

Appendix B – Initial Evaluation Questions

This Appendix includes the First set of Evaluation Questions, sent to all of the modelers by the South Carolina Department of Insurance in November 2012.

A set of follow-up questions were sent to each individual modeler in March 2013. Modeler responses to both sets of questions are provided in Attachments 1 through 4.



Division of Actuarial & Market Services
1201 Main Street, Suite 1000
Columbia, SC 29201

Alternate Mailing Address:
P.O. Box 100105, Columbia, S.C. 29202-3105
Telephone: (843) 579-0527

Memorandum

To: All Modeling Organizations that Prepare Hurricane Catastrophe Models
Used By Insurers in Rate Filings in South Carolina

From: Leslie M. Jones
Deputy Director, Actuarial & Market Services

Date: November 1, 2012

Subject: Evaluation of Hurricane Catastrophe Models.

Pursuant to SC Code of Laws Section 38-75-1140(A), the South Carolina Department of Insurance has assembled a panel of experts to evaluate the hurricane catastrophe models used in property insurance rate filings in South Carolina.

Please provide responses to the following questions to assist the expert panel in its review of the hurricane catastrophe models that your organization prepares that are used by insurers in rate filings in South Carolina. Your responses should be received no later than January 1, 2013. Earlier submissions are welcomed.

In addition, Forms SC-1, SC-2 and SC-3 shall be completed and included with responses to the questions. Attached files "*Form SC-1.xlsx*", "*Form SC-2.xlsx*" and "*Form SC-3.xlsx*" should be used for the corresponding forms. Instructions for completing the three forms are provided in EXHIBIT 1 following the questions.

Please submit your responses via e-mail to me at ljones@doi.sc.gov, with a copy to Will Davis at wdavis@doi.sc.gov and Marty Simons at mmsimons@mmsimons.com.

Pursuant to SC Code of Laws Section 38-75-1140(F), propriety or trade secret information that is submitted must be kept confidential by the Director. Please clearly mark any information that is trade secret or proprietary to assist us in our compliance with this requirement.

Please do not hesitate to call me if you have any questions or if you would like to discuss this further. I may be reached directly at 843-577-3413.



Questions for Hurricane Modelers Participating in the South Carolina Hurricane Catastrophe Model Review

General Questions

1. Specify the model version numbers for each of the most recent three model versions used in developing South Carolina loss costs.
2. Provide the dates of acceptance and expiration by the Florida Commission on Hurricane Loss Projection Methodology (FCHLPM) for each model version cited in item 1.
3. Describe any differences (regardless of the level of their expected impact) between the model used to develop the South Carolina loss costs and the corresponding model version (cited in item 2) that was found to be acceptable by the FCHLPM.
4. Describe any differences in the current model from the two previous versions of your model that had an actual or potential change in the hurricane loss costs produced for any property in South Carolina.

Meteorological Questions

1. Historical hurricane database used to develop the stochastic storm set for calculating loss costs in South Carolina.
 - a. Identify the publication date of the HURDAT database used in the model to produce South Carolina loss costs.
 - b. Identify the set of historical storms (i.e. hurricanes, tropical storms, etc.) used in developing or validating the model.
 - c. Describe the source and date of publication of any additional (not HURDAT) historical data used in the model. Provide a complete publication reference and website from which this database can be obtained. State how this data is used in the development of the historical database used by the model.
 - d. Identify the time period of historical data available and the time period of historical data used in the creation of the model stochastic storm set used to produce the loss costs.
 - e. Describe any adjustments, exclusions or edits made to any of the cited historical source data.
2. Describe any frequency adjustments to the historical storm database relevant to South Carolina.
3. Provide specific justifications for each frequency adjustment applied.



