Regulating Hurricane Insurance Loss Costs Produced by Computer Models

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By

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1. Hugo (1989), Andrew and Iniki (1992)
2. Florida Commission on Hurricane Loss Projection Methodology
3. Hawaii Hurricane Model Review Committee
4. Insurance Rate Filings and Hurricane Loss Estimation Models (time permitting)

Hugo, Andrew and Iniki

- Lessons learned
  - **Previous estimates of loss potentials from hurricanes were seriously inadequate**
  - **Insurance industry claim data is not a credible basis from which to produce hurricane insurance costs**

Hugo, Andrew and Iniki

- Aftermath
  - **Insurer insolvencies**
  - **Increased insurer exposure management**
    - **Coastal market curtailments**
    - **Availability shortages**

Hugo, Andrew and Iniki

Hurricanes Hugo, Andrew and Iniki signaled the need to quantify the levels of risk associated with providing hurricane insurance.

ACTUARIAL STANDARD OF PRACTICE NO. 39
TREATMENT OF CATASTROPHE LOSSES IN PROPERTY/CASUALTY INSURANCE RATEMAKING

Provides for the use of non-insurance data (including models) when insurance company claim data is insufficient for rate making.

ACTUARIAL STANDARD OF PRACTICE NO. 38

USING MODELS OUTSIDE THE ACTUARY'S AREA OF EXPERTISE (PROPERTY AND CASUALTY)

Provides guidance to the actuary when using models that are outside of the actuary's area of expertise

Hurricane Models

Hurricane models are designed to utilize our scientific knowledge of hurricanes and our engineering knowledge of how properties are damaged by hurricanes to estimate the **average annual cost** associated with providing property insurance coverage for damage caused by hurricanes over an extensive period of time (i.e. 100,000 years).

BLACK BOX

INSIDE THE BLACK BOX

Florida Commission on Hurricane Loss Projection Methodology

Insurance Consumer Advocate
Fla. Hurricane Catastrophe Fund Executive Director
Executive Director of Citizens P.I.C.
Director of Emergency Management
FHCF Advisory Council Actuary
Florida OIR Actuary
P & C Company Actuary
Professor of Insurance Finance
Professor of Statistics
Professor of Computer Science
Professor of Meteorology

Accurate

Designed and constructed in a careful, sensible, and scientifically acceptable manner such that they correctly describe the critical aspects needed to project loss costs

Reliable

Consistently produce dependable results and that there is no inherent or known bias which would cause the model or technique to overstate or understate the results

Standards

for 2007

- **General (4 standards)**
- **Meteorology (6 standards)**
- **Vulnerability (2 standards)**
- **Actuarial (10 standards)**
- **Statistical (6 standards)**
- **Computer (7 standards)**

Standards

- To be determined acceptable, the model must have been found acceptable for all Standards.
- If the model fails to be found acceptable, by a majority vote, for any one Standard, the model will not be found to be acceptable.

Professional Team

- Meteorologist - Dr. Jenni Evans
- Structural Engineer – Fred Stolaski
- Actuary – Martin Simons
- Statistician – Dr. Mark Johnson
- Computer Scientist – Dr. Paul Fishwick

General Standard

G-2 Qualifications of Modeler Personnel and Consultants

- ***A. Model construction, testing, and evaluation shall be performed by modeler personnel or consultants who possess the necessary skills, formal education, or experience to develop the relevant components for hurricane loss projection methodologies.***
- ***B. The model or any modifications to an accepted model shall be reviewed by either modeler personnel or consultants in the following professional disciplines: structural/wind engineering (licensed Professional Engineer), statistics (advanced degree), actuarial science (Associate or Fellow of Casualty Actuarial Society), meteorology (advanced degree), and computer/information science (advanced degree). These individuals shall be signatories on Forms G-1 through G-6 as applicable and shall abide by the standards of professional conduct if adopted by their profession.***

Meteorological Standard

M-2 Hurricane Characteristics

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

Vulnerability Function

A curve depicting the percentage of damage to a property from different wind speeds

Vulnerability Standard

V-1 Derivation of Vulnerability Functions

- ***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.***
- ***The method of derivation of the vulnerability functions shall be theoretically sound.***
- ***Any modification factors/functions to the vulnerability functions or structural characteristics and their corresponding effects shall be clearly defined and be theoretically sound.***

