

# A Short History of Computing Technology

intel

## revolution in evolution

Highlights from the Journey to 1 Billion PCs

1,000,000  
900,000  
800,000  
700,000  
600,000  
500,000  
400,000  
300,000  
200,000  
100,000

1,000,000  
900,000  
800,000  
700,000  
600,000  
500,000  
400,000  
300,000  
200,000  
100,000



**1981** - IBM introduces its first personal computer featuring the Intel® 8088 microprocessor. It spurs the PC revolution and sets industry standards that still exist today. The IBM platform enabled hardware makers and software programmers to develop programs and add-on accessories. Until then, most PCs had been closed and proprietary.

**1982** - Lotus Development Corporation introduces Lotus 1-2-3, which becomes a best-seller application.\*

**1983** - The IBM PCXT establishes the IBM format PC featuring an Intel processor. Acorn Computers completes the first portable computer, the Osborne. It weighs 24 pounds and plugs into the wall.

**1984** - Apple introduces the Macintosh with a GUI. A GUI is a graphical user interface that provides visual representation for what was previously lines of DOS code, making PCs more usable for non-technical people.

**1985** - Intel introduces the 386™ microprocessor featuring 275,000 transistors - more than 100 times as many as the original 4004. The 386™ microprocessor was a 32-bit chip that brought "multi-tasking" capabilities to the PC.

**1986** - Intel introduces the Pentium™ processor and Microsoft introduces Windows® 3.1, providing a solid multimedia platform for consumer games and learning applications. Increased processing capabilities, coupled with the availability of affordable CD-ROM drives and sound cards, set in multimedia on the PC.

**1987** - Toshiba introduces the 11000 laptop PC, making portable computing more widely available.

**1988** - The number of PCs shipped worldwide reaches nearly 120 million.\*

**1989** - Intel introduces the Pentium™ processor and Microsoft introduces Windows® 3.11, providing a solid multimedia platform for consumer games and learning applications. Increased processing capabilities, coupled with the availability of affordable CD-ROM drives and sound cards, set in multimedia on the PC.

**1990** - In Geneva, Switzerland, Tim Berners-Lee develops a new technique for distributing information on the internet, eventually called the World Wide Web.

**1991** - Dell introduces the first PC featuring an Intel processor. Microsoft DOS and a hard drive as the most popular personal computing platform.

**1992** - The number of PCs shipped worldwide reaches 202 million.\*

**1993** - Intel introduces the Pentium™ processor and Microsoft introduces Windows® 3.11, providing a solid multimedia platform for consumer games and learning applications. Increased processing capabilities, coupled with the availability of affordable CD-ROM drives and sound cards, set in multimedia on the PC.

**1994** - The number of PCs shipped worldwide reaches nearly 288 million.\*

**1995** - Microsoft launches Windows® 95 and its browser, Internet Explorer. Selling more than 1 million copies in the first four days, the operating system helps make PCs into more than 250 million businesses, homes, and schools around the world.\*\*

**1996** - Intel introduces the Pentium™ III processor and the number of PCs shipped worldwide reaches more than 497 million.\*

**1997** - Intel introduces the Pentium™ III processor and the number of PCs shipped worldwide reaches more than 617 million.\*

**1998** - Dell introduces the Pentium™ III processor and the number of PCs shipped worldwide reaches 580 million.\*

**1999** - Intel introduces the Pentium™ III processor. The number of PCs shipped worldwide reaches nearly 706 million.\*

**2000** - Intel introduces the Pentium™ III processor. The number of PCs shipped worldwide reaches nearly 706 million.\*

**2001** - 20th anniversary of IBM's first personal computer. Microsoft introduces the Windows® XP operating system. Nearly half a billion people around the world have access to the internet for the first time.†

**2002** - Intel introduces the Mobile Intel® Pentium™ 4 Processor-M, bringing desktop performance to the laptop PC. The PC industry ships the 1 billionth PC, according to industry analyst firm Gartner Dataquest.‡

**2007-2008** - The number of PCs shipped worldwide may reach 2 billion, according to industry analyst firm Gartner Dataquest.†

**1971** - Intel, founded by Robert Noyce, Gordon Moore and Andy Grove, introduces the world's first microprocessor and calls it the Intel® 4004.

**1974** - Intel introduces the 8080 microprocessor, which was used in the first single circuit board computer - the Altair.

**1976** - Apple releases the Apple I, the first single circuit board computer. The following year, the company introduces the Apple II. A first for a personal computer, the Apple II featured color graphics.†

**1977** - Intel introduces the Intel® 8085 microprocessor.

**1980** - Microsoft ships the "Microsoft" operating system with a graphical user interface. Amstar Online is founded.†

**1985** - The number of PCs shipped worldwide reaches nearly 64 million and a 15-year period of continuous growth begins.†

**1986** - Intel introduces the Pentium™ processor and Microsoft introduces Windows® 3.1, providing a solid multimedia platform for consumer games and learning applications. Increased processing capabilities, coupled with the availability of affordable CD-ROM drives and sound cards, set in multimedia on the PC.

