Catastrophic Risk Planning Model Evaluation

State Farm Filing[1]
with
The Maryland Insurance Administration

Evaluation Performed by

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PART 1. INTRODUCTION

The Maryland Insurance Administration (MIA) contracted with Martin M. Simons, Public Actuarial Consultant to fulfill the requirements of the MIA's Request for Proposal entitled Catastrophic Risk Planning Model Evaluation Consulting Services (Project Number D80R1400004).

1. Scope of Work as contained in the RFP

The Contractor will perform an examination of State Farm's use of catastrophic risk planning models in 2007 and 2010 to describe:

(1) the catastrophe risk planning models used by State Farm during each year, including the strengths and weaknesses of each;

(2) how State Farm used the catastrophe risk planning models, including any similarities and differences between 2007 and 2010;

(3) the data State Farm used to run each of the catastrophe risk planning models, including the limitations of the data and the impact of the data on each model's predicted loss, if any;

(4) the appropriateness of combining the predicted loss of each catastrophe risk planning model in the manner used by State Farm to compare predicted losses and risk by geographic area;

(5) the reasons for the differences in predicted losses and risk by geographic area in 2007 and 2010 and whether these differences indicate a material change in State Farm's risk profile from 2007 to 2010;

(6) the extent to which State Farm included in its risk assessment in 2010 the impact of the mitigation efforts undertaken in 2007 to reduce State Farm's risk profile; and

(7) any other factor(s) the contractor believes is relevant for MIA to consider when determining if State Farm's current intent to non-renew certain risks on the barrier island in Ocean City, Maryland is reasonably related to State Farm's economic and business purposes.

2. Work Plan

The work plan for this assignment has been designed based on Mr. Simons' extensive experience in working with similar issues in Florida, Hawaii, Massachusetts, and in South Carolina.

The work plan consisted of the following parts:

1. Reviewed State Farm filing and correspondence between the filer and the MIA;
2. Prepared request for additional information needed from filer;
3. Communicated with the MIA staff (ongoing throughout assignment);
4. Prepared MIA Modeler Questionnaire;
5. Reviewed modeler responses;
6. Reviewed specific meteorological and engineering responses with Contractor's sub-contractors;
7. Requested further Modeler clarifications;
8. Prepared this Report.

3. Project Approach

To complete this work plan in a timely and thorough manner, Mr. Simons contracted with a hurricane expert (Jenni L. Evans) and a structural engineer (Masoud M. Zadeh) to provide assistance in reviewing specific meteorological and structural engineering responses from the modelers. These individuals are members of the Florida Commission on Hurricane Loss Projection Methodology's (FCHLPM) Professional Team and are each well versed in the issues underlying this project.

Dr. Jenni L. Evans is a Tenured Full Professor in the Department of Meteorology at The Pennsylvania State University. She is a well known expert on extratropical transitioning of hurricanes, an effect that is much more important in the development of loss costs in Maryland than in Florida.

Dr. Masoud M. Zadeh is a licensed Professional Engineer with extensive knowledge and experience in the creation, coordination, management and review of Catastrophic Risk Planning Models.

Mr. Simons', and Drs. Evans and Zadeh's resumes are provided in Appendix 5.[2]

2 Appendices may be found on the compact disc included with this Report.

PART 2. ANALYSIS

A series of questions and requests for information (Item 4 under the Work Plan, above) was submitted through State Farm Counsel to each of the modelers (AIR Worldwide, EQECAT and RMS) and the modelers' responses to those questions and requests for information were provided through State Farm Counsel to Mr. Simons.

Following the receipt of responses from the modelers, and review by Mr. Simons and his colleagues (Items 5 and 6, above), a second set of follow up requests was submitted to each of the modelers through State Farm Counsel (item 7, above). The material requested, questions asked and responses received (with a few items redacted as proprietary at the request of the modeler) may be found in Appendix 4 on the compact disk incorporated as a part of this Report.

