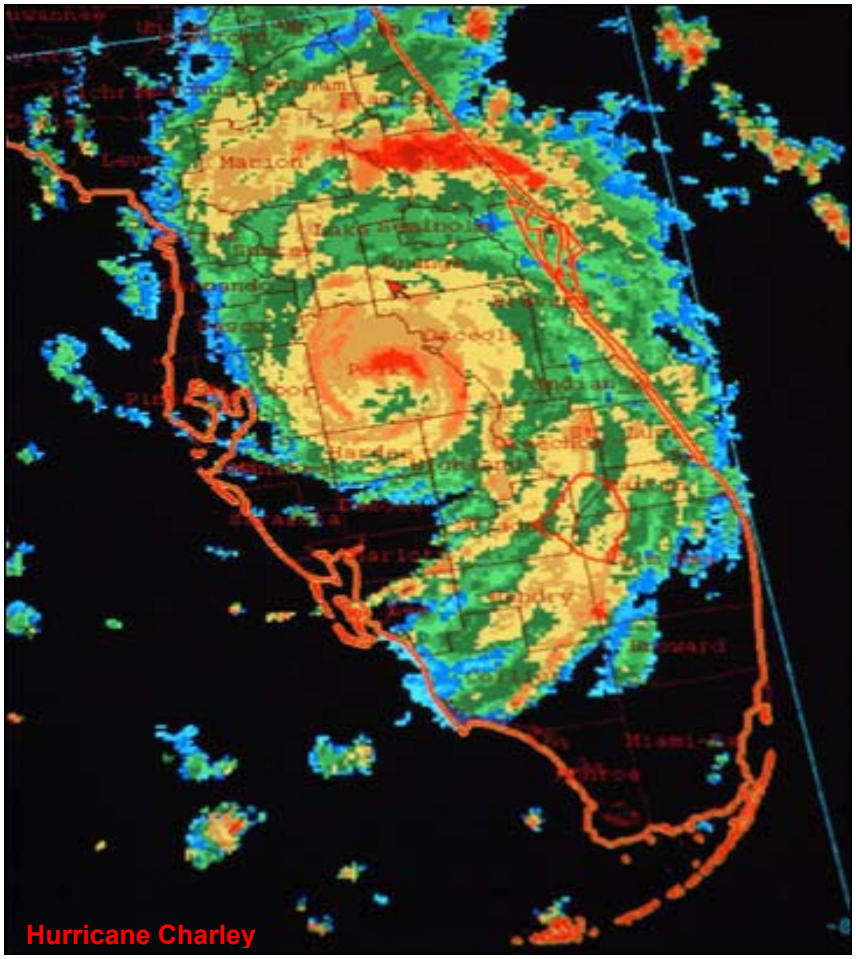
Florida Commission on Hurricane Loss Projection Methodology



Professional Team Report
2004 Standards

Risk Management Solutions, Inc.

On-Site Review
April 7 – 8, 2005

Additional Verification Review
May 24, 2005

On April 7-9, 2005, the Professional Team visited on-site at Risk Management Solutions, Inc. (RMS) in Newark, California. The following people participated in the review.

RMS

Richard R. Anderson, FCAS, MAAA, Chief Actuary, Actuarial and Financial Modeling
Munish Arora, M.S., Engineering Analyst, Model Development Operations
Kyle A. Beatty, Manager, Technical Marketing and Catastrophe Response
Auguste Boissonnade, Ph.D., Vice President, Model Development, Weather Risk
Michael Drayton, Ph.D. – Consultant, Director, Three Letters Ltd.
Uday K. Eyunni, Lead Software Engineer, Catastrophe Applications, RiskLink Product Development
Jason Lin, Ph.D., Lead Wind Engineer, Product Development
Guy C. Morrow, S.E., Vice President, Model Development
Rohit Prakash Mehta, Senior Engineer, Model Development and Implementation
Hemant Nagpal, Engineering Analyst, Model Development Operations
Mohsen Rahnama, Ph.D., Vice President – Engineering & Model Development, Product Development
John Reiter, Vice President, RiskLink Software Development, Catastrophe Applications, RiskLink Product Development
Mohan P. Sharma, Ph.D., Lead Engineer, Global Risk Modeling
Rajesh K. Singh, Ph.D., P.E., Lead Engineer, Model Development Operations
Pane Stojanovski, Ph.D., Vice President, Model Development Operations
Jim Tomcik, Vice President Catastrophe Applications, Product Quality & Release Management
Michael Young, M.E.Sc., P.E., Lead Wind Vulnerability Engineer, Product Development

Professional Team

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

The review began with introductions and an overview of the audit process. RMS gave a presentation highlighting the hurricane risk model components and outlining the model changes since the February 2004 submission and the associated effects on loss costs. Some of this presentation will be given to the Commission in June. Changes to the model components since the previous submission are:

- Update to the mobile home vulnerability curves
- Definition of an event
- Updated land use land cover dataset
- Updated roughness calculations
- Changes in Variable Resolution Grid aggregation to ZIP

Discussed and reviewed corrections to be made to the submission that will be provided to the Commission prior to the June 1-3, 2005 meetings.