Vulnerability Standard

V-1 Derivation of Vulnerability Functions (continued)

- ***Construction type and construction characteristics shall be used in the derivation and application of vulnerability functions.***
- ***In the derivation and application of vulnerability functions, assumptions concerning building code revisions and building code enforcement shall be reasonable and be theoretically justified.***
- ***Vulnerability functions shall be separately derived for building structures, mobile homes, appurtenant structures, contents, and additional living expense.***
- ***The minimum wind speed that generates damage shall be reasonable.***

Actuarial Standard

- <u>**A-4 Demand Surge**</u>

<u>***A. Demand surge shall be included in the model's calculation of loss costs.***</u>

<u>***B. The methods, data, and assumptions used in the estimation of demand surge shall be actuarially sound.***</u>

Forms

for 2007

- General – 6 Forms –(expert certification)
- Meteorological – 3 Forms
  + Official Hurricane Set
- Vulnerability – 3 Forms
- Actuarial – 8 Forms
- Statistical – 5 Forms

Hurricane model reviews performed by the Florida Commission on Hurricane Loss Projection Methodology provide the basis for the review of hurricane model used to produce hurricane insurance costs in other jurisdictions.

Other Hurricane Prone States

Determination that the model being reviewed appropriately considers individual state criteria

Hawaii Hurricane Model Review

- Initiated in 2001
- Updated June 30, 2003
- Based on FCHLPM reviews
- Composition –
  - Actuary – Marty Simons
  - Engineer – Gary Chock
  - Meteorologist – Tom Schroeder

Objective

to ensure that models used to produce property insurance loss costs in Hawaii appropriately consider Hawaii hurricane characteristics and frequencies, Hawaii construction types and Hawaii land use and land cover data in their development

Hawaii Model Review Questions

- Twenty-one questions, some with several subparts.
- Does the model provide reasonable consideration of:
  - Hawaii hurricane history (windfield)
  - Pacific hurricanes
  - Hawaii topography
  - Hawaii building stock
  - Hawaii land use – land cover
  - Hawaii policy language

Hawaii Model Review Questions

Is the model the same as that which has been accepted by the Florida Commission on Hurricane Loss Projection Methodology (FCHLPM)?

If not, describe the major differences.

Insurance Rate Filings and Hurricane Loss Estimation Models

- ***Journal of Insurance Regulation, 4/2004***
- ***By Charles C. Watson, Jr., Mark E. Johnson, and Martin Simons***
- ***324 Public Domain Model Combinations***

Public Windfield Models

Wind Field

- **Rankin Vortex**
- **Holton (1992)**
- **Miller (1967)**
- **SLOSH (Jenesnianski, et al., 1992)**
- **Stand. Project Hurricane (Schwerdt, et al,1979)**
- **Bretschneider (1972)**
- **AFGWC (Brand, et al., 1977)**
- **Holland (1980)**
- **Georgiou (1985)**

Public Friction (Boundary Layer Models)