4. Describe how the model defines a “hurricane” causing loss in South Carolina. Specify how the hurricane windspeed threshold (64 knots; 74 mph; 33 m s^{-1}) is applied in this definition.
5. Describe how the model defines a “bypassing hurricane” causing loss in South Carolina.
6. Describe (in detail) the process used to incorporate the effects of bypassing storms in the South Carolina modeled loss costs.
7. Provide details of the process used to develop the expected landfall frequencies of storms by hurricane strength (Saffir-Simpson (SS) categories 1 through 5) in the South Carolina domain.
8. Provide a map showing all historical storms in the database since 1900 used in the model that produced damaging winds on land within the domain bounded by 31.0°N to 37.0°N and 77°W to 84°W .
 - a. Provide a table and corresponding histogram showing the frequency distribution of hurricanes affecting South Carolina by SS category (based upon maximum sustained wind) for the historical storm set and simulated historical storm set.
 - b. Provide a table and corresponding histogram showing the distribution of hurricanes by SS category (as in part a) in the stochastic storm set at first landfall for this domain.
9. Provide four maps, each showing a separate randomly chosen 110 year period of stochastic storms that produce damaging winds on land within the domain previously described.
10. Describe how the model incorporates important modeled storm characteristics (e.g. intensity, radius of maximum winds, translational velocity) and the effects of the environment (e.g. topography, over-land weakening) on the storm.
11. Describe how the model incorporates the effects of weakening or filling of the storm over land and their impact on the spatial distribution of damaging winds, including the effect of surface characteristics.
12. Describe how the model incorporates the effects of topography on modeled storm characteristics or loss costs produced in South Carolina.
13. Document the Saffir Simpson category and storm characteristics at landfall (maximum wind speed, radius of maximum winds, etc.) associated with the strongest landfalling storm affecting South Carolina in the stochastic storm set.
14. Provide the source, collection and publication dates of land use/land cover data used in the model to develop friction factors (or other measure of surface roughness) for the development of South Carolina loss costs.
15. Provide Form SC-1, *Spatial Distribution of Maximum Winds in South Carolina Due to Hurricane Hugo (1989)*.



Vulnerability Questions

1. Provide description of categories of occupancies used by model. Include statements on personal and commercial residential property occupancy and all sub-categories of these occupancies.
2. For personal and commercial residential properties describe building classification (including mobile homes (MH) and the basis used for South Carolina building stock in each model.
3. Provide a list of main building characteristics used in the above building classification for South Carolina.
4. Provide a list of secondary building characteristics (if used by model), which might influence the performance of buildings to hurricane hazards in South Carolina.
5. Provide a description of how model's building vulnerability functions address construction practices in South Carolina.
6. List various hurricane hazards that might impact performance of a building and how these have been addressed by model.
7. Describe how the building code development in South Carolina is addressed by the model.
8. Describe any regional variations in building characteristics in South Carolina in the model and provide the basis for the variations.
9. Provide a detailed description of vulnerability function development for each building class. Also provide the basis for "average" building in each class of buildings, specifically for South Carolina.
10. Provide a description of uncertainty in vulnerability functions used by model.
11. Provide a description of how vulnerability functions are developed and used by model when one or more of building characteristics used in building classification is not known or is missing.
12. Provide a description of how the vulnerability functions for "unknown" building class is developed. If any weighting of vulnerability functions used by model for unknown building characteristics, provide the methodology used and the basis for the weights.
13. Provide a description of validation and verification of appropriateness of building vulnerability functions used by model for South Carolina. Provide description of South Carolina hurricane loss data used in such validation.



14. Provide a detailed description of building classes for appurtenant structures (outbuildings) used by model.
15. Provide a description of vulnerability function development and associated uncertainty for each building class.
16. Provide a description of vulnerability function and associated uncertainty for contents.
17. Provide a detailed description of categories of additional living expense (ALE) (or loss of use) used by model.
18. Provide a description of if and how building mitigation might impact contents and ALE losses.