- Page 39, G-2.2A, Table 3 revised to include credentials for Mr. Charles Neumann.
- Page 83, M-2, revised response to clarify models found acceptable by the FCHLPM.
- Pages 94-95, revised response to M-5A and corrected Figure 7 to include new land use land cover data.
- Page 102, Form M-2, Figures 10 & 11 legend revised with a low isotach range of 40 mph.
- Pages 119-120, Form V-2, revised for correct mitigated structure values.
- Page 251, S-5, revised Figure 37.

With one exception (Standard M-1), the Professional Team verified all of the Standards, contingent upon additional documentation provided to the Commission. With regards to Standard M-1, the following is relevant.

In the RMS submission (page 81), the response to M-1.2 states:

> "The set of historic hurricanes used in development of RMS' U.S. Hurricane model includes the same set of hurricanes and landfall parameters specified by the Commission in the November 1, 2003 Report of Activities."

This date was not deemed a deficiency since the date was disclosed.

Audit item 1, Report of Activities as of November 1, 2004 states:

> "Failure to update the hurricane set to the most recent year is not acceptable."

The Pre-Visit Letter states:

> "M-1.2, page 81 – Confirm the date of the Commission storm set used."

RMS made a compelling, pragmatic case regarding their implementation of the November 1, 2003 Official Storm Set.

* *

Additional Verification Review – May 24, 2005

Risk Management Solutions, Inc. (RMS) submitted corrections to the RMS model submission under the 2004 Standards on May 6, 2005. The submission was updated to include the 2003 hurricane season and corrected for other issues identified during the Professional Team's initial on-site review.

A conference call was held on May 24, 2005 among a subset of the Professional Team, RMS, and SBA staff. On the basis of this review, **all Standards are now verified**.

The following people participated in the additional verification review:

RMS

Richard R. Anderson, FCAS, MAAA, Chief Actuary, Actuarial and Financial Modeling
Kyle A. Beatty, Manager, Technical Marketing and Catastrophe Response
Guy C. Morrow, S.E., Vice President, Model Development
Rohit Prakash Mehta, Senior Engineer, Model Development and Implementation

John Reiter, Vice President, RiskLink Software Development, Catastrophe Applications, RiskLink Product Development
Pane Stojanovski, Ph.D., Vice President, Model Development Operations

Professional Team

Mark Johnson, Ph.D., Statistician, Team Leader
Marty Simons, ACAS, Actuary
Masoud Zadeh, Ph.D., P.E., Structural Engineer
Anne Bert, Staff
Donna Sirmons, Staff

Report on Deficiencies

The Professional Team reviewed the following deficiencies cited by the Commission at the March 10 & 11, 2005 meetings. All deficiencies were corrected by the established time frame and have been verified. A copy of the revised submission pages, with the revisions made to the original submission highlighted, is enclosed with this report.

1. References. There are numerous places in the submission in which cited material is incomplete (e.g., publication dates). In particular:
   G-1. Disclosure 2. Page 16. Neumann reference cited as 1998 but not in reference list on page 30 (Neumann, 1999 does appear).
   G-1. Disclosure 4. Page 34. Sparks reference.

   Revised page 16 submitted with Neumann reference citation corrected.
   Revised page 34 submitted with Sparks reference removed.

2. G-2. Disclosure 1.G. Table 2. Page 38. Mix of Company Clients for 1998 is missing.

   Revised page 38 submitted with a revised Table 2 showing only the Mix of Company Clients for 2004.

3. G-2. Disclosure 2.A. There are mistakes or missing information in Tables 3-6, pages 39-43 and inconsistencies with Table 8, page 62 (e.g., credentials for several of the consultants; highest degree and university; several new employees have been with RMS for more than one year; error with Liang Zhang; William Andrew Wheeler in Table 7; Michael Drayton's status in Table 8.)

   Revised pages 39-43 submitted with corrections and missing information on new employees working on the model that are new to the company and/or new to the project provided in Tables 3-7.

4. G-2. Disclosure 2.C. Page 61. Names missing from Figure 5.

   Revised page 61 submitted with names provided in Figure 5 and text added to clarify which personnel listed in Tables 3-7 are related to model design, testing, execution, maintenance, and decision-making.

5. G-2. Disclosure 3.A. Pages 62-64. Provide the dates of the peer reviews.

   Revised pages 62-64 submitted with the dates provided for the peer reviews.

6. G-4. Disclosure 1. Page 67. Disclose those conversion factors that are relevant to this submission. A specific reference for such conversion factors is required.

   Revised page 67 submitted providing the conversion factors relevant to the submission along with a reference for each.

7. Forms G-1 through G-6, pages 69-79. The certifications must be related to RiskLink version 4.5a. The model and version name on each form should be given as RiskLink version 4.5a.

Revised pages 69-79, Forms G-1 through G-6 submitted with the correct reference to the model and version number submitted for compliance with the 2004 Standards.

8. M-2. Disclosure 3. Page 85. Justify the spatial variation of the conversion factors. (Note, the text of the disclosure does not match the current Report of Activities.)

   Revised page 85 submitted providing justification for the spatial variation of the conversion factors.

9. Form V-2. Page 119. Form is not completed for masonry Wall-Floor strength.

   Revised page 119 (first page of Form V-2) submitted providing missing information for masonry Wall-Floor strength mitigation measures.