The MIA Modeler Questionnaire and Modeler-Specific Follow-up questions related to how each model produces loss costs specifically in the State of Maryland:

1. Differences from model determined acceptable in Florida
2. Source of determination of frequency of hurricanes causing damage in Maryland
3. Source of determination of strength of hurricanes causing damage in Maryland
4. Source of Maryland building stock assumptions used in the model
5. Vulnerability of residential constructions in Maryland to hurricanes
6. Effect of land use and land cover in Maryland
7. Special model assumptions applicable to Maryland, if any
8. Effects of extratropical transition, an effect that is much more important in the development of loss costs in Maryland than in Florida
9. Effects of demand surge on Maryland loss costs
10. Effects of mitigation on Maryland loss costs
11. Several other specifics to determine whether the model is appropriate for use in Maryland

The basis of our analysis of each model relied upon in the filing has been that the model was determined to be acceptable for producing hurricane insurance loss costs *in the State of Florida.* With this criterion satisfied, we assess the model's applicability to Maryland. Those jurisdictions that are exposed to hurricanes along the Atlantic and Gulf coasts of the United States are able to base a substantial portion of their regulatory information needs on the work performed by the Florida Commission. The FCHLPM reviews of hurricane models are extensive.

The reviews performed by the Florida Commission (Appendices 1, 2, and 3), while extremely beneficial to a review of a hurricane model in Maryland, do not provide for a complete determination of the efficacy of the model for producing Maryland hurricane insurance loss costs. However, with the FCHLPM reviews as a basis, other hurricane prone states have the capability of limiting their review (and the expenses associated with their review) to those items that are specific to the jurisdiction under review.

An example of the need for an independent Maryland review may be found in the FCHLPM Meteorological Standard, M-1

Standard M-1 Base Hurricane Storm Set

A. Annual frequencies used in both model calibration and model validation shall be based upon the National Hurricane Center HURDAT starting at 1900 as of June 7, 2009 (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.

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

The Florida Commission's acceptance under Standard M-1 specifies that the historical hurricanes used in developing, calibrating and validating the model shall be derived from a defined source. In addition, if the model is based on "short" or "medium" term portions of the historical record since 1900[3] instead of the entire specified historical time period, this must be disclosed and supported.

Each of the modeling organizations referenced in the filing has developed short or medium term models in an attempt to account for the effects of recent climate changes. These short or medium term models generally use a portion of the historical period to estimate the effects of those climate changes on future expected hurricane strengths and frequencies. There have (as of the date of this Report) been no short or medium term models deemed acceptable by the Florida Commission. A determination that the appropriate data have been used to develop hurricane frequencies and characteristics has been made for the models examined for use in Maryland.

Another example of the need for additional information in determining the acceptance of a model for use in Maryland may be found in Part B. of Standard M-3:

Standard M-3 Hurricane Probabilities

B. Modeled hurricane landfall strike 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).

To obtain acceptance from the Florida Commission, modelers must show that the comparisons between modeled and historical hurricane activity are statistically reasonable. Similarly, an analysis of comparative Maryland modeled hurricane events with historical hurricanes requires that modeled hurricane activity for Maryland be statistically supported.

3 Although the historical record dates back to the mid 19th century, the FCHLPM requires that the historical data used start at 1900. Applicable earlier historical data may be used but is not required.

Models develop a set of hurricanes, known as the stochastic storm set. The stochastic storm set includes the hurricanes that are predicted in the model to occur in the next several hundred thousand years. Each hurricane in the stochastic storm set has been defined relative to its path, its strength and its windfield (the shape of the storm).

Standard M-4 Hurricane Windfield Structure

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

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

The FCHLPM Standard M-4 mandates that the windfields in the model's stochastic storm set be consistent with historical windfields in Florida. However, hurricane wind patterns change as the hurricane moves away from the tropics. For example, as a hurricane moves north, the rotational speed of the winds tends to diminish, the radius of maximum winds (the eye of the hurricane) tends to increase, and the forward speed of the hurricane tends to increase. This effect is known as extratropical transition, affecting Maryland hurricanes to a greater extent than Florida hurricanes.

