Catastrophes:

Models and Reserving

Using Cat Simulation Models After the Loss

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Using Cat Simulation Models After the Loss

- Models prior to loss
- Limitations to any model
- Models after the loss
- Katrina at T + 5
- Standards of Practice: ASOP 38
- Katrina at T + 15

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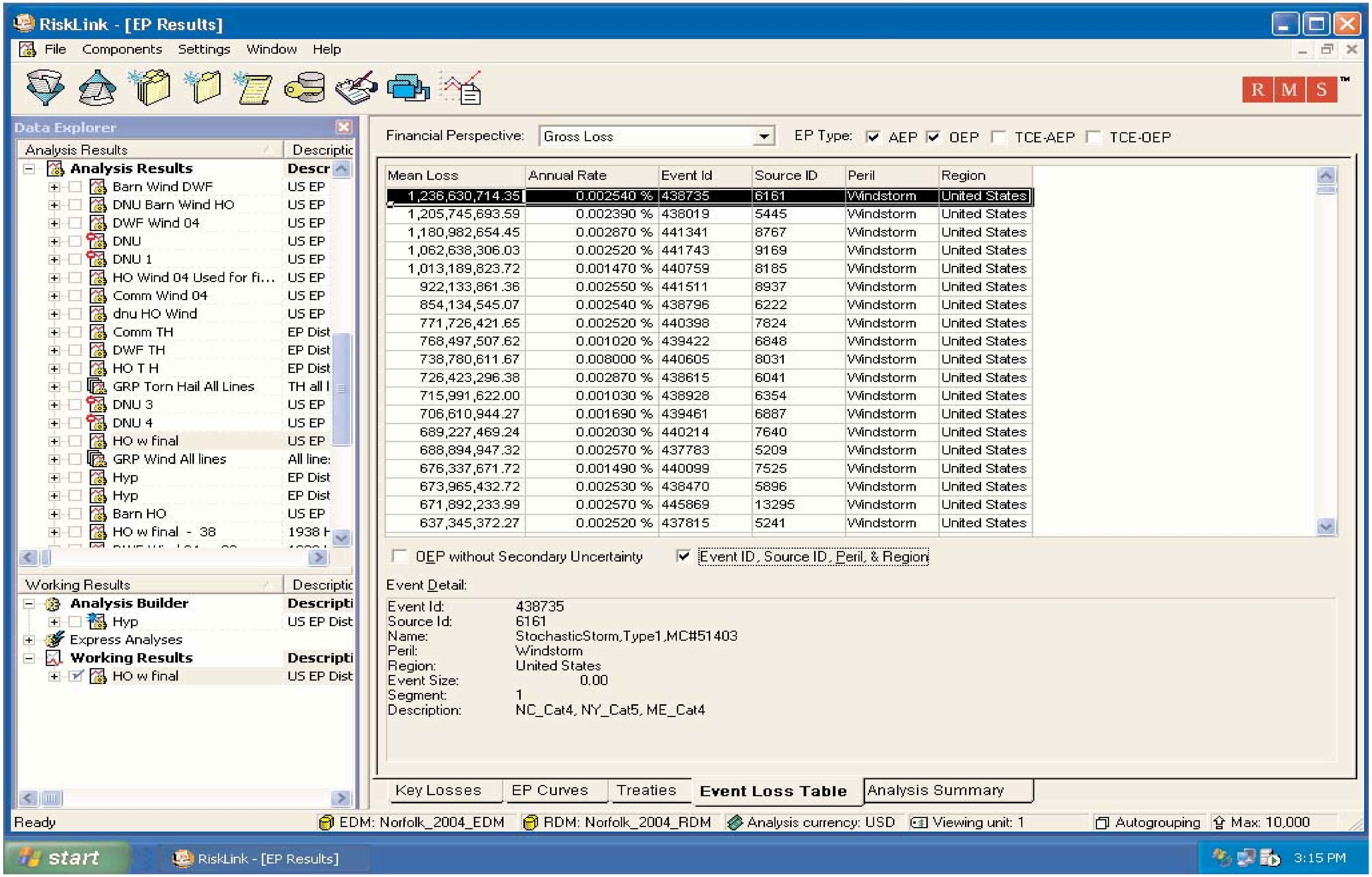
Models Prior to Loss