10. A-6. Disclosure 2. Page 136. Non-responsive to second sentence of disclosure.

    Revised page 136 submitted with additional text provided.

11. A-8. Disclosure 2. Page 141. Non-responsive to second sentence of disclosure.

    Revised page 141 submitted with additional text provided.

12. Form A-3. Figures 19-21. Pages 151-153. There are exposures in some of the ZIP Codes colored as No Exposure (e.g., Monroe County).

    Revised pages 151-153 submitted with loss costs for ZIP Codes previously colored as No Exposure.

GENERAL STANDARDS – Mark Johnson, Leader

G-1 Scope of the Computer Model and Its Implementation

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. 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 will be reviewed.

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

Pre-Visit Letter

1. G-1.2, page 17 – It appears as though some of the Figure 2 simulated "Type2" hurricane tracks do not correspond to the Type 2 definition given on page 16. Be prepared to explain.

2. G-1.2, page 18 – How many storms in the stochastic set impact adjacent states?

3. G-1.2, page 22 – Be prepared to discuss the applicability of the log law in the hurricane environment.

4. G-1.2, pages 22-23 & 26 – Provide the conversion factor for converting 10-minute sustained wind speed to 3- second peak gust wind speed.

5. G-1.2, page 23 – Describe the ALE vulnerability development.

6. G-1.2, page 23 – Which combination in Table 1 provides the 26 combinations?

7. G-1.2, page 24 – Does the beta distribution apply to the new mobile home vulnerability functions?

Verified: YES

Professional Team Comments:

Reviewed the program that calculates wind speeds, the input file for the variable resolution grid cells, and how the files are used for updating the roughness factors.

Reviewed the simulated tracks for Type 2 hurricanes in Figure 2.

Reviewed the number of storms in the stochastic set that impact adjacent states.

Reviewed the 26 building vulnerability classes provided in Table 1 including the construction class, building material, number of stories, and occupancy and the weighting factor used for any unknown cases.

G-2 Qualifications of Modeler Personnel and Independent Experts

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

B. The model or any modifications to an accepted model shall be reviewed by either modeler personnel or independent experts 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 independent experts 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 will be reviewed.

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

Verified: **YES~~, Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed resumes of modeler personnel new to RMS or to work on the model:

- Munish Arora, B. Tech, M.S., Master of Planning, School of Planning and Architecture, New Delhi; B. Tech – GRDSP, Guru Nanak Dev University, Amritsar
- Arundhati Nilesh Bopardikar, Master in Computer Science and Economics
- Prasad V S K Gunturi, Master of Engineering in Earthquake Engineering (Structural Dynamics), Indian Institute of Technology, Roorkee, India; Bachelor of Engineering in Civil Engineering, Andhra University, India
- Sherry Huang, BA in Economics and Statistics, University of California at Berkeley, CA
- Sridhar Iyer, MS Computer Science, West Virginia University; BE Mechanical Engineering, Regional Engineering College, Trichy, India
- Vikrant Kalhan, Master of Computer Applications (MCS), Institute of Management Technology, Ghaziabad, India; BCS University of Poona, Pune, India; ISC, La-Martiniere College, Lucknow, India
- Philip D. LeGrone, P.E., CSP, BS, Industrial & Systems Engineering, University of Florida, December 1988
- Hemant Nagpal, BE Civil Examination, Delhi College of Engineering, Delhi, India
- Terrance Ng, Master of Science, Computer Science, University of Illinois at Chicago; BS Computer Science, Illinois Institute of Technology, Illinois
- Pooja Sayal, BE, University of Delhi; AISSCE, CBSE Delhi; AISSE, CBSE, Delhi
- Rajesh K. Singh, Ph.D., P.E., Stanford University; Masters from University of British Columbia; Bachelors from IIT, Kanpur. Focus of academic research was on numerical modeling of nonlinear dynamics of very large structural systems and finite element modeling of nonlinear fluid flow in stenosed arteries.
- James Stephen Tomcik, BS Computer Science, University of Akron
- Andrew Wheeler, BS Mathematics, Portland State University, Portland, OR

Reviewed the independent peer reviews of the model and their relevancy to the current submission.

Revised response to G-2.2A, Table 3 to include credentials for Mr. Charles Neumann to be provided to the Commission.

Revised response to G-2.2.A, Table 3, page 39 received and reviewed by the Professional Team.

Revised Forms G-1, G-2, G-3 and G-5 with updated signatures after revisions are made to the submission to be provided to the Commission.

Revised Forms G-1 through G-6, pages 69-79 in the revised submission received and reviewed by the Professional Team.

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

8. G.3.B, page 66 – Describe the way in which exposures are distributed across the ZIP.

Verified: YES

Professional Team Comments:

Reviewed the process for calculating exposure, wind speeds, and loss for each storm in the stochastic storm set by using a variable resolution grid methodology.

Reviewed application of the variable resolution grid methodology to the new land use land cover database.

G-4 Units of Measurement

A. All units of measurement for model inputs and outputs shall be clearly identified.

B. All model outputs of length, wind speed, and pressure shall be in units of statute miles, statute miles per hour, and millibars, respectively.