Hurricanes are impacted by the land over which they move: hurricane winds can be substantially reduced over rough surfaces, but will not be reduced by as much over smoother ground or water. If, for example, the hurricane travels over a metropolitan area, the wind speeds decrease more than if the hurricane travels over a less populated area. Since the coastline in Maryland is very different from that of Florida, a review of the methods used to account for the effects of the Maryland land cover has been performed.

We have reviewed the modeler responses relating to their specification of windfields appropriate to Maryland to determine consistency with the historical record and with current knowledge regarding how hurricanes behave.

As with the meteorological review, it is important to determine that the engineering standards used in the models are appropriate for the location being considered. An example of the need for additional information in determining the acceptance of a model for use in Maryland may be found in Parts A, D and G of Standard V-1.

Standard V-1 Derivation of Vulnerability Functions[4]

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

4 A vulnerability function is a depiction of the relationship between wind speeds and the damage caused to properties at those wind speeds.

(5) site inspections. Any development of the vulnerability functions based on structural calculations or expert opinion shall be supported by tests, site inspections, and historical data.

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

G. Vulnerability functions shall include damage due to hurricane hazards such as wind speed and wind pressure, water infiltration, and missile impact. Vulnerability functions shall not include explicit damage due to flood, storm surge, or wave action.

The effects of hurricanes on specific building types (e.g., masonry or frame constructions) may be similar regardless of which state the building is located if the construction practices at the time of construction are the same. Nevertheless, it is important to determine whether a modeler is treating construction types differently in different states and regions, and if so, it is also important to determine that such treatment is justifiable from an engineering perspective.

Construction practices and choices may be different in different regions and states due to, among other factors, differences in environmental conditions, temperature, and wind and other loads such as snow loading. These differences may or may not result in different vulnerability (wind/damage relationship) assessment for the same class of buildings.

To be deemed acceptable, the models must account for improvements in construction brought about through improved building codes. Models are required to incorporate the effects of building codes on the expected damage caused by hurricanes. It is, however, important to note that new building codes only affect new construction or in some cases repairs and remodeling to older properties. Therefore, the effects of building code revisions or improvements in building code enforcement may take a substantial amount of time before overall losses in a specific jurisdiction decrease as a result.

Storm surge occurs when the ocean water is pushed ahead of the storm, sometimes creating damaging waves prior to the time where the hurricane winds are over land and also causing inland flooding from rivers that cannot drain into the sea because of the storm surge blocking the river mouth. Homeowners' insurance policies do not generally cover losses from storm surge[5]. The storm surge losses, since they are not covered by the hurricane insurance policy, must not be included in the hurricane insurance loss costs produced by the model. This is especially critical when the models are producing loss costs for the barrier islands or for areas on or very near to the Intracoastal Waterway.

An exception to this prohibition on storm surge damage relates to storm surge damage to the infrastructure. If, for example, a power generating station is damaged by storm surge, resulting in loss of power to the building, the insurance policy may cover the cost of living elsewhere until the power is restored. A review of each model is necessary to determine that these effects are appropriately dealt with in the model.

5 Storm surge losses are generally covered under the Federal Flood Insurance Program.

One of the greatest benefits to be gained through the use of appropriately vetted catastrophe models concerns the ability to put a statistically reasonable value on various mitigation measures. It is through mitigation that future hurricane losses (lives and property) may be reduced and managed. The Florida statute specifically requires modelers to develop scientifically based mitigation credits for six specific construction techniques.

Standard V-2 Mitigation Measures

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.

Our reviews of the models in Florida include an in-depth review of the process used by the modelers to develop mitigation credits. Although little if any additional review was required in this project for models that have been deemed acceptable by the Florida Commission, we understand that the subject of mitigation is one that is of great interest. Those with a specific interest in the way hurricane models consider hazard mitigation measures and their effects are referred to Appendix 7 on the compact disc accompanying this Report.

Information employed in determining the acceptance of a model for use in Maryland should only include insured wind-related hurricane damage and additional living expense losses as required in the FCHLPM Standard A-1:

Standard A-1 Modeled Loss Costs and Probable Maximum Loss Levels.