Models Prior to Loss

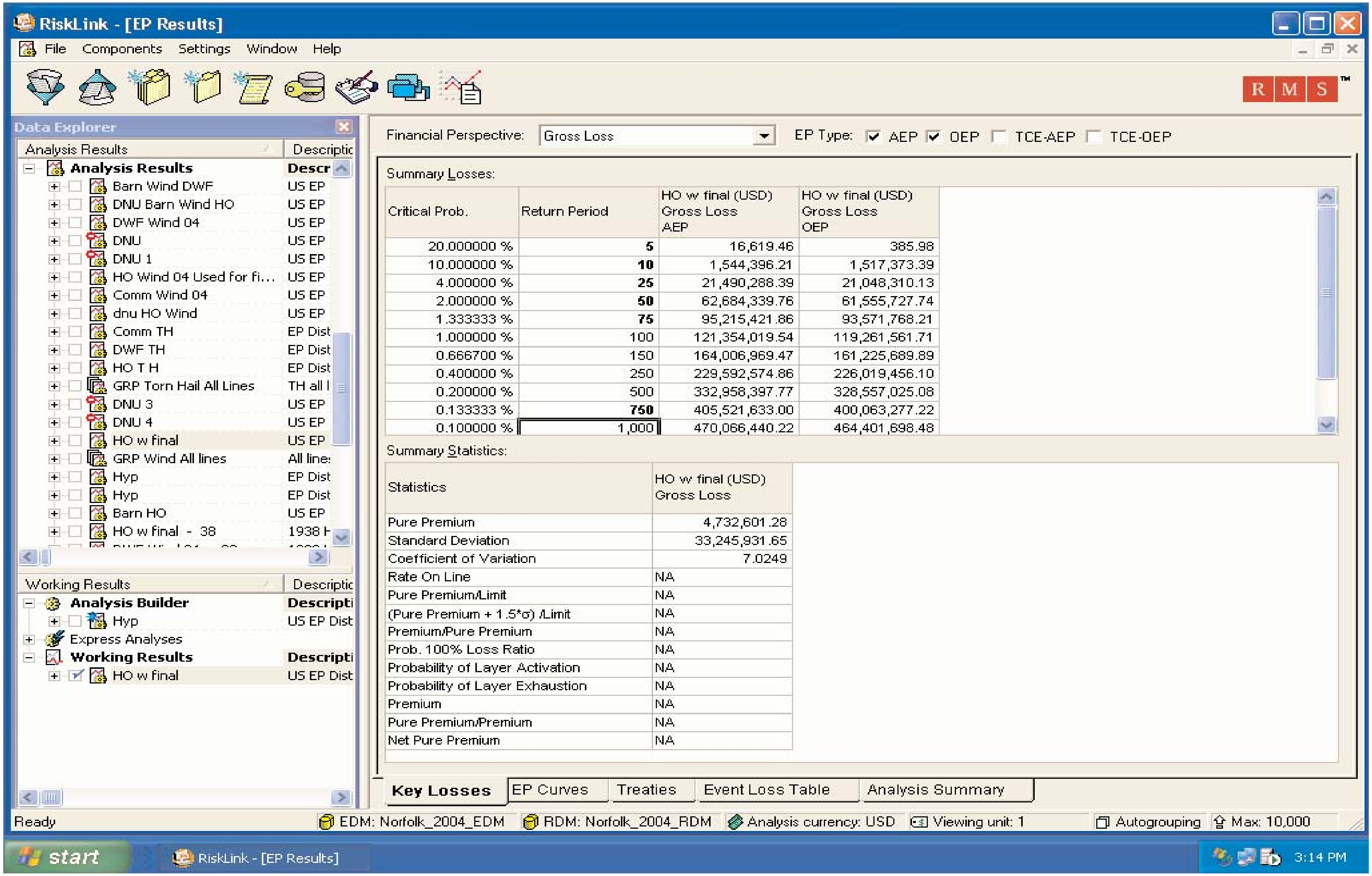
Some Definitions

Event Losses	A table of all simulated events, with estimates of portfolio loss amounts, descriptive code for the event, and the annual rate of the event recurring. Usually sorted by loss amount.
Exceeding Probability	Annual probability of a loss equal, to or exceeding, a given amount.
Return Time	Period (in years) = 1 / Annual E.P. This does not have an easy interpretation as a probability. Don't try!