**1987** - Toshiba introduces the 11000 laptop PC, making portable computing more widely available.

**1988** - The number of PCs shipped worldwide reaches nearly 120 million.\*

**1989** - Intel introduces the Pentium™ processor and Microsoft introduces Windows® 3.11, providing a solid multimedia platform for consumer games and learning applications. Increased processing capabilities, coupled with the availability of affordable CD-ROM drives and sound cards, set in multimedia on the PC.

**1990** - In Geneva, Switzerland, Tim Berners-Lee develops a new technique for distributing information on the internet, eventually called the World Wide Web.

**1991** - Dell introduces the first PC featuring an Intel processor. Microsoft DOS and a hard drive as the most popular personal computing platform.

**1992** - The number of PCs shipped worldwide reaches 202 million.\*

**1993** - Intel introduces the Pentium™ processor and Microsoft introduces Windows® 3.11, providing a solid multimedia platform for consumer games and learning applications. Increased processing capabilities, coupled with the availability of affordable CD-ROM drives and sound cards, set in multimedia on the PC.

**1994** - The number of PCs shipped worldwide reaches nearly 288 million.\*

**1995** - Microsoft launches Windows® 95 and its browser, Internet Explorer. Selling more than 1 million copies in the first four days, the operating system helps make PCs into more than 250 million businesses, homes, and schools around the world.\*\*

**1996** - Intel introduces the Pentium™ III processor and the number of PCs shipped worldwide reaches more than 497 million.\*

**1997** - Intel introduces the Pentium™ III processor and the number of PCs shipped worldwide reaches more than 617 million.\*

**1998** - Dell introduces the Pentium™ III processor and the number of PCs shipped worldwide reaches 580 million.\*

**1999** - Intel introduces the Pentium™ III processor. The number of PCs shipped worldwide reaches nearly 706 million.\*

**2000** - Intel introduces the Pentium™ III processor. The number of PCs shipped worldwide reaches nearly 706 million.\*

**2001** - 20th anniversary of IBM's first personal computer. Microsoft introduces the Windows® XP operating system. Nearly half a billion people around the world have access to the internet for the first time.†

**2002** - Intel introduces the Mobile Intel® Pentium™ 4 Processor-M, bringing desktop performance to the laptop PC. The PC industry ships the 1 billionth PC, according to industry analyst firm Gartner Dataquest.‡

**2007-2008** - The number of PCs shipped worldwide may reach 2 billion, according to industry analyst firm Gartner Dataquest.†

**2003** - Intel introduces the Pentium™ D processor and the number of PCs shipped worldwide reaches more than 800 million.\*

**2004** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2005** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2006** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2007** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2008** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2009** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2010** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2011** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2012** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2013** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2014** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2015** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2016** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2017** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2018** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2019** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

**2020** - Intel introduces the Pentium™ D processor. The number of PCs shipped worldwide reaches more than 800 million.\*

For more information, please visit <http://www.intel.com>

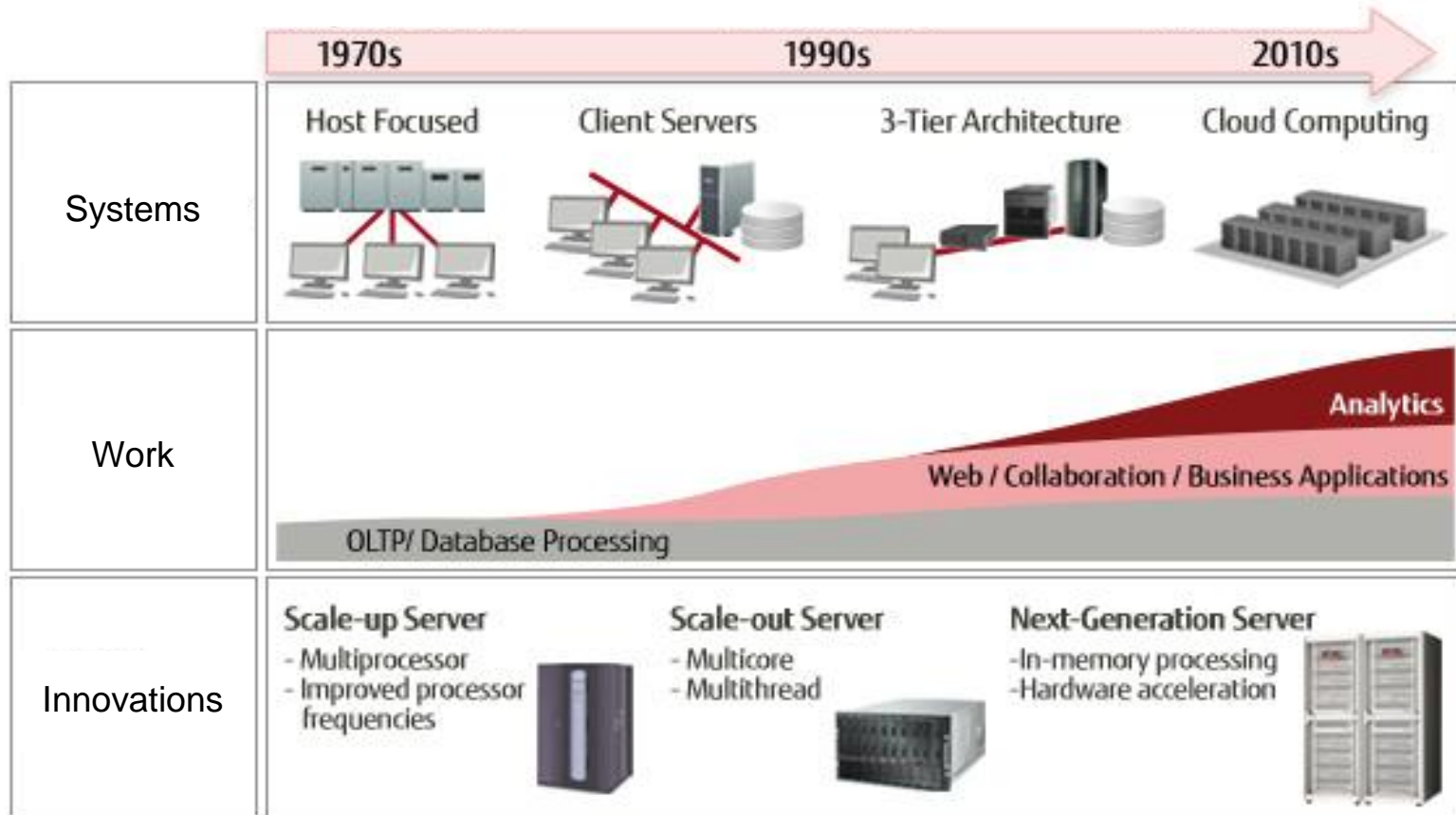
Intel and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries. Other names and brands may be claimed as the property of others.