C. Wind inputs to the damage function shall be in units consistent with currently used wind measurement units and/or shall be converted using standard meteorological/engineering conversion factors.

Audit

The appropriateness and accuracy of the measurements, conversion factors, and techniques will be reviewed.

Verified: YES

Professional Team Comments:

Verified appropriate units of measurement used throughout the submission and exhibits.

G-5 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. Relationships within the model among the meteorological, vulnerability, and actuarial components shall be reasonable.

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.

Pre-Visit Letter

9. G-5, page 68 – Be prepared to show supporting material, especially for wind field and vulnerability functions.

Verified: YES

Professional Team Comments:

The independence of the meteorology, vulnerability, and actuarial components was verified and their theoretical soundness was discerned in the course of the review.

Reviewed model changes relevant to hurricane event definition and model wind field specification. Verified the use of model-generated winds in loss calculations for historical storms.

METEOROLOGICAL STANDARDS – Jenni Evans, Leader

M-1 Official Hurricane Set*

*(*Significant Revision)*

For landfall frequency analyses, the modeler shall use the latest updated Official Hurricane Set. Updates to HURDAT approved by the Tropical Prediction Center/National Hurricane Center are acceptable modifications to the Official Hurricane Set. Additional information from the National Hurricane Center or from peer reviewed atmospheric science literature can be used to justify modifications to the Official Hurricane Set.

Audit

1. The modeler will provide the hurricane set used. Failure to update the hurricane set to the most recent year is not acceptable. For revisions to HURDAT, only complete incremental revisions are acceptable.

2. The additional information from the National Hurricane Center or from peer reviewed atmospheric science literature will be reviewed.

Pre-Visit Letter

10. M-1.2, page 81 – Confirm the date of the Commission storm set used.

Verified: ~~No~~ YES

Professional Team Comments:

Verified that the dates provided in the modeler's submission are consistent with the implementation in the model.

The modeler's hurricane set does not include 2003.

Discussed the implications of adding a year of no storms immediately prior to a year of four new storms.

Additional Verification Review Comments:

Verified RMS has now updated the stochastic hurricane set for 2003.

Revisions were made on page 16 to clarify language for Type 2 storms.
Revisions were made to the dates provided on pages 81 and 231 to show the inclusion of the 2003 hurricane season.

M-2 Hurricane Characteristics*

*(*Significant Revision)*

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, and the spatial and time variant wind fields, shall be based on information documented by currently accepted scientific literature or modeler information accepted by the Commission.

Audit

1. Identify all of the hurricane characteristics used in the model. For hurricane characteristics modeled as random variables describe the probability distributions used.

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. The modeler will present time-based contour animations (capable of being paused) of wind and pressure fields 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.

6. Map the location of the peak hurricane intensity compared to the western most point of a random selection of recurving storm tracks for hurricanes effecting Florida.

7. All modeler-specific scientific literature provided in Disclosure 9 will be reviewed to determine acceptability.

Pre-Visit Letter

11. M-2.4, page 85 – Be prepared to discuss the conversion from sustained winds to gusts, including the treatment of inherent uncertainties.

Verified: **YES~~, Contingent upon additional documentation provided to the Commission~~** **Additional documentation received**

Professional Team Comments:

Verified no change in the set of hurricane characteristics used in the model from the previous year.

Reviewed variation of gradient to surface wind speed reduction across storm as it relates to Florida.

Reviewed the 10-minute sustained wind speeds aloft conversion to 3-second peak gusts at 10-meter and the relationship with the roughness and gust factors.

Documentation reviewed:
- Cook, N.J. (1985), The Designer's Guide to Wind Loading of Building Structures. Building Research Establishment Report, Butterworths, London, England
- Cook, N.J. (2003), Report to Modeler (see M-5)
- Modeler documents describing roughness methodology

Reviewed Mark DeMaria's data containing radius to hurricane winds by quadrant.

Reviewed asymmetric nature of moving hurricane.

Reviewed the uncertainties associated with the conversion of gradient winds to surface winds.

Reviewed surface roughness classes and roughness lengths applied to the model estimates of peak gust winds (3 seconds) at 10-meter elevation.

Reviewed graphical representation of modeled surface roughness effects comparing the impact of surface roughness versus one-minute mean and gust wind speed.

Reviewed example calculations of the gust factor.

Revised response to Standard M-2 to be provided to the Commission.

Revised response to M-2, page 83 received and reviewed by the Professional Team.

Additional Verification Review Comments:

Reviewed revised Figure 6 with updated landfall counts after inclusion of the 2003 hurricane season.

M-3 Landfall Intensity*

*(*Significant Revision)*

Models shall use maximum one-minute sustained 10-meter wind speed when defining hurricane landfall intensity. This applies both to the Official Hurricane 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

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

Pre-Visit Letter

12. M-3.2, page 91 – Clarify whether bypassing storms (i) must result in hurricane-force winds over land or (ii) achieve an intensity over water of Cat 1 or more.

Verified: YES

Professional Team Comments:

Reviewed the method used to define a model event, including the handling of bypassing storms.

Reviewed spatial distribution of hurricane landfall intensity.

M-4 Hurricane Probabilities*

*(*Significant Revision)*

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

B. Modeled hurricane probabilities shall reasonably reflect the Official Hurricane Set through 2003 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. 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 and landfall angles.