Event Loss Table



EP Results



Summary Losses:

Critical Prob.	Return Period	HO w final (USD) Gross Loss AEP	HO w final (USD) Gross Loss OEP
20.000000 %	5	16,619.46	385.98
10.000000 %	10	1,544,396.21	1,517,373.39
4.000000 %	25	21,490,288.39	21,048,310.13
2.000000 %	50	62,684,339.76	61,555,727.74
1.333333 %	75	95,215,421.86	93,571,768.21
1.000000 %	100	121,354,019.54	119,261,561.71
0.666700 %	150	164,006,969.47	161,225,689.89
0.400000 %	250	229,592,574.86	226,019,456.10
0.200000 %	500	332,958,397.77	328,557,025.08
0.133333 %	750	405,521,633.00	400,063,277.22
0.100000 %	1,000	470,066,440.22	464,401,698.48

Summary Statistics:

Statistics	HO w final (USD) Gross Loss
Pure Premium	4,732,601.28
Standard Deviation	33,245,931.65
Coefficient of Variation	7.0249
Rate On Line	NA
Pure Premium/Limit	NA
(Pure Premium + 1.5*σ) /Limit	NA
Premium/Pure Premium	NA
Prob. 100% Loss Ratio	NA
Probability of Layer Activation	NA
Probability of Layer Exhaustion	NA
Premium	NA
Pure Premium/Premium	NA
Net Pure Premium	NA

Models Are Very Good at Considering:

- Coverages A and B
- Experimental data from wind tunnel/shake table tests
- Number of major historical events for large geographic regions (e.g. a state or fault)
- Reconciliation to industry data, such as PCS or Sigma
- 25-year to 75-year return times

Structure Loss vs. Construction Data

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Two Houses, Two Fates
Two houses on Belmont Street in Pensacola had distinctly different fates when Ivan hit. The house on the right was built in 1903 and refurbished. The house on the left is only a few years old.

Limitations to Any Model

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Model Limitations

More Subtle Factors That the Models Can Currently Only Implicitely Reflect:

- Coverage D and Risk Excess layers
- Secondary uncertainty/ Correlation issues
- The degree of enforcement of local building codes
- Foliage
- Weather patterns before and after loss events
- Physical alignment of structures along events' force vectors
- Local variations of concentrations or hazard (street address detail)
- Changes in claims handling and other industry practices

Also:

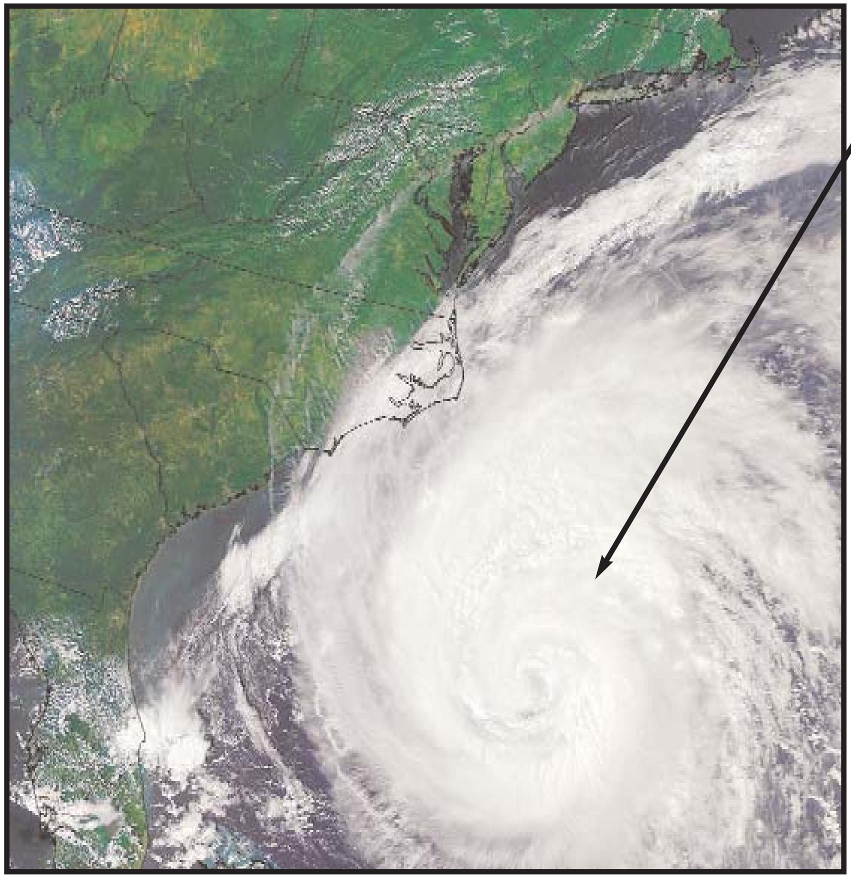
- Data for medium-sized events, 0-10 year return time losses, are not collected as consistently as for larger events. Modelers must look to larger events and back into these events
- Data for mega-events, 250+ year return time losses, are also missing due to limited history. Modelers must extrapolate loss potentials from smaller events