\*Source: [www.intel.com](http://www.intel.com)  
 \*\*Source: [www.intel.com](http://www.intel.com)  
 †Source: [www.intel.com](http://www.intel.com)  
 ‡Source: [www.intel.com](http://www.intel.com)

†Source: [www.intel.com](http://www.intel.com)  
 ‡Source: [www.intel.com](http://www.intel.com)  
 ††Source: [www.intel.com](http://www.intel.com)  
 †††Source: [www.intel.com](http://www.intel.com)  
 ††††Source: [www.intel.com](http://www.intel.com)

<http://alphabitesoup.files.wordpress.com>

# Technology Trends Drive “Hi-Res” Computer Modeling

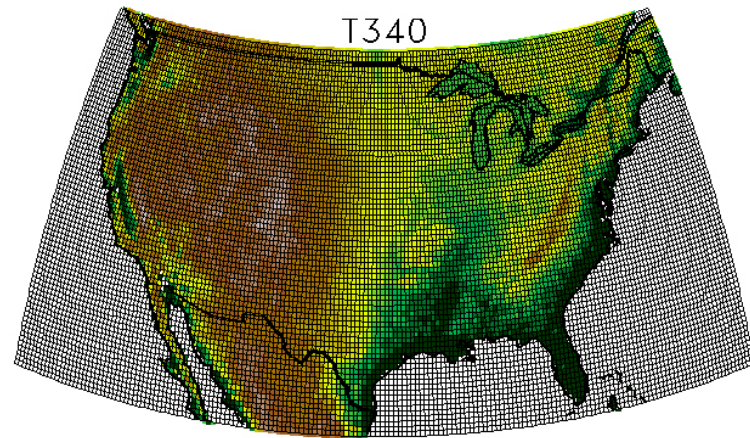
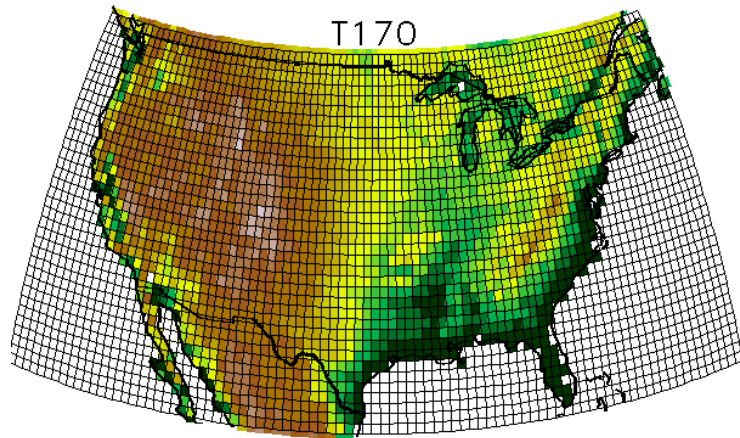
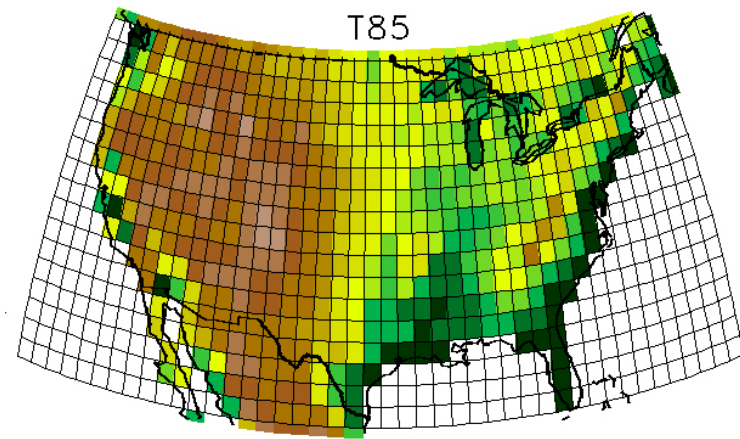
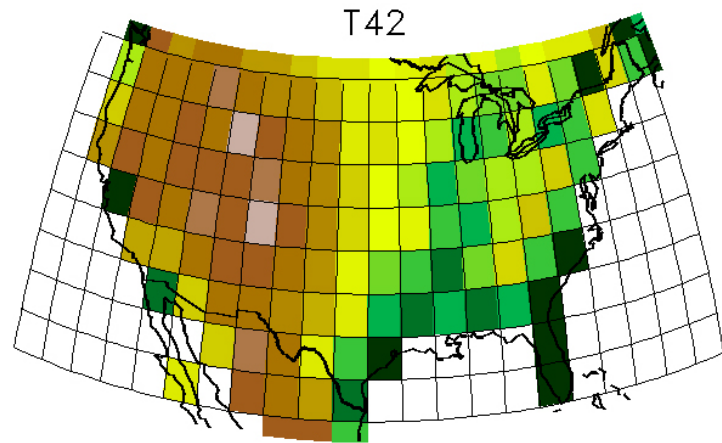