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. Demonstrate the goodness-of-fit of distributions to historical hurricane characteristics.

6. Provide the source documents or any research performed to develop the functions used for simulating model variables or databases.

Verified: YES

Professional Team Comments:

Reviewed the handling of by-passing storms.

Reviewed the difference in historical and modeled storms provided in Form M-1. Compared Form data with 2003 submission.

Reviewed random-walk technique and the classification of historical storms into five types depending on the storm's formation point and track.

Additional Verification Review Comments:

Reviewed revised Form M-1 with updated modeled rates after inclusion of the 2003 hurricane season.

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 reasonable in comparison to 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 historical Florida hurricanes and to weakening rates 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

13. M-5, page 94 – Provide the four documents listed in Dr. Cook's letter on page 279 for our review.

14. M-5.5, page 97 – Discuss whether the over-land decay rate is the same for all stochastic storms.

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed documentation:

- Treatment of roughness in the RMS US Hurricane Model – Overview
- US HU ground roughness classification schemes and associated roughness lengths
- Roughness sampling tool description
- UD HU surface roughness database
- ASTER User Handbook, NASA

Reviewed plot of modeled wind speed degradation rates compared to Kaplan-DeMaria over time.

Reviewed the process for implementing and validating the new land use land cover data used in the model. Reviewed examples comparing the National Land Cover Data (USGS), the Florida Water Management District data, and the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) satellite imagery data with aerial photographs. Reviewed the decision-making process RMS used in selecting ASTER satellite imagery to update the land use data in the model.

Reviewed quality control of new land use land cover data as it was implemented in the model.

Reviewed comparison of the impact of the previous and new land use land cover datasets on winds over Florida for an example stochastic storm. Reviewed difference map of winds between these plots. Reviewed these plots compared to "over water" equivalent for storm.

Reviewed in detail Form M-2 and the differences between the historical storm set and the stochastic model.

Revised Form M-2 with legend corrected for low range isotach value of 40 mph to be provided to the Commission.

Revised Form M-2, page 102 received and reviewed by the Professional Team.

Revised response to M-5A with corrected Figure 7 to be provided to the Commission.

Revised response to M-5.A, page 94 and Figure 7, page 95 received and reviewed by the Professional Team.

Additional Verification Review Comments:

Reviewed revised Form M-2 with updated stochastic one-minute wind speed reflected in maps.

M-6 Logical Relationships of Hurricane Characteristics*

*(*Significant Revision due to Form M-3)*

A. The radius of maximum winds shall reflect historical hurricane characteristics.

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

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

Audit

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

Verified: YES

Professional Team Comments:

Reviewed Form M-3 table and Figure 12 and how Rmax is handled in the model.

Reviewed variation of Rmax with latitude in Florida.

VULNERABILITY STANDARDS – Masoud Zadeh, Leader

V-1 Derivation of Vulnerability Functions*

*(*Significant Revision due to Form V-1)*

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 reasonable and be theoretically sound.

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. Describe how the duration of wind speeds at a particular location over the life of a hurricane is considered.

8. Form V-1 will be reviewed.

Pre-Visit Letter

Be prepared to explain in detail the revised mobile home vulnerability functions.

15. V-1, page 105 – Be prepared to discuss and show documents indicating how the vulnerability functions for building structures, mobile homes, appurtenant structures, contents, and additional living expense are derived.

16. V-1.B, page 105 – Be prepared to show how vulnerability functions were derived with supporting documents. Also how you developed "average" buildings.

17. V-1.E, page 106 – Show support for year modifiers for structure, content and ALE.

18. V-1.1, page 108 – Be prepared to show supporting material from a complete cycle of the flow chart for deriving and implementing of vulnerability functions, including the "basic vulnerability functions", calibration, and validation, and use of industry data.

19. V-1.5, page 113 – How many residential classes and what are they (which combinations of Table 13). Show, if any, vulnerability functions for renters, owners, and condos.

20. V-1.6, page 114 – 3-sec peak gust is input to vulnerability functions, here it is in one-minute sustained. Show how 3-sec peak gust is converted to 1-minute sustained.

23. Form V-1, page 117 – Please explain the relative closeness of estimated damages in Part B for the wood frame and the mobile home categories.

Verified: YES

Professional Team Comments:

RMS provided a review of their vulnerability/damage assessment module including the following.

Reviewed in detail the development of the vulnerability functions and examined the process for the updates to the mobile home vulnerability functions.

Documentation reviewed:

- Vulnerability Function Development Flowchart
- Loss Data Binder #1 with claims data from Hurricanes Andrew, Hugo, Fran, and Georges, the procedures for processing and validating the claims data
- Claims data from Hurricanes Charley, Frances and Jeanne and validation process
- J. H. Wiggins Company (1980), Assessment of Damageability for Existing Buildings in a Natural Hazards Environment, Volume 1: Methodology, Prepared for The National Science Foundation, Washington, D.C. Technical Report No. 80-1332-1.

Reviewed plots of new mobile home vulnerability curves compared to previous curves and the data points from actual claims damage from Charley, Frances, and Jeanne.

Reviewed implementation of new curves in the model.

Reviewed vulnerability curves for different construction types and contents.