Actuarial Questions

1. Provide data used to perform any comparison of model loss cost outputs with historical data if such data is available, especially relative to any available historical data within the domain bounded by 31.0 °N to 37.0 °N and 77°W to 84°W, or for construction types that are representative of those that are found in South Carolina.
2. Describe any changes made to the model from the previous two versions. Describe how these changes have affected the South Carolina loss costs.
3. Provide a description of the techniques and data used to develop estimates of demand surge for South Carolina, including a description of the implicit inclusion of demand surge in the historical data used in the development, validation or verification of model results as well as any explicit inclusion of demand surge.
4. Describe and justify the process used when adjustments need to be made to the input exposure data.
5. Provide completed forms SC-2 and SC-3 in accordance with accompanying instructions.
6. In generating hurricane simulated storm set used for loss cost projection, demonstrate the adequacy of the number of storms generated to produce convergence at county levels in state of South Carolina.
7. Describe how the model develops loss costs for replacement cost coverage versus actual cash value coverage.



EXHIBIT 1 – Part 1
Form SC-1: Spatial Distribution of Maximum Winds in South
Carolina
Due to Hurricane Hugo (1989)

(Page 1 of 1)

- A. Provide a table of maximum windspeeds in the file named “*Form SC-1.xlsx*.” for the given set of ZIP Codes. If relevant, describe how the land surface is treated for the calculation of winds over actual terrain for any ZIP Codes in which the population-weighted centroid is over water.

Assumptions

- Windspeeds to be reported are the maximum 1-minute sustained winds at the population-weighted centroid for each ZIP Code for
 - the actual terrain used in your model
 - a uniform open terrain

B. Provide all of the input hurricane characteristics that are used in the above to define Hurricane Hugo (1989), including, but not limited to, the track, central pressure and radius of maximum winds along the track.

C. Provide a color contour map of the maximum winds for the modeled version of Hurricane Hugo (1989) for land use set for actual terrain as defined by the modeling organization.

D. Provide a color contour map of the maximum winds for the modeled version of Hurricane Hugo (1989) for land use as set for uniform open terrain.

Maximum winds in these maps are defined as the maximum one-minute sustained winds over the terrain as modeled and recorded at each location. Maps are not restricted to ZIP Code resolution.

Use the following seven isotach values and interval color coding:

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

Contouring *in addition to* these isotach values may be included. The same color scheme and increments shall be used for both maps.

- E. Demonstrate the consistency of the spatial distribution of model-generated winds with observed windfields for Hurricane Hugo (1989) with reference to the set of ZIP Codes reported in item A.



EXHIBIT 1 – Part 2
Form SC-2: Loss Costs for a Set of Locations in South Carolina
Logical Relationship to Risk

(Page 1 of 3)

A. Provide the logical relationship to risk in the format shown in the file named “*Form SC-2.xlsx*.” There are six sheets in this file:

Purpose	Sheet Name
Construction Sensitivity	Construction
Building Code/Enforcement (Year Built) Sensitivity	Building Code
Number of Stories Sensitivity	Number of Stories
Policy Form Sensitivity	Policy Form
Coverage Sensitivity	Coverage
Deductible Sensitivity	Deductible

- B. All sheets have the same 68 locations with given latitudes and longitudes.
- C. Deductibles are per occurrence and are to be expressed as a % of Coverage A limit for all Policy Forms, except for Condo Policy Form which is % of Coverage C limit.
- D. Create an exposure set for each location for each sheet by modeling all of the structures per the indicated assumptions and other assumptions you might make. For example for the “Deductible” Sheet, assume owner (Single Dwelling) policy, wood frame construction with year of construction of 2000 and number of stories being 1. Using your model, compute the loss costs (per \$1000 of Coverage A) for 0%, 2%, and 3% deductible levels.
- E. Any and all additional assumptions, deviations, and differences from the prescribed exposure information that you must make to compute loss costs using your model must be disclosed and explained in the space provided in the Excel file “*Form SC-2.xlsx*” (insert additional rows into each sheet if needed).
- F. Use the exposure data corresponding to various policy types given on the next page.
- G. Report results for each of the locations individually. For Owner and Mobile Home Policy Forms, loss costs are per \$1,000 of Coverage A. For Condo Policy Form, provide loss costs per \$1000 of Coverage C. All loss costs shall be rounded to 3 decimal digits.