<http://www.fujitsu.com>

## Examples

- Faster processors (Moore’s Law)
- Multiple cores and processors
- Grid and Cloud Computing

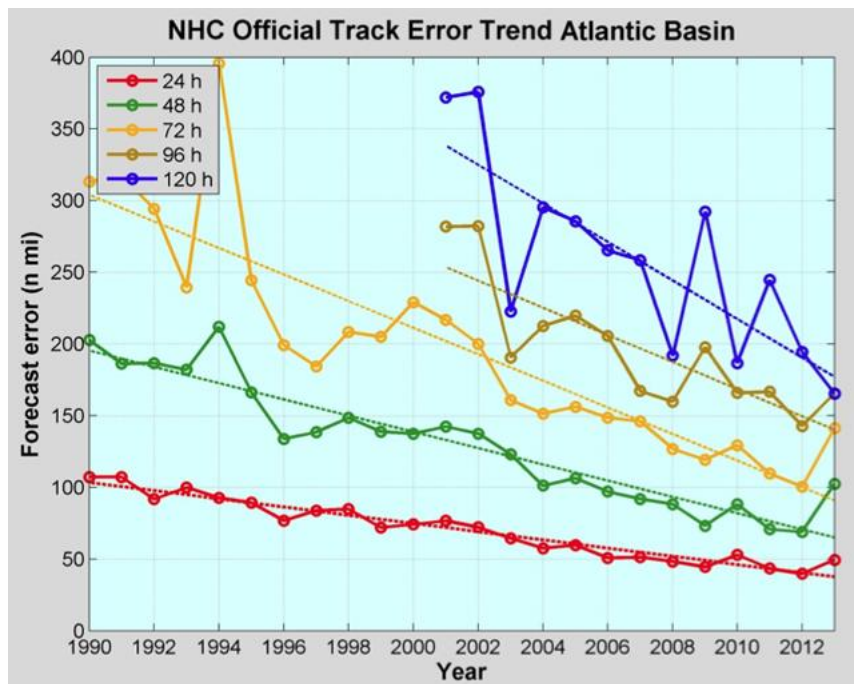
# Climate Research Gains with Advances in Computing Power



<https://www2.ucar.edu/news/understanding-climate-change-multimedia-gallery>



# Hurricane Forecasts Have Improved with Better Technology



- 60% reduction in 1-3 day track forecast errors in last 24 years
- 40% reduction in 4-5 day track forecast errors in last 13 years

- Noticeable improvement in intensity forecasts for 2013
- Improvements attributed to
  - Higher resolution grids
  - Better physical models

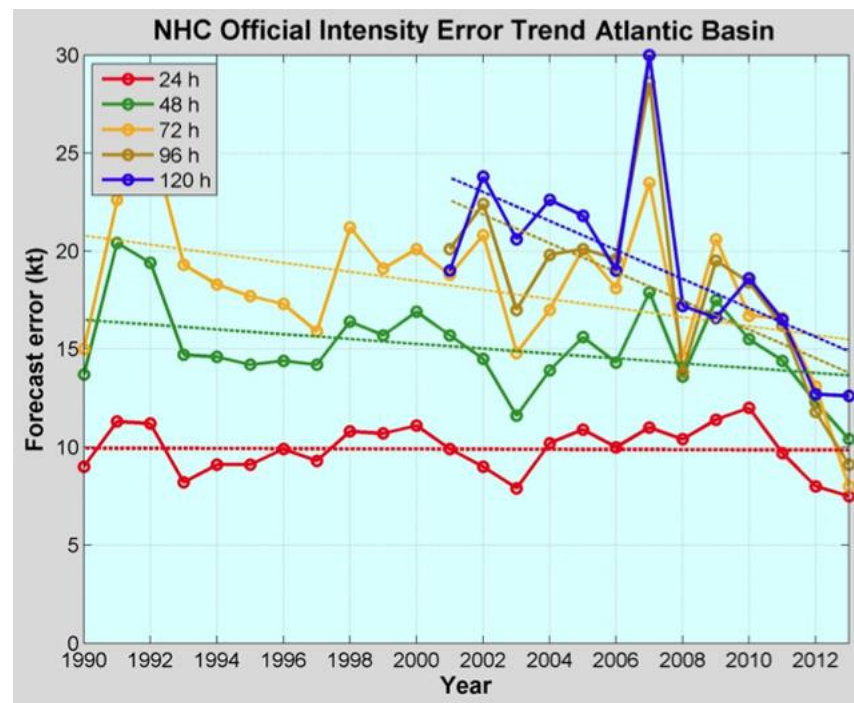
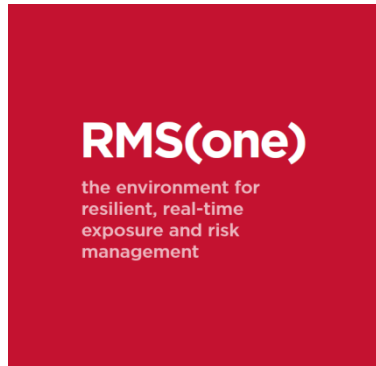