Reviewed the results in Form V-1 including an explanation of the wood frame and mobile home estimated damage percentages.

Reviewed the process for determining the coefficient of variation and the mean damage ratio.

Reviewed the process for developing the year modifiers applied to the different construction categories.

Reviewed the process and factors for converting from 3-second gust to one-minute sustained winds.

RMS provided a discussion regarding duration of wind speeds.

V-2 Mitigation Measures*

*(*Significant Revision due to Form V-2)*

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 reasonable both individually and in combination.

Audit

1. Form V-2 provides the information used in auditing this Standard.

2. Total effect on damage due to use of multiple mitigation measures will be reviewed and shown to be reasonable. Any variation in the change over the range of wind speeds for individual and multiple mitigation measures will be reviewed and shown to be reasonable.

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

21. V-2.A&B, page 115 – Be prepared to show wall-to-floor-to-foundation strength relation to foundation system.

22. V-2.B, page 115 – Be prepared to show justification why mitigation measures apply only to coefficient of variation of damage estimate.

24. Form V-2, page 119 – Please explain the non-effect of any mitigation measures at the lower percentile ranges, for both wood and masonry base structures.

25. Form V-2, page 119 – Be prepared to support the impacts for braced gable.

26. Form V-2, page 119 – For the mitigated structure cell at the bottom of Form V-2 (structure), define which type of shutters are used.

27. Form V-2, page 120 – Please explain why the overall low damage change for the frame and masonry structures are 2.5% and 3.0%, respectively, when individually, there is no effect of any of the mitigation measures at the low ranges on Figure 15?

Verified: **YES, ~~Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed Form V-2 in detail and the errors made in originally completing the form.

Reviewed the wood frame base structure and foundation modifier definitions including examples of engineered and non-engineered foundations.

Reviewed the application of secondary modifiers to the base vulnerability functions. Reviewed example of secondary modifier functions.

Reviewed graphical representation of individual mitigation measures and their cumulative effect at various wind speeds.

Reviewed procedures used to avoid double-counting the effects of modifiers.

Reviewed documentation of changes to the roof geometry, roof covering, roof anchor, windows, skylights, and roof sheathing modifiers.

For Form V-2, RMS provided the definition of mitigated structure.

Revised Form V-2 with corrected values for mitigated structure to be provided to the Commission.

Revised Form V-2, pages 123-124 received and reviewed by the Professional Team.

ACTUARIAL STANDARDS – Marty Simons, Leader

A-1 Modeled Loss Costs*

*(*New Standard)*

Modeled loss costs shall reflect all damages starting when damage is first caused in Florida from an event modeled as a hurricane at that point in time and will include all subsequent damage in Florida from that event.

Any variations in modeled loss costs shall be justified.

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.

Pre-Visit Letter

28. A-1, page 121 – Be prepared to describe how RMS estimates damage from bypassing storms. Include in the description, examples of storms that reach hurricane strength prior to or subsequent to causing damage in Florida and are not of hurricane strength when damage is caused in Florida. This was a general issue broached at the March 10-11 Commission meeting.

29. A-1.2, page 121 – Describe how the loss costs are affected by storms that reach hurricane strength prior to or subsequent to causing damage in Florida and are not of hurricane strength when damage is caused in Florida. This point also is related to M-3.2 on page 91.

Verified: YES

Professional Team Comments:

Reviewed the definition of an event in the model, the handling of several different bypassing storms, and the handling of multiple events at a single location.

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 reasonable and appropriate.

Audit

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

30. A-2, page 122 – Provide any insurance data obtained since the prior review of the model by the FCHLPM.

31. A-2.6, page 123 – Provide demonstration of how a user would "input the actual cash value instead of the replacement cost value into RiskLink version 4.5a".

Verified: YES

Professional Team Comments:

Verified the only new insurance data obtained and reviewed was the mobile home loss data from Hurricanes Charley, Frances, and Jeanne. This data was used as the basis for updating the mobile home loss cost calculations.

Reviewed the handling of actual cash value and replacement cost in the model.

Reviewed the modeler's investigations and handling of claims procedures used by insurers.

A-3 Loss Cost Projections

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.

C. Loss cost projections shall not explicitly include demand surge.

Audit

1. Demonstrate how the presence of demand surge has been considered in any analysis where Hurricane Andrew losses are used for development or verification of the model or its output. Demonstrate how demand surge is considered in any other data used in the development or verification of the model.

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

Verified: YES

Professional Team Comments:

Reviewed the process for determining and extracting demand surge from insurance claims data from Hurricanes Charley, Frances, and Jeanne. Verified demand surge was not included in the process used to incorporate the claims data when updating and validating the mobile home vulnerability curves.

A-4 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

32. A-4, page 127 – Are population centroids being used?

33. A-4.4, page 128 – Provide examples of validations referenced in this section.

Verified: YES

Professional Team Comments:

Reviewed the input data collection and validation process, claims data and correspondence with the insurance company.

Reviewed the claims data obtained from mobile home losses from Hurricanes Charley, Frances, and Jeanne.

Reviewed claims data from Hurricanes Andrew, Hugo, Fran, and Georges, the procedures for processing and validating the claims data contained in Loss Data Binder #1.