Demand Surge (for Blue Tarps)

This is not a pipe.

A **pipe** has weight, volume, texture, use, scent, taste and a history and a future independent of this view.

A **picture** only has color, height and length, and does not have a past or future.



This is not a hurricane.

A hurricane has varying rainfalls, pressure levels, shearing forces, embedded tornadoes, windblown debris, and follows an unforeseeable track to interact with land and values with their own independent history and future.

A model only represents limited parameters, such as maximum sustained winds, forward speed, radius and central pressure and a simplified track of movement.

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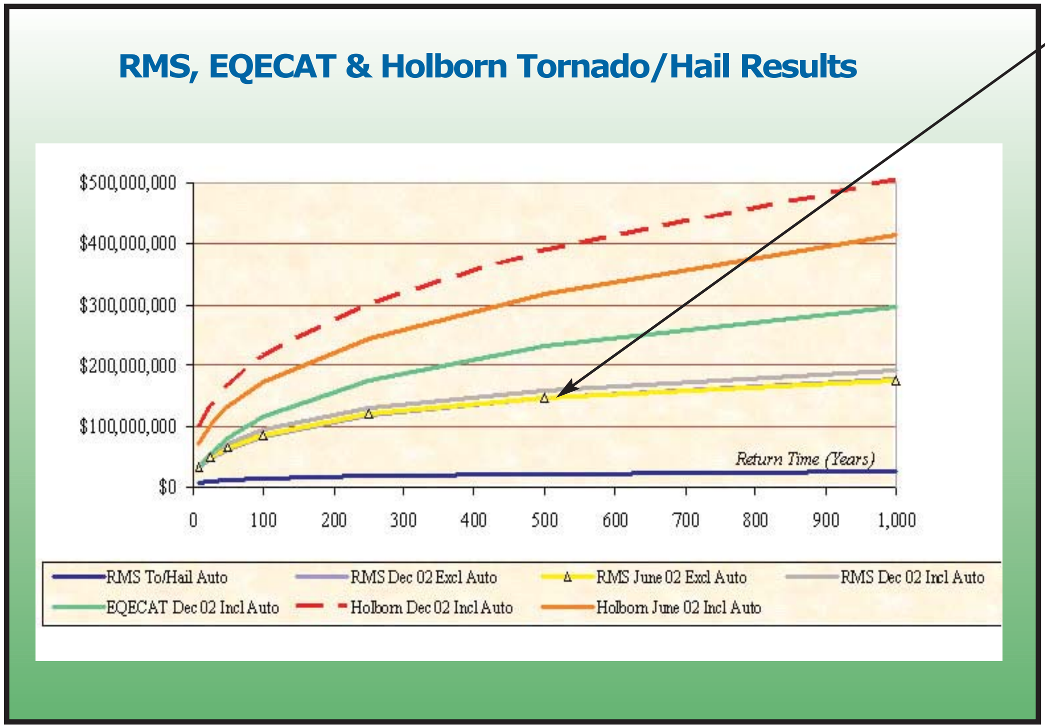


(With apologies to Rene´ Magritte.)

This is not a 500-year loss.

A **return time loss** is the actual result of the most severe loss in a period of time. It reflects the full physical, legal, economic and practical realities of the loss event, the insured values and the market.

An **estimated loss** only represents the result of a model applied to coded exposure data files under simplifying standard assumptions.

Models After the Loss

Models After the Loss

- Pre-existing simulated "events" selected to most cosely match the actual or expected event
- Industry loss estimates based on after-the-event reconaissance
- Marketshare estimates overall
- "Back casting" physical event details
- Industry Loss in geographic detail → local damage factors
- Footprint files → localized market shares

Models After the Loss

A special concern:

Using the same model to reserve as you used to price or underwrite.