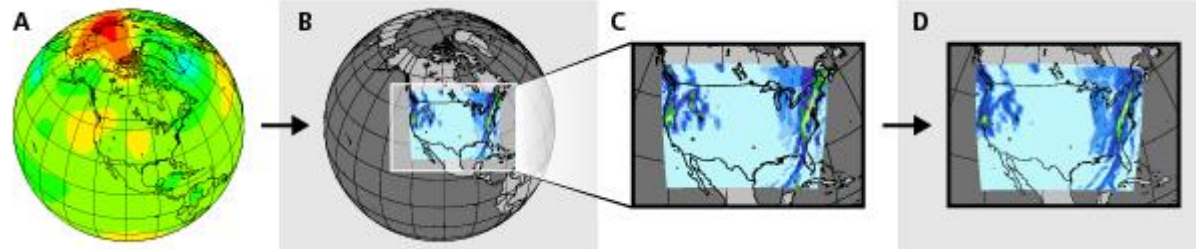
Image credit: 2013 National Hurricane Center Forecast Verification Report  
Jeff Masters' Wunderblog, August 2014

# Catastrophe Models are Increasingly High Resolution

- RMS to deliver “HD models” with their RMS(one) Platform
- AIR increasing resolution of models, including flood



<http://riskinc.com/Publications/rmsone-brochure.pdf>



<http://www.air-worldwide.com/Publications/AIR-Currents/2013>

## Applications of high resolution models for catastrophes

- Higher resolution grids for hazard models
- More detailed industry exposure databases
- Additional damage functions, building details, and financial terms

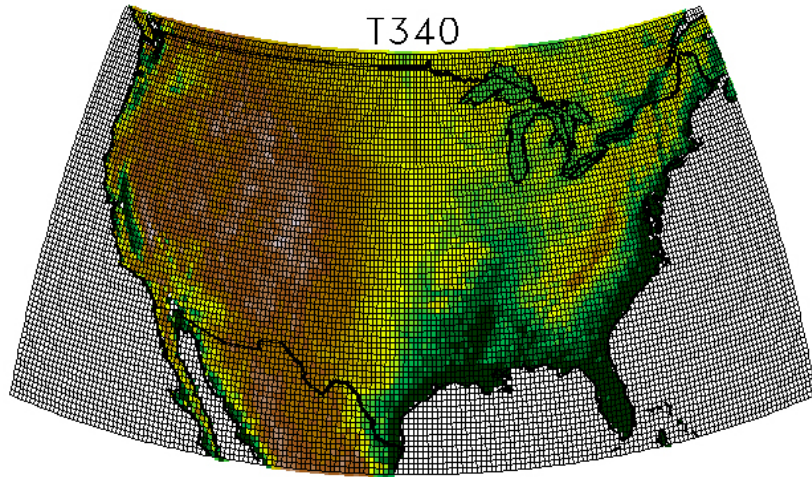
# Will CAT Models become more Accurate in “Hi Res”?

Perhaps.... But probably not \*. There are limitations:

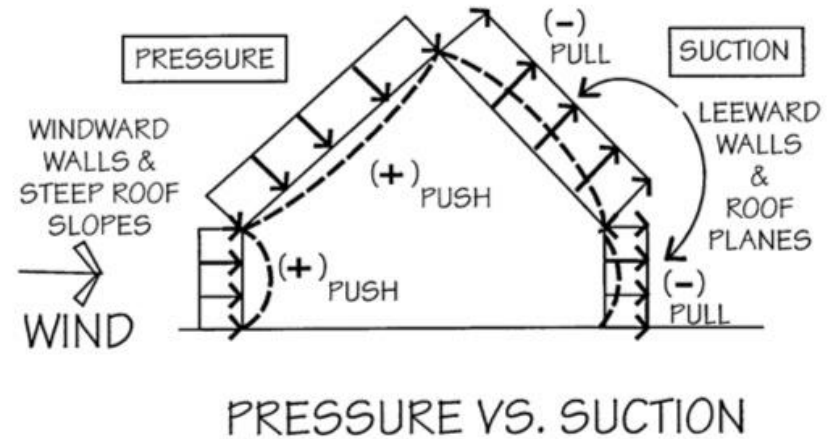
- Scale of the problem
- Accuracy of underlying data
- Reliance on empirical relationships and simplifying assumptions