Reviewed examples of how inappropriate values in a portfolio are blocked from further analysis.

Reviewed in-house tool for rules to detect portfolio problems.

A-5 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 friction or roughness increase, all other factors held constant.

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., structures, 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, A-5 and A-6 will be used to assess coverage relationships.

Pre-Visit Letter

37. Form A-4, page 155 – Be prepared to discuss changes in this form from last year.

38. Form A-5, page 157 – Be prepared to discuss changes in this form from last year. Aside from changes from last year, the ZIP Codes included will be discussed.

39. Form A-6, page 169 – Be prepared to discuss changes in this form from last year.

Verified: YES

Professional Team Comments:

Reviewed the differences in Forms A-4, A-5, and A-6 from last year and the reasons for each of those differences.

Additional Verification Review Comments:

Reviewed revised Form A-2 with updated loss costs, revised Form A-3 with updated loss costs reflected in the maps, and revised Form A-6 with updated figures for "Expected Annual Hurricane Losses" and "Return Time (Years)" after the inclusion of the 2003 hurricane season.

A-6 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.

Audit

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.

Pre-Visit Letter

34. A-6, page 135 – Whether 2004 insurer claim experience is incorporated in the development, testing or verification of the current model version or not, describe the methods used to account for the implementation of multiple deductibles in the insurers' claim payment historical records for policy periods where more than one hurricane caused damage at a single location. Describe how multiple deductible claim experience in the historical record is included in the projection of future loss costs. Describe any differences between the process used to account for "multiple deductibles" in this submission and the process used in prior submissions.

Verified: YES

Professional Team Comments:

Reviewed the current handling of deductibles in the model and the future plans for updating the model to handle seasonal deductibles. Reviewed the analyses performed on the effect of seasonal deductibles on loss costs.

Verified no change in the methodology for handling deductibles and policy limits.

A-7 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

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 plots of new mobile home contents curves compared to previous curves and the curves from actual claims damage from Charley, Frances, and Jeanne.

Discussed impact of two storms over same location on claims data.

Verified no change in the methodology for handling contents losses.

A-8 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.

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.

Pre-Visit Letter

35. A-8.1, page 140 – Describe how "the impact on ALE losses due to storm surge damage to infrastructure was not excluded in calibrating ALE loss functions". Describe how storm surge damage is otherwise excluded from loss functions.

Verified: YES

Professional Team Comments:

Reviewed mobile home claims data from Hurricanes Charley, Frances, and Jeanne, which included ALE claims data.

Reviewed the impact on ALE losses due to storm surge damage to the infrastructure on developing the ALE vulnerability functions.

Verified no changes were made to the methodology for handling ALE.

A-9 Output Ranges*

*(*Significant Revision)*

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

B. All other factors held constant:

1. ***Output ranges produced by the model shall have a pattern of declining loss costs with increasing deductibles.***
2. ***Output ranges produced by the model shall reflect lower loss costs for masonry construction versus frame construction.***
3. ***Output ranges produced by the model shall reflect lower loss costs for residential risk exposure versus mobile home risk exposure.***
4. ***Output ranges produced by the model shall reflect lower loss costs, in general, for inland counties versus coastal counties.***
5. ***Output ranges produced by the model shall reflect lower loss costs, in general, for northern counties versus southern counties.***
6. ***Output ranges produced by the model shall reflect lower loss costs for contents versus structures.***
7. ***Output ranges produced by the model shall reflect lower loss costs for additional living expense versus structures.***
8. ***Output ranges produced by the model shall be positive and non-zero for all given risk exposures.***

Audit

1. Forms A-7, A-8, and A-9 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

We would also like to review in detail the other major changes since last year.

36. A-9.2, page 144 – Describe the separate contribution to the differences (for each county included in Table 16 on page 145) in the output ranges from those in the prior submission, separately relative to:
    1. updated storm set
    2. updated land use – land cover data
    3. update ZIP Code aggregation method

40. Form A-8, page 225 – Be prepared to discuss this form in detail relative to the changes made in the model.

Verified: YES

Professional Team Comments:

Reviewed changes in loss costs by county other than those caused solely by mobile home revisions and the effect on the loss costs for the changes made in the model – updated storm set, land use and land cover, and ZIP Code aggregation method.

Reviewed details of the effects on loss costs the changes in the model had on several counties provided in Table 16.

Additional Verification Review Comments:

Reviewed revised Forms A-7 and A-8 with updated loss costs and revised Form A-9 with updated loss costs reflected in the maps after the inclusion of the 2003 hurricane season.

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

41. S-1.2, page 231 – Is the frequency distribution based on 1900 to 2002? Although 2004 is not required, 2003 should be. This statement in the submission seems to contradict the statement in M-1, page 81.

42. S-1.5, pages 233-235 – Be prepared to explain Figures 25-27.

44. Form S-2, page 256 – Be prepared to discuss the changes in this form from last year, in particular the increase for all return times but a decrease for the top event.

Verified: YES

Professional Team Comments:

Reviewed the changes in Form S-1 from last year attributed to the change in the definition of an event in the model.

Reviewed the uncertainty in the loss costs due to the uncertainty in the central pressure, Rmax, and translational velocity and the confidence bounds displayed in Figures 25, 26, and 27.