Potato Famine

Katrina at T + 5

Katrina at T + 5

- The latest wind-only loss estimates (as of Friday PM, September 2) are:
  - *EQE $9Bn – $17Bn*
  - *AIR $12Bn – $26Bn*
  - *RMS $20Bn – $35Bn*

  These are all on the low side, because of non-modeled exposures. They likely exclude LAE, insured Flood losses, most marine losses (except RMS is including rigs), at least EQE is only speaking about the second landfall. There are no estimates yet from PCS or Sigma, and they will be informative.

  But even with this detail, the degree of damage will be fairly difficult to gauge. Here are some considerations:
  - *The models do not measure flood except at the coastline. Homes are insured by the Federal plan, not the market, but there is Flood coverage for Personal and Commercial auto, Contractors and Farm equipment, PAF's, Cargo, MOP and many commercial property policies (although usually sublimited.)*
  - *Further inland, tree limb damage is not modeled outside of the areas with sustained winds over 50 or so mph. There will be losses inland that are not modeled.*

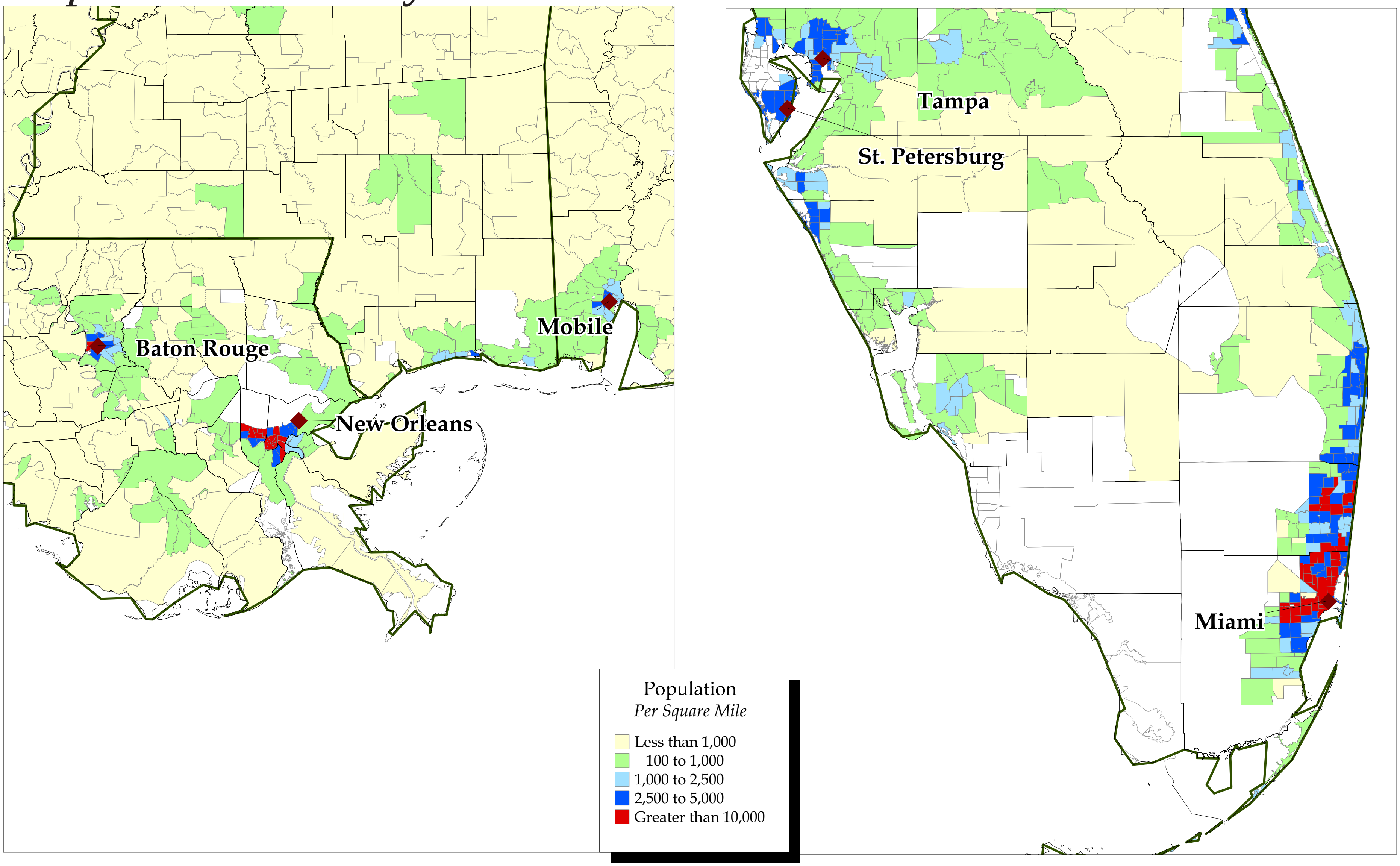
Katrina at T + 5 (cont'd)