\* Some exceptions

# Important Processes Occur at Very Small Spatial Scales



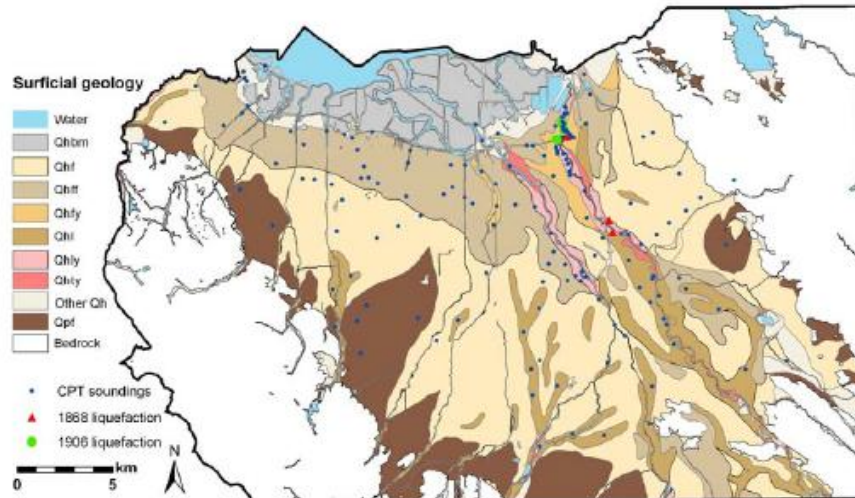
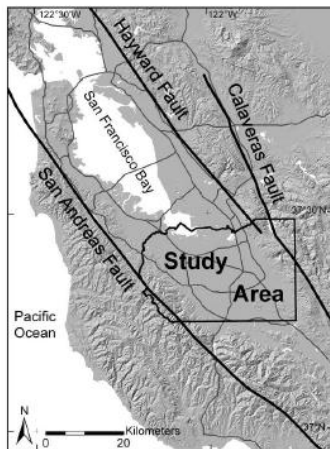
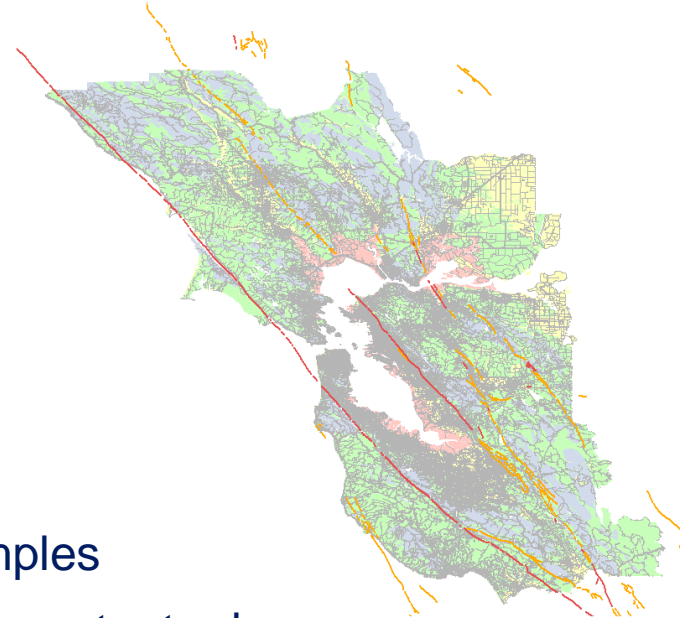
Weather and Climate ~ Order of (km)



Wind Loads on Buildings ~ Order of (m)

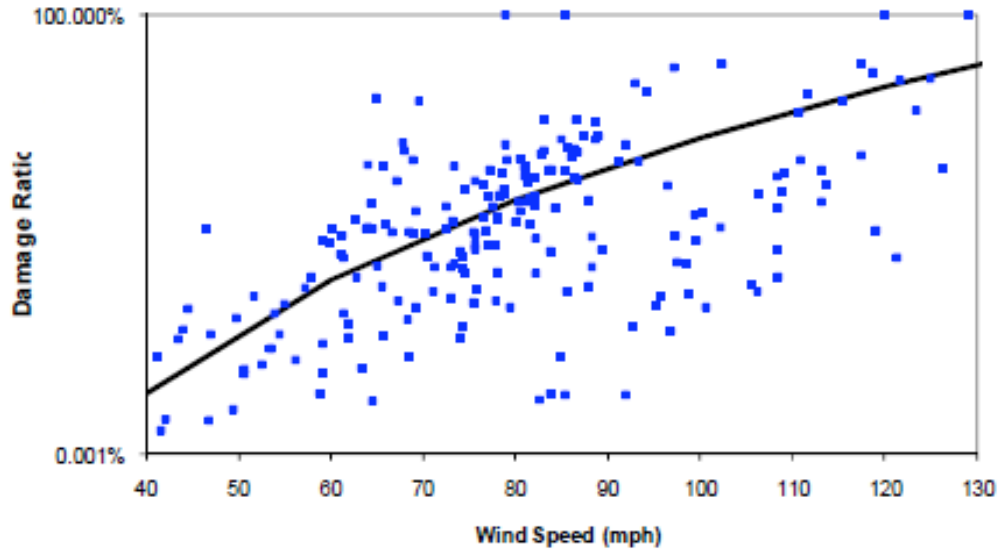
# Inaccuracies in underlying data is unavoidable