Reviewed in further detail Figures 28, 29, and 30.

Reviewed results provided in Form S-2 compared to last year and the reason for the decrease in the top event.

Additional Verification Review Comments:

Reviewed revised Forms S-1 and S-2 after inclusion of the 2003 hurricane season.

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 new modeling companies which have not previously provided the Commission with this analysis.

Verified: YES

Professional Team Comments:

Reviewed results of the loss cost sensitivity analysis involving central pressure, Rmax, and translational velocity shown in Figures 31, 32, and 33.

Reviewed the relative sensitivities of central pressure, Rmax, and translational velocity in the model.

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 new modeling companies which have not previously provided the Commission with this analysis.

Verified: YES

Professional Team Comments:

Reviewed the results of the uncertainty analysis on loss costs conducted by changing the central pressure, Rmax, translational velocity, and the exponent in the filling rate formula.

S-4 County Level Aggregation*

(Significant Revision due to possible change in loss costs)*

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

Audit

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

43. S-4, page 248 – How does the sampling scheme ensure that the standard error is less than 2.5% of the loss cost estimate.

Verified: YES

Professional Team Comments:

Reviewed the process and results of the sampling of the stochastic storm set using 100,000 years. Reviewed the estimation of the standard error using a 50,000 sample size.

S-5 Replication of Known Hurricane Losses

The model shall reasonably replicate 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:
        a. Personal versus commercial
        b. Residential structures
        c. Mobile homes
        d. Condominiums
        e. Structures only
        f. 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

45. Form S-3, pages 257-258 – We would like to discuss this data in detail.

Verified: **YES~~, Contingent upon additional documentation provided to the Commission~~ Additional documentation received**

Professional Team Comments:

Reviewed graphical comparison of modeled loss versus historical loss including new mobile home claims data from Hurricane Charley provided in Figure 37.

Reviewed the results shown in Form S-3.

Examined historical storms with special attention to the effects of model changes since last year.

Revised Figure 37 to be provided to the Commission.

Revised Figure 37, page 251 received and reviewed by the Professional Team.

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 Form S-4 and determined the explanation of differences from last year appeared reasonable.

Additional Verification Review Comments:

Reviewed revised Form S-4 with updated modeled average annual zero deductible statewide loss costs after inclusion of the 2003 hurricane season.

COMPUTER STANDARDS – Paul Fishwick, Leader

C-1 Documentation*

*(*Significant Revision)*

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.

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.

Verified: YES

Professional Team Comments:

Reviewed the hierarchically-organized, primary document binder in electronic form with sections for each Computer Standard.

Reviewed user documentation.

Verified that the documentation was created, and is maintained separately from the source code.

C-2 Requirements*

*(*Significant Revision)*

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

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.

Verified: YES

Professional Team Comments:

Verified that a complete set of requirements for each software component is maintained. Reviewed documentation of system requirements, user requirements, marketing requirements, and development requirements

Reviewed the requirements documentation for updating and implementing the land use and land cover data changes in the model.

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.

Verified: YES

Professional Team Comments:

Reviewed the internal model architecture and component design documentation.

Traced a stochastic storm wind field calculation from a data flow diagram to the code.

Reviewed control and data flow documentation for roughness sampling.

Reviewed schema definitions for the hazard database.

C-4 Implementation*

*(*Significant Revision)*

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 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 and consistency.

Verified: YES

Professional Team Comments:

Reviewed source code and code metrics used for surface roughness calculation processed with the new ASTER data.

Reviewed the surface roughness software component table, including the component name, number of lines of code, blank lines, and comment lines, the file paths, external creation dates, dates last modified, and the person responsible for the modification.

Reviewed the software component table for a stochastic storm set wind field input into the model.

Reviewed a hierarchical trace from the flow diagram level to the code level for ZIP Code aggregation.

Reviewed coding guidelines for both C++ and FORTRAN codes.

C-5 Verification*

*(*Significant Revision)*

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 components, defining the model.***

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

46. C-5, pages 270-271 – Be prepared to show detailed unit test documentation for testing on each model component, including all aspects of the model (meteorology, actuarial, vulnerability, statistics, user interface, and other components).

Verified: YES

Professional Team Comments:

Reviewed the procedures and process used for making updates to the vulnerability database for mobile homes.

Reviewed the test plan, test data, software validation after each build, and the testing implementation of the mobile home vulnerability curve updates.

Traced a requirement for roughness sampling to the final code, including unit testing.

Reviewed the roughness sampling tool and the logic flowchart for the surface roughness component.

Reviewed a detailed test plan report, including the test case design and implementation.

Reviewed data testing software for unacceptable values for a coverage A data item.

Reviewed a regression test plan between recent builds of RiskLink.

Reviewed an aggregation test at the level of the RiskLink product.

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.

Verified: YES

Professional Team Comments:

Reviewed the policy for revisions made to the model.

Verified that the modeler uses tracking software for code, data, and documentation.

C-7 Security*

*(*Significant Revision)*

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 the policy and procedures ensuring security of the computer code, data, and documentation.

Reviewed anti-virus software and virus protection procedures.

Reviewed procedures for backup, off-site storage, maintenance, security of all documentation, software, data, and computer code.