Modeled loss costs and probable maximum loss levels shall reflect all insured wind related damages from storms that reach hurricane strength and produce damaging winds on land in Florida.

These hurricane risk planning models are designed to produce property insurance loss costs from hurricanes. Generally, property insurance actuarial pricing separates the losses from wind damage into those caused by hurricanes (which are determined by the Catastrophic Risk Planning Model) and those caused by other wind events such as tropical storms which are based upon more traditional actuarial calculations. If the model includes the effects of tropical storms in its modeled hurricane loss costs, the resulting hurricane loss costs will be upwardly biased.

It is also likely that the wind damage caused by tropical storms will be double counted if the hurricane model includes tropical storms; once in the production of the hurricane loss costs by the catastrophic risk planning model and again in the calculation of wind loss costs caused by events other than hurricanes (including tropical storms) in the portion of the loss costs that are calculated using more traditional actuarial ratemaking methods.

The input used by the models consists of the hurricane related characteristics of the properties for which the model results are being produced, such as the construction characteristics, policy limits, deductibles, mitigation criteria, etc.. An important part of the review of a Catastrophic Risk Planning Model is the determination of how the insurance exposure data are input and used in the modeling process.

Standard 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 modeling organization shall be based upon accepted actuarial, underwriting, and statistical procedures.

B. For loss cost and probable maximum loss level estimates derived from or validated with historical insured hurricane losses, the assumptions in the derivations concerning (1) construction characteristics, (2) policy provisions, (3) claim payment practices, (4) coinsurance, (5) contractual provisions, and (6) relevant underwriting practices underlying those losses, as well as any actuarial modifications, shall be appropriate.

In addition to our reviews of how the model incorporates the data, a primary question that the recipient of a model's output must ask is, "Did you (the filer) do anything that changed or might be expected to change any of the model results?" We must be assured that neither the modeler nor the filing insurer has made any inappropriate adjustments to any of the data used by the modeler to run, calibrate or validate its model.

The model must be capable of incorporating user-specific information at a level appropriate to the insured peril:

Standard A-5 User Inputs

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

Recipients of a model's results should require an output report similar to that which is described in each of the submissions to the FCHLPM. The output report presents a description of the input data and whether or not the filer has made any changes to the input data or the output of the model.

Some of the information necessary for a thorough review of a Catastrophic Risk Planning Model is considered trade secret or proprietary by the modeler. To review all portions of each model, the FCHLPM established the Professional Team in 1996. The Florida Statutes were subsequently revised to allow Commission members to attend the Professional Team's on-site reviews and to be presented with proprietary information (in closed sessions to protect the proprietary information from the sunshine law requirements).

Generally, from one to three Commission members attend each of our reviews. Commission rules mandate that Commissioners attending our on-site reviews are there as observers and are not to participate in the review. After the Professional Team members leave the modelers offices at the end of each day of the review, the modeler may respond to questions Commissioners may have.

In addition, if more than one Commission member attends an on-site visit, they are precluded from discussing the model or our review of the model since Florida Statute would necessitate a public meeting in that event.

The Commission rules were revised following the passage of a statute allowing Commissioners to be presented with trade secret or proprietary information in a closed meeting session. At the closed meetings, unlike open FCHLPM meetings attendees (limited to Commission members, Professional Team members, the specific modeler under review and FCHLPM staff) are required to turn off computers, cell phones and any other devices capable of the recording or transmitting the proceedings.

Notes taken by the Professional Team are reviewed by the modeler at the end of the on-site visits. Modelers are permitted to review our notes and our Professional Team Report to remove any material they consider proprietary. Notes removed are placed in a sealed envelope, brought to the Commission's closed sessions, and are destroyed following the closed meeting. This allows for a process whereby the Commission may be presented with all information requested by its members, including information considered trade secret or proprietary.

There has not been an instance, since the FCHLPM process began in which a modeler has refused to provide requested information to the Professional Team.

Refer to the Report of Activities (Appendix 1) for a complete description of the FCHLPM process.