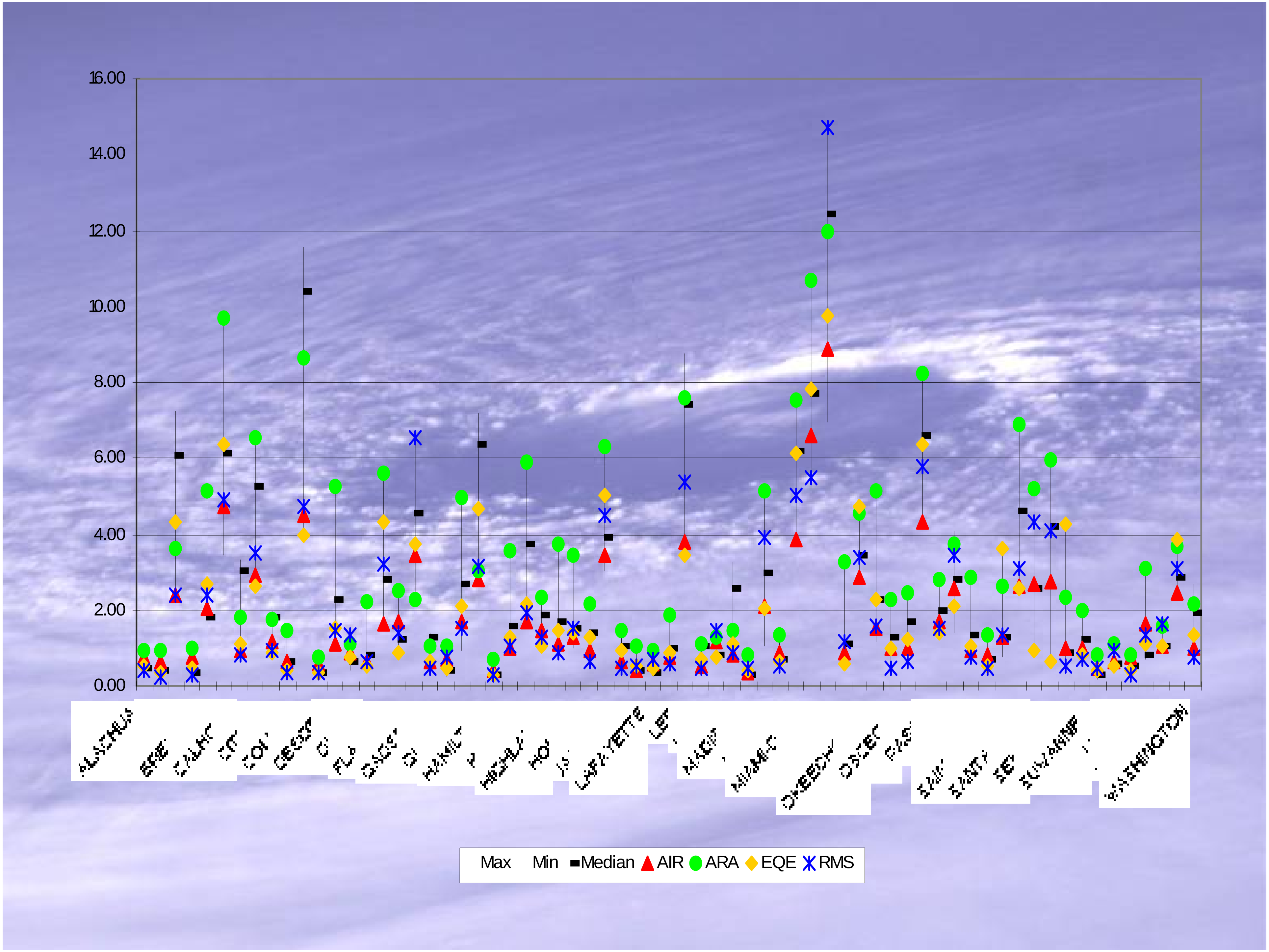
- None (Schwerdt, et al., 1979)
- Cell-based (Cook, 1985)
- ASCE (2000)
- Trajectory (Watson, 1995)

Public Damage Functions

- Australian (Leicester, et al., 1978)
- Foremost (1996)
- Friedman (1984)
- Clemson 1 (Sill, et al., 1997)
- Clemson 2 (Rosowsky, et al., 1999)
- Professional Team (FCHLPM, 2002)
- X-cubed (Howard, et al., 2972)
- Energy (Watson, 2002)
- Stubbs (USAID/OAS, 1996)