- Fault locations are approximately mapped
- USGS: “Surface geology provides only a rough estimate of the site effect.”
- Even the highest resolution data is limited
  - Practical limitations to number of soil samples
  - Other factors (e.g., water table) play an important role

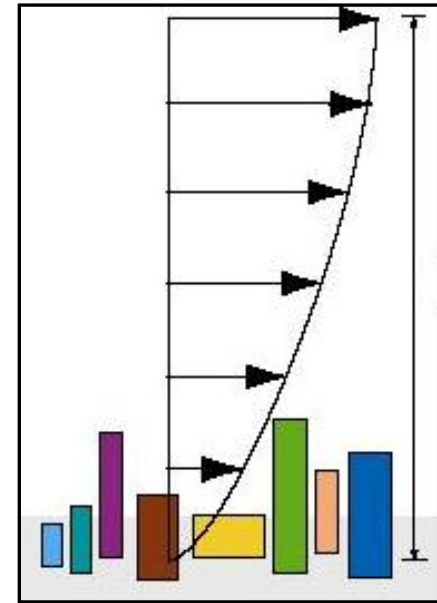




# Empiricism and Simplifying Assumptions are Widely Used



Widely scattered claims information



Roughness  $\sim$  F(land use)

Data: <http://www.iawe.org/Proceedings/11ACWE/11ACWE-Jain.Vineet2.pdf>

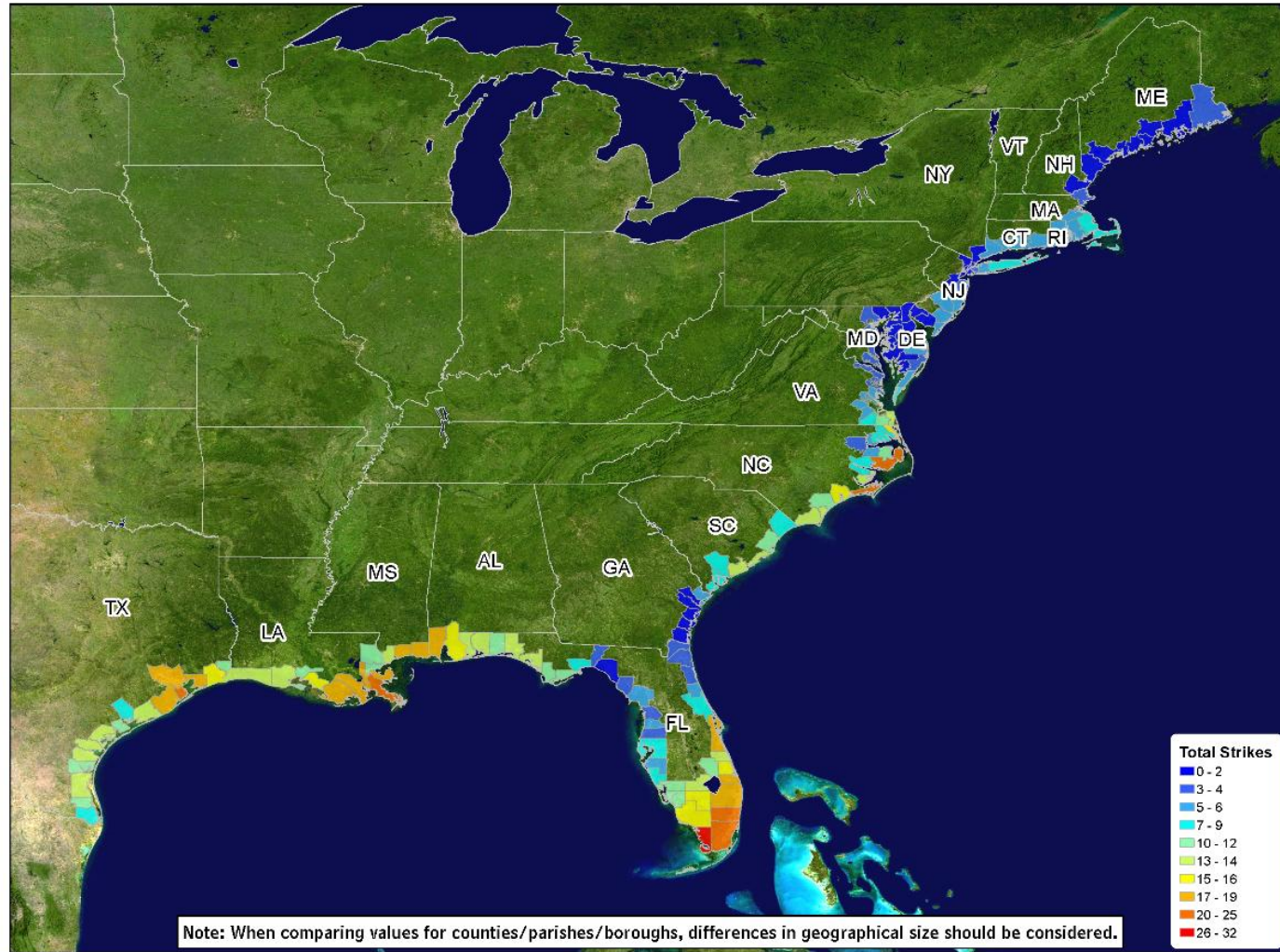
# Additional Computing Power can be Deployed to Gain Insight