**Form SC-2: Loss Costs for a Set of Locations in South Carolina
Logical Relationship to Risk**

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Policy Form Specifications

<u>Policy Type</u>	<u>Assumptions</u>
Owners	<p>Coverage A = Structure</p> <ul style="list-style-type: none"> • Coverage A limit = \$150,000 • Replacement Cost not included • Ordinance or Law not included <p>Coverage B = Appurtenant Structures</p> <ul style="list-style-type: none"> • Coverage B limit = 10% of Coverage A limit • Replacement Cost not included • Ordinance or Law not included <p>Coverage C = Contents</p> <ul style="list-style-type: none"> • Coverage C limit = 50% of Coverage A limit • Replacement Cost not included <p>Coverage D = Time Element</p> <ul style="list-style-type: none"> • Coverage D limit = 20% of Coverage A limit • Time Limit = 12 months • Per Diem = \$150.00/day per policy, if used <p> ✧ Loss costs per \$1,000 shall be related to the Coverage A limit. ✧ Loss costs for the various specified deductibles shall be determined based on per occurrence deductibles. ✧ All-other perils deductible shall be \$500. </p>
Condo Unit Owners	<p>Coverage A = Structure</p> <ul style="list-style-type: none"> • Coverage A limit = \$1,000 • Replacement Cost not included <p>Coverage C = Contents</p> <ul style="list-style-type: none"> • Coverage C limit = \$50,000 • Replacement Cost not included <p>Coverage D = Time Element</p> <ul style="list-style-type: none"> • Coverage D limit = 20% of Coverage C limit • Time Limit = 12 months • Per Diem = \$150.00/day per policy, if used <p> ✧ Loss costs per \$1,000 shall be related to the Coverage C limit. ✧ Loss costs for the various specified deductibles shall be determined based on per occurrence deductibles. ✧ All-other perils deductible shall be \$500. </p>



Form SC-2: Loss Costs for a Set of Locations in South Carolina Logical Relationship to Risk

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Policy Form Specifications

(Continued)

<u>Policy Type</u>	<u>Assumptions</u>
Mobile Home	<p>Coverage A = Structure</p> <ul style="list-style-type: none">• Coverage A limit = \$50,000• Replacement Cost not included• Ordinance or Law not included <p>Coverage B = Appurtenant Structures</p> <ul style="list-style-type: none">• Coverage B limit = 10% of Coverage A limit• Replacement Cost not included• Ordinance or Law not included <p>Coverage C = Contents</p> <ul style="list-style-type: none">• Coverage C limit = 50% of Coverage A limit• Replacement Cost not included <p>Coverage D = Time Element</p> <ul style="list-style-type: none">• Coverage D limit = 20% of Coverage A limit• Time Limit = 12 months• Per Diem = \$150.00/day per policy, if used <p>◇ Loss costs per \$1,000 shall be related to the Coverage A limit.</p> <p>◇ Loss costs for the various specified deductibles shall be determined based on per occurrence deductibles.</p> <p>◇ All-other perils deductible shall be \$500.</p>



EXHIBIT 1 – Part 3
Form SC-3: Loss Costs for a Subset of ZIP Codes in South Carolina
Logical Relationship to Risk

(Page 1 of 3)

- A. Provide the logical relationship to risk in the format shown in the file named “*Form SC-3.xlsx*.” There are six sheets in this file:

Purpose	Sheet Name
Construction Sensitivity	Construction
Building Code/Enforcement (Year Built) Sensitivity	Building Code
Number of Stories Sensitivity	Number of Stories
Policy Form Sensitivity	Policy Form
Coverage Sensitivity	Coverage
Deductible Sensitivity	Deductible

- B. All sheets have the same 80 ZIP Codes located in South Carolina.
- C. Use population weighted centroid for each ZIP Code. If a centroid falls in water, move it to the closest point on land.
- D. Locate each exposure at the centroid of each ZIP Code.
- E. Deductibles are per occurrence and are expressed as a % of Coverage A limit for all Policy Forms, except for Condo Policy Form which is % of Coverage C limit
- F. Create exposure set for each ZIP Code for each sheet by modeling all of the structures per the indicated assumptions and other assumptions you might make. For example for “Deductible” sheet, assume owner policy (Single Dwelling Policy), wood frame construction with year of construction of 2000 and number of stories being 1. Using your model compute the loss costs (per \$1000 of Coverage A) for 0%, 2%, and 3% deductible levels.
- G. Any and all additional assumptions, deviations, and differences from the prescribed exposure information that you must make to compute loss costs using your model must be disclosed and explained in the space provided in the Excel file “*Form SC-3.xlsx*” (insert additional rows into each sheet if needed).”
- H. Use the exposure data corresponding to various policy types given on the next page.
- I. Report results for each of ZIP Codes individually. For Owner and Mobile Home Policy Forms, loss costs are per \$1,000 of Coverage A. For Condo Policy Form, provide loss costs per \$1000 of Coverage C. All loss costs shall be rounded to 3 decimal digits.



Form SC-3: Loss Costs for a Subset of ZIP Codes in South Carolina

Logical Relationship to Risk

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Policy Form Specifications

<u>Policy Type</u>	<u>Assumptions</u>
Owners	<p>Coverage A = Structure</p> <ul style="list-style-type: none"> • Coverage A limit = \$150,000 • Replacement Cost not included • Ordinance or Law not included <p>Coverage B = Appurtenant Structures</p> <ul style="list-style-type: none"> • Coverage B limit = 10% of Coverage A limit • Replacement Cost not included • Ordinance or Law not included <p>Coverage C = Contents</p> <ul style="list-style-type: none"> • Coverage C limit = 50% of Coverage A limit • Replacement Cost not included <p>Coverage D = Time Element</p> <ul style="list-style-type: none"> • Coverage D limit = 20% of Coverage A limit • Time Limit = 12 months • Per Diem = \$150.00/day per policy, if used <p>✧ Loss costs per \$1,000 shall be related to the Coverage A limit.</p> <p>✧ Loss costs for the various specified deductibles shall be determined based on per occurrence deductibles.</p> <p>✧ All-other perils deductible shall be \$500.</p>
Condo Unit Owners	<p>Coverage A = Structure</p> <ul style="list-style-type: none"> • Coverage A limit = \$1,000 • Replacement Cost not included <p>Coverage C = Contents</p> <ul style="list-style-type: none"> • Coverage C limit = \$50,000 • Replacement Cost not included <p>Coverage D = Time Element</p> <ul style="list-style-type: none"> • Coverage D limit = 20% of Coverage C limit • Time Limit = 12 months • Per Diem = \$150.00/day per policy, if used <p>✧ Loss costs per \$1,000 shall be related to the Coverage C limit.</p> <p>✧ Loss costs for the various specified deductibles shall be determined based on per occurrence deductibles.</p> <p>✧ All-other perils deductible shall be \$500.</p>



Form SC-3: Loss Costs for a Subset of ZIP Codes in South Carolina

Logical Relationship to Risk

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Policy Form Specifications

(Continued)

<u>Policy Type</u>	<u>Assumptions</u>
Mobile Home	<p>Coverage A = Structure</p> <ul style="list-style-type: none">• Coverage A limit = \$50,000• Replacement Cost not included• Ordinance or Law not included <p>Coverage B = Appurtenant Structures</p> <ul style="list-style-type: none">• Coverage B limit = 10% of Coverage A limit• Replacement Cost not included• Ordinance or Law not included <p>Coverage C = Contents</p> <ul style="list-style-type: none">• Coverage C limit = 50% of Coverage A limit• Replacement Cost not included <p>Coverage D = Time Element</p> <ul style="list-style-type: none">• Coverage D limit = 20% of Coverage A limit• Time Limit = 12 months• Per Diem = \$150.00/day per policy, if used <p>✧ Loss costs per \$1,000 shall be related to the Coverage A limit.</p> <p>✧ Loss costs for the various specified deductibles shall be determined based on per occurrence deductibles.</p> <p>✧ All-other perils deductible shall be \$500.</p>