Study Criteria

- **Topography: US 90 meter DEM from USGS**
- **Land Cover: NASA/UMD 250m Global Land Cover data set (Spring 2003)**
- **Track: 1851-2002 revised HURDAT data from NHC**
- **Exposure: Census 2000 Block Group data (the STF3 data set).**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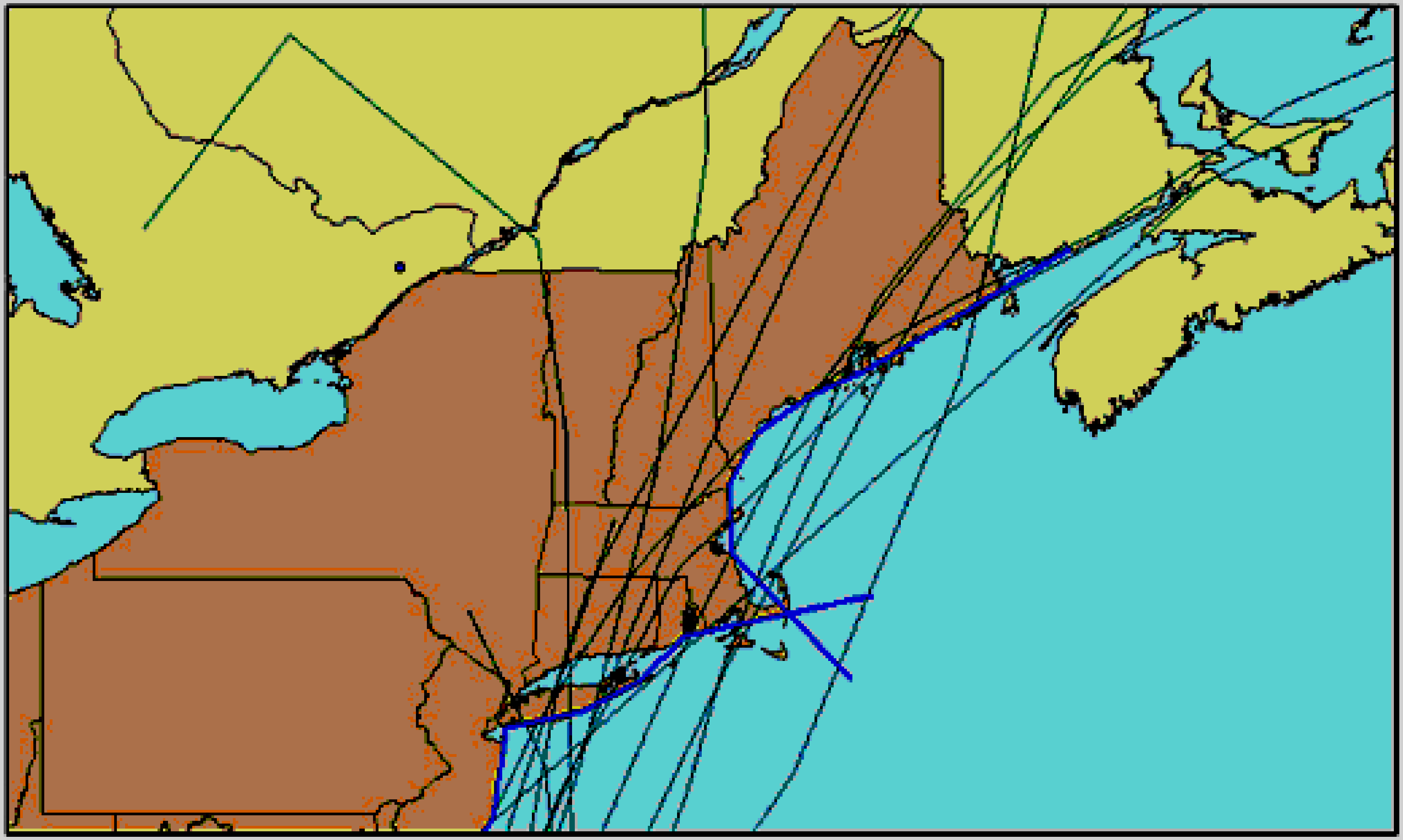
Other Hurricane Prone States

- **Determination that the model being reviewed appropriately considers individual state criteria**

106 Year (1900-2005) Historical Northeast Hurricanes



Individual State Criteria

- **Meteorology**
  - **Hurricane frequencies**
  - **Hurricane tracks**
  - **Hurricane strengths**
  - **Topography**
  - **Land use**
  - **Land cover**
  - **Extratropical transition**
- **Vulnerability**
  - **Construction characteristics**
  - **Building codes and enforcement**
- **Actuarial**
  - **Policy language**
  - **Insurance company practices**

Some Additional References

- **Hurricane Best Track Files (HURDAT), Atlantic Tracks File www.nhc.noaa.gov/pastall.shtml**

- **Florida Commission on Hurricane Loss Projection Methodology www.sbafla.com/methodology/**

- **Watson, Charles C., Johnson, Mark E. and Simons, Martin M., *Insurance Rate Filings and Hurricane Loss Estimation Models,* Journal of Insurance Regulation, April 2004.**