- *The tornados in Georgia can be modeled, but they could not be in these estimates at this date.*
- *The marine loss will be substantial. RMS notes that this is likely the largest rig storm loss ever, and Ivan was a sizeable loss. There is also a great deal of damage to docks, marinas and yachts.*
- *There has been some notable fires and looting.*
- *Mold.*
- *Existing and compounding damage from Ivan and Dennis in the Mobile to Pennsacola areas.*
- *Time element coverage will be extended because of the continuing evacuation orders and because of the need to clean up from flooding before residents can safely return.*

We should also expect a higher than expected degree of demand surge, both because of the remaining inflations from the 2004 situation, and because of significant resources devoted to Fed Flood and other uninsured losses.

Katrina vs. Ivan

Population Density



Katrina at T + 5
Holborn Observations

On-shore Wind Loss	Based on windspeed, pressure, local population, initial news reports and preliminary client "footprint" analyses, we estimate damage as similar to Andrew's $22Bn in 2005 dollars.
Off-shore Loss	Worst ever, > Ivan's $2.6 Bn
Insured Flood	BAD!
Total Market Loss	Worst ever natural Cat in nominal dollars
Total Economic Loss	As bad as 9/11 in dollars, less than SF 1906 or Kobe as a percent of GDP

ACTUARIAL STANDARDS BOARD

Actuarial Standard
of Practice
No. 38

Using Models Outside the Actuary's Area of Expertise (Property and Casualty)

Developed by the
Task Force on Complex Models of the
Casualty Committee of the
Actuarial Standards Board

Adopted by the
Actuarial Standards Board
June 2000

(Doc. No. 071)

Standards of Practice: ASOP 38

3.1 When Using a Model, the Actuary Should Do All of the Following

a. Determine appropriate reliance on experts;

b. Have a basic understanding of the model;

c. Evaluate whether the model is appropriate for the intended application;

d. Determine that appropriate validation has occurred; and

e. Determine the appropriate use of the model.

3.2 Reliance on Expert

The Actuary Should Consider the Following:

a. Whether the individual or individuals upon whom the actuary is relying are experts in the applicable field;

b. The extent to which the model has been reviewed or opined on by experts in the applicable field, including any known significant differences of opinion among experts concerning aspects of the model that could be material to the actuary's use of the model; and

c. Whether the model has been certified as having met such standards

3.3 Understanding of the Model

Be reasonably familiar with the basic components of the model and understand both the user input and the model output, as discussed below.

a. Model Components—identify which fields of expertise were used in developing or updating the model, and should make a reasonable effort to determine if the model is based on generally accepted practices within the applicable fields of expertise. The actuary should also be reasonably familiar with how the model was tested or validated and the level of independent expert review and testing.

b. User Input—The actuary should understand the user input that is required to produce the model output. This understanding includes the level of detail required in the user input to produce results that are consistent with the intended use of the model.

c. Model Output—The actuary should determine that the model output is consistent with the actuary's intended use of the model.

3.4 Appropriateness of the Model for the Intended Application

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Consider limitations of the model, modifications to the model, and the assumptions needed in order to apply the model output.

Some additional considerations include the following:

a. The adequacy of the historical data in representing the range of reasonably expected outcomes consistent with current knowledge about the phenomena being analyzed.

b. Be aware of significant development in relevant fields or expertise.

3.5 Appropriate Validation
Refer to ASOP No. 23, Data Quality

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Examine the model output for reasonableness:

a. Results derived from alternate models

b. How historical observations compare

c. Consistency and reasonableness or relationships among various output

d. The sensitivity of the model output to variations

Katrina at T + 15

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Comments or Questions

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