provide material cited as available for review by the Professional Team under C-2 (page 224)

40. C-2, page 224 – Provide documentation on the new requirements indicated by G-1, Disclosure 5.

Verified: YES

Professional Team Comments:

Reviewed the requirements binder containing:

- Demand Surge Requirements
- CLASIC/2™ Requirements Summary
- CLASIC/2™ User Interface – System Requirements and Specifications

Reviewed requirements for demand surge and contents vulnerability modification.

C-3 Model Architecture and Component Design

The modeler shall maintain and document (1) detailed control and data flow diagrams and interface specifications for each software component, and (2) schema definitions for each database and data file. 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.

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

Pre-Visit Letter

38. Provide material cited as available for review by the Professional Team under C-3 (page 225)

41. C-3, page 225 – Describe how the items in G-1, Disclosure 5 are reflected in changes to the model architecture and component design.

Verified: YES

Professional Team Comments:

Reviewed high level flowchart for demand surge.

Reviewed UNICEDE®/px Data Exchange Format – Preparer's Guide – Version 8 for formatting data used as an input to the model.

Reviewed the model architecture and component design binder containing:

- CLASIC/2™ Architecture Overview
- CLASIC/2™ Business Layer
- CLASIC/2™ Database Reference Manual

C-4 Implementation

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

B. The modeler 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 modeler 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.

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: component name, date created, dates modified and by whom, purpose or function of the component, and 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.

Pre-Visit Letter

42. C-4, pages 226-227 – Show the modified code implementation resulting from the changes in G-1, Disclosure 5.

Verified: YES

Professional Team Comments:

Reviewed code used to create and format Form A-5.

Reviewed code associated with landfall intensity.

Reviewed code for determining maximum storm intensity over water at landfall.

Reviewed code for calculating wind speed from central pressure for symmetric and asymmetric components, including revised glossary, comments in the code, and a more effective method of reporting range bound errors.

Reviewed the query processing code in SQL used for creating the distribution of hurricanes by size of loss (Form A-5).

Reviewed the formulas used to create Form V-3 from Form V-2.

Reviewed the implementation of demand surge calculation.

Reviewed the implementation binder containing:

- HURSIM – Data files
- Demand surge validation and implementation
- Data files for validation and calculation of demand surge
- Model 21 technical overview
- Fortran catalog generation line count
- Fortran physical properties line count
- Fortran ZIP all line count
- Datafile converter line count
- CLASIC/2™ engine and Model 21 line counts
- Fortran coding guidelines
- C++/COM coding guidelines
- C#/.Net coding guidelines
- Technical documentation guidelines

C-5 Verification

A. General

For each component, the modeler shall maintain procedures for verification, such as code inspections, reviews, calculation crosschecks, and walkthroughs, sufficient to demonstrate code correctness.

B. Component Testing

1. The modeler 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 modeler shall use testing software to assist in documenting and analyzing all databases and data files accessed by components.

2. The modeler 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 modeler will be reviewed.

3. The component (unit, regression, aggregation) and data test processes and documentation will be reviewed.

Pre-Visit Letter

38. Provide material cited as available for review by the Professional Team under C-5 (pages 228-229)

43. C-5, pages 228-229 – Describe the code and data testing and verification procedures resulting from the changes in G-1, Disclosure 5.

Verified: YES

Professional Team Comments:

Reviewed error bounds checking procedure associated with wind speed calculation.

Reviewed an Excel spreadsheet confirming the minimum wind speed at which damage occurs.

Reviewed dual implementation in Fortran and C++ for research code porting.

Reviewed the modeler's use of CXXTest for unit tests and SilkTest for graphical user interface testing.

Reviewed the verification binder containing:

- Model 21 basic QA test cases
- Model 21 final QA test cases
- CLASIC/2™ QA test tools
- Demand surge test plan
- CLASIC/2™ UNICEDE®/px import test plan
- Installation test plan
- Model 21 range reports basic test plan

C-6 Model Maintenance and Revision

A. The modeler 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 shall result in a new model version number.

C. The modeler shall use tracking software to identify all errors, as well as modifications to code, data, and documentation.

Audit

1. All policies and procedures used to maintain the code, data, and documentation will be reviewed. For each component in the system decomposition, the modeler should provide the installation date under configuration control, the current version number, 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.

Pre-Visit Letter

38. Provide material cited as available for review by the Professional Team under C-6 (page 231)

44. C-6, pages 230-231 – Describe how the changes in G-1, Disclosure 5 are reflected by the requirements for this Standard.

Verified: YES

Professional Team Comments:

Reviewed the improved and expanded use of Visual SourceSafe (VSS) for control of code and data.

Reviewed the method for distinguishing between development and release areas within VSS.

Reviewed the new policy for model maintenance and revision.

Reviewed the model maintenance and revision binder containing:

- Model and software revisions and versioning

C-7 Security

The modeler 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:

Reviewed administrator restricted access for Visual SourceSafe (VSS).

Reviewed new method of recovering model documentation, data, and code components in the event of a catastrophe.

Reviewed the security binder containing the AIR code, data, and documentation security policy.