- Additional analyses, to monitor exposure changes
- Longer catalogs, to increase tail convergence
- More scenarios, to improve geographic coverage
- Multiple samples, to stress-test model assumptions

## *Practical Examples*

- Simulating frequency-severity assumptions
- Hurricane Modeling with RiskInsight
- Surge modeling with Oasis

# The Historical Hurricane Landfall Record is Short ....

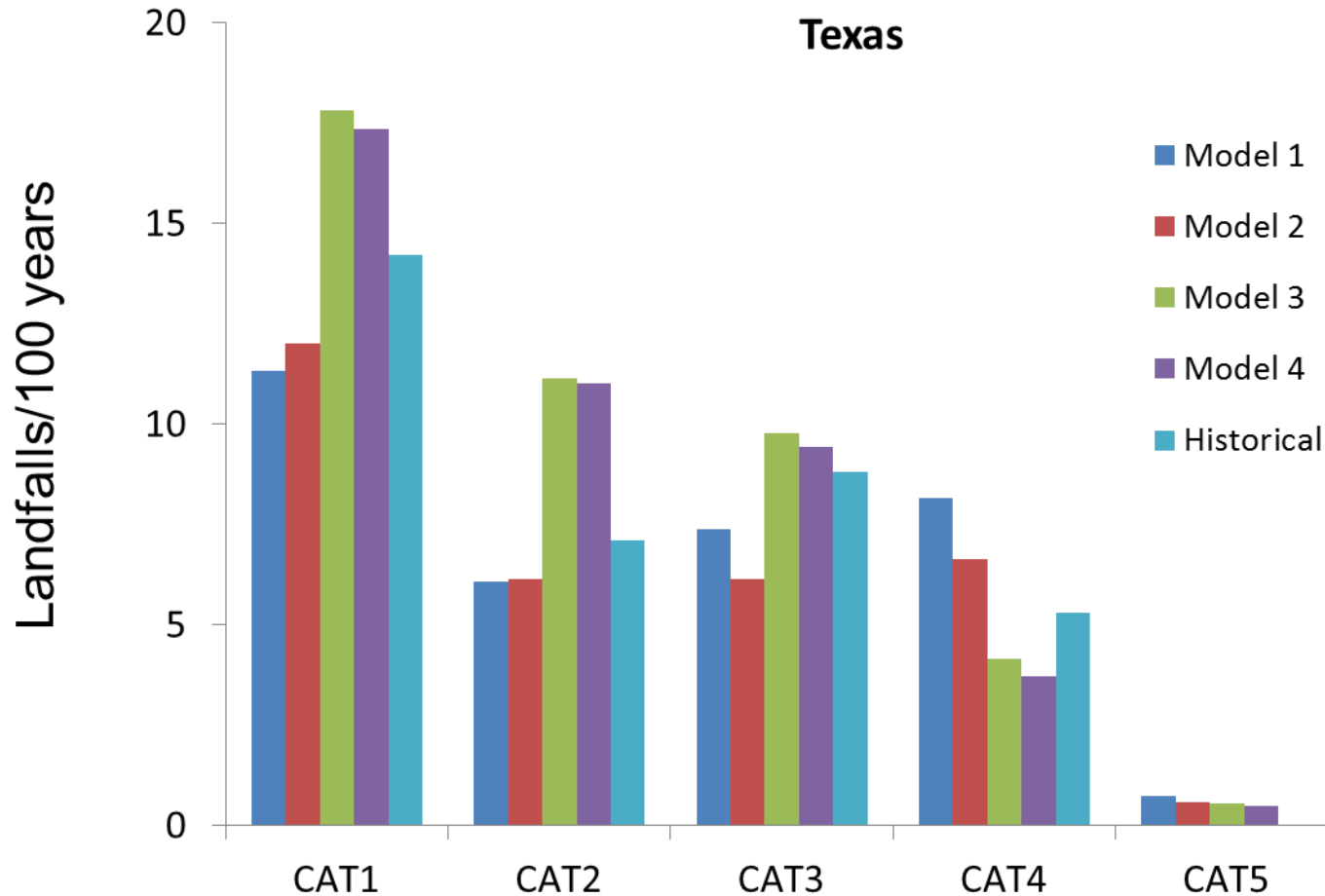


**Total number of hurricane strikes by counties/parishes/boroughs, 1900-2010**

Data from NWS NHC 46: Hurricane Experience Levels of Coastal County Populations from Texas to Maine. Jerry D. Jarrell, Paul J. Hebert, and Max Mayfield. August, 1992, with updates.