PART 3. CONCLUSIONS

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The models included in the State Farm filing provide ample support that the potential hurricane losses in Worcester County are greater than those for other counties in Maryland and that the loss is greater where the property is closer to the water. These findings provide support for its filing request to non-renew certain risks on the barrier island in Ocean City, Maryland.

AIR Worldwide Corporation has provided ample support that the AIR Atlantic Tropical Cyclone Model v11.0, Program CLASIC/2 v11 is an acceptable tool for producing hurricane insurance loss costs in the State of Maryland.

EQECAT has provided ample support that the EQECAT model WORLDCATenterprise Version 3.13 is an acceptable tool for producing hurricane insurance loss costs in the State of Maryland.

The RMS Model submitted in the filing is not the same model as that which has been deemed acceptable for producing loss costs in the State of Florida. The RMS model used in the filing includes damage from weaker storms (classified as tropical storms) in addition to those storms that reach hurricane strength. This model feature would, in itself, preclude acceptance by the FCHLPM (see Standard A-1, above).

We are therefore unable to review the RMS model used in the filing without initiating a process similar to that which is performed by the Florida Commission. Such a process would be both time consuming and costly. While we are aware that an upward bias results from the inclusion of tropical storms with the information available to us, we are not able to determine whether there are any other differences between the model filed here and that which was deemed acceptable by the Florida Commission or whether there are effects on any other parts of the model due to the inclusion of tropical storms. This finding applies to the use of the RMS model, and does not negate the support for the State Farm request stated above.

RMS states in its initial response:(**emphasis added**)

> "The RiskLink 8.0.1a model was certified under the FCHLPM Report of Activities 2008 Standards on July 24, 2009. It remains certified until September 2011. The main differences between RiskLink 8.0.1.a and RiskLink 9.0 (used by State Farm) are explained in the RMS response to Question 4.
>
> The event sets for RiskLink 8.0.1a and the standard U.S. Hurricane models are derived from the same underlying Monte Carlo set; however, the set for RiskLink 8.0.1a has more events (19,047 compared to approximately 16,000 in the standard U.S. Hurricane models)."
>
> "**In the model approved by the FCHLPM, the event definition used excludes events where the maximum wind speed does not have hurricane force winds over Florida (tropical depressions and tropical storms). The event definition for the standard U.S. Hurricane model does include losses produced by some tropical depressions and tropical storms associated with secondary landfalls, although winds must be at least 50 mph to cause loss.**

The factors contributing to the difference in losses between RiskLink 8.0.1a and RiskLink 9.0 (using historical event rates) and each factor's approximate magnitude are:

- **Different years reflected in the historical event rates: RiskLink 9.0 is 1 percent higher than RiskLink 8.0.1a**
- **Different convergence criteria for county loss levels with the boiling down process: RiskLink 9.0 is 2 percent higher than RiskLink 8.0.1a**
- **Different definitions of an event: RiskLink 9.0 is 5-6 percent higher than RiskLink 8.0.1a"**

The inclusion of tropical storms in its stochastic storm set produces an upward bias in the hurricane insurance loss costs produced by the RMS RiskLink 9.0 model, included in the filing. According to RMS, the approximate magnitude of the upward bias is from 8% to 9%.

While it is the Commission and not the Professional Team that determines acceptability in Florida (based to a great extent on the information provided in the Professional Team Reports) we believe RMS RiskLink 9.0 would not be deemed acceptable for producing hurricane insurance loss costs in Florida.

Revisions in the AIR Atlantic Tropical Cyclone Model v11.0, Program CLASIC/2 v11 and the EQECAT WORLDCATenterprise Version 3.13 models between the time of the 2007 and 2010 filings are due mainly to changes in population movements and ZIP Code designations. The Florida Commission requires ZIP Codes to be updated at least every two years.

Perhaps the most frustrating thing about the current state-of-the-science regarding Catastrophic Risk Planning Models concerns the differences among the model results. This is not new relative to property and casualty insurance ratemaking. Standard actuarial techniques often result in differences in loss costs among individual insurers.

These models are based on a stochastic process wherein several variables within the modeling process must be determined using statistical procedures based on the scientific, meteorological, engineering and actuarial information available at the time. Each of these variables (for example, radius of the hurricane eye, forward speed, transitioning, wind speed versus damage ratios, the effects of mitigation, etc.) is produced in the model using various probability distributions. While these methods may produce disparate results, the review of the model is designed to determine that each step in the process is performed using accepted scientific and actuarial criteria that have been determined to be reasonable based upon rigorous statistical tests. Papers that are used by the modelers to justify various portions of the model must have been reviewed and published in the appropriate scientific journals.

While there will always be differences among model results due to the stochastic process, these differences are negligible when compared to the differences present under any other method of determining hurricane insurance risk that is available to the property insurance pricing actuaries today. Uncertainties are prevalent throughout the process since the century and a half of historical data provides a very short historical picture for rare events like hurricanes. The models use hundreds of thousands of years of stochastic storms, created through

the application of the most recent scientific findings regarding each aspect of hurricane events.

Due to the levels of uncertainty described above, it is preferred that a filer base its hurricane insurance loss costs on a combination of model results as has been done in the State Farm filing. The Florida Hurricane Catastrophe Fund for example (the largest hurricane insurance provider in the world) uses a weighted average of the outputs of the five hurricane models that have been deemed acceptable by the FCHLPM. The California Earthquake Authority employs the outputs of the AIR, EQECAT and RMS earthquake models. Combining of the results from more than one modeler tends to reduce the uncertainties as long as each model used in the calculation has been determined to be appropriate for use.

If a model meets the requirements of the Florida Commission, we do not believe it is appropriate to compare individual component strengths and weaknesses of the models. Based upon the answers to our questions, we have evaluated whether each model that has been accepted by the FCHLPM is also appropriate for producing hurricane insurance loss costs for the State of Maryland. **If a model has known weaknesses that will impact inappropriately upon the loss costs produced by it, then it should not be used to establish hurricane insurance loss costs.**

The modeled loss costs are generally directly calculated using actual State Farm exposures (properties insured). The methods used in the models to account for unknown items in the State Farm exposure files (if there had been any) have been reviewed in detail and have been determined to be appropriate as a part of the Florida review process. **Our determination of the appropriate inclusion of the insurer exposures applies equally to the model's application by State Farm in Maryland**.

Each of the models allows for the inclusion of the effects of mitigation. It should be understood, however, that the effects of mitigation are frequently medium to long term in nature since only a small to moderate number of mitigation installations are implemented each year, and hence, the effects of mitigation measures in the Maryland loss cost calculations are not immediately evident. In its review of the models relative to their accounting for mitigation measures, the Florida Commission performs a detailed review of the methods and results of accounting for mitigating against hurricane losses. **The models are capable of producing mitigation credits on an individual property basis as well as accounting for the overall effects of mitigation in a specified area.**

The determination of acceptability of a model for producing loss costs does not result in the approval of loss costs and rates in Maryland. This Report is designed as a tool to assist the regulatory authority in that approval process.

PART 4. ADDENDUM – Appendices

In addition to the direct response called for in the RFP, this Report (including the appendices provided on the accompanying CD) is designed to provide a substantial amount of information to assist the Maryland Insurance Administration in its future hurricane risk assessment efforts. Below is a listing of files included on the CD.

Report: Catastrophic Risk Planning Model Evaluation. (this Report)

Appendix 1. FCHLPM Report of Activities

The primary source document for those responsible for regulating the use of Catastrophic Risk Planning Models for producing hurricane insurance loss costs is the Report of Activities of the FCHLPM. The Commission process, which has been developed and improved as our knowledge of hurricanes has increased is defined in detail in the Report of Activities.

The Report of Activities contains the Commission's Standards, the purpose for each Standard, the material that must be disclosed in the modeler's submission, the Forms that must be filled out relative to each Standard, and the audit items that will be included in the Professional Team's on-site audit of the model. The inclusion of the audit items does not preclude members of the Professional Team from asking for other information.

The most recent Report of Activities may be found on the compact disc accompanying this Report.

Each Report of Activities issued by the Commission since 1999, may be found at the FCHLPM website:

www.sbafla.com/methodology/CommissionDocuments/tabid/784/method/ReportofAcitivities/tabid/820/Default.aspx

Appendix 2. Modeler Submissions to the Florida Commission on Hurricane Loss Projection Methodology

The most recently accepted Submissions provided to the Florida Commission by AIR, EQE and RMS may be found on the compact disc accompanying this Report.

Each model submission, including the AIR Worldwide and EQECAT models reviewed in this Report as well as each of the models deemed acceptable by the Commission since its inception may be found at the FCHLPM website:

www.sbafla.com/methodology/ModelerSubmissions/tabid/785/Default.aspx

Appendix 3. Reports of the Professional Team to the FCHLPM

Following each on-site visit with each modeler, the Professional Team provides the Commission with a report outlining the material we reviewed relative to each part of each Standard. Following the receipt of the Professional Team Report, the Commission meets to vote on

whether the model is acceptable for producing hurricane insurance loss costs in Florida. If the Commission vote is negative on any single Standard, the model has been found unacceptable.

The most recent Professional Team Report to the Commission for AIR, EQECAT and RMS may be found on the compact disc accompanying this Report.

Each of the Professional Team Reports submitted from 1999 through the most current report including the Professional Team Report for the AIR and EQECAT models covered in this Report may be found at the FCHLPM website:

www.sbafla.com/methodology/CommissionDocuments/ProfessionalTeamReports/tabid/824/Default.aspx

Appendix 4. Information requested and obtained for this Report.

- AIR Worldwide Corporation
- EQECAT
- RMS
- State Farm Fire and Casualty Insurance Company (proprietary individual modeled loss costs)

Appendix 5. Curriculum Vitae of Contract Experts

- *Martin M. Simons
- Jenni L. Evans
- Masoud M. Zadeh

Appendix 6. Journal of Insurance Regulation 2008 - Inside The Black Box - Evaluating and Auditing Loss Models

The process used in producing this Report is based upon this paper, published in 2008 by the Journal of Insurance Regulation.

*Dumm, Randy E, Johnson, Mark E. and Simons, Martin M., *Inside the Black Box: Evaluating and Auditing Hurricane Loss Models, Journal of Insurance Regulation*, Winter, 2008

Appendix 7. *Report to the Hawaii Legislature on the Feasibility of a Wind Resistive Device Grant Program, December 13, 2001

For those interested in the relationship between hurricane modeling and hazard mitigation, this Report, prepared for the Hawaii Hurricane Relief Fund by a modeler not involved in this proceeding provides a detailed analysis relative to the most financially expeditious way for the State of Hawaii to assist homeowners in mitigating their homes against hurricane damage.

Appendix 8. *American Academy of Actuaries Issue Brief - Cat Models

This brief, issued in 2009, presents the current state of the regulation of Catastrophic Risk Planning Models for property insurance hurricane loss cost projecting.

*asterisked items may be downloaded from www.mmsimons.com

Part 5 – ACKNOWLEDGMENT

We thank the modelers for their responses to our requests for information. This Report would not have been possible without the willingness of the modelers to provide the information necessary for us to complete our task.

We also appreciate the work done by State Farm, allowing us to receive and provide the information needed by the MIA in determining whether specific versions of specific Catastrophic Risk Planning Models provide the support needed for approval of property insurance filings using such models in the State of Maryland.

We thank the Maryland Insurance Administration for your patience as this process took somewhat more time than that which we all had anticipated. This Report has been designed to provide Maryland with a process and the information necessary to implement that process, using meteorological, structural engineering and actuarial expertise available through the Maryland University system or elsewhere in the State of Maryland. We sincerely hope that this Report will provide a vast amount of information that you will find useful in dealing with similar issues in the future.

We welcome the opportunity to respond to future Requests for Proposals from the Maryland Insurance Administration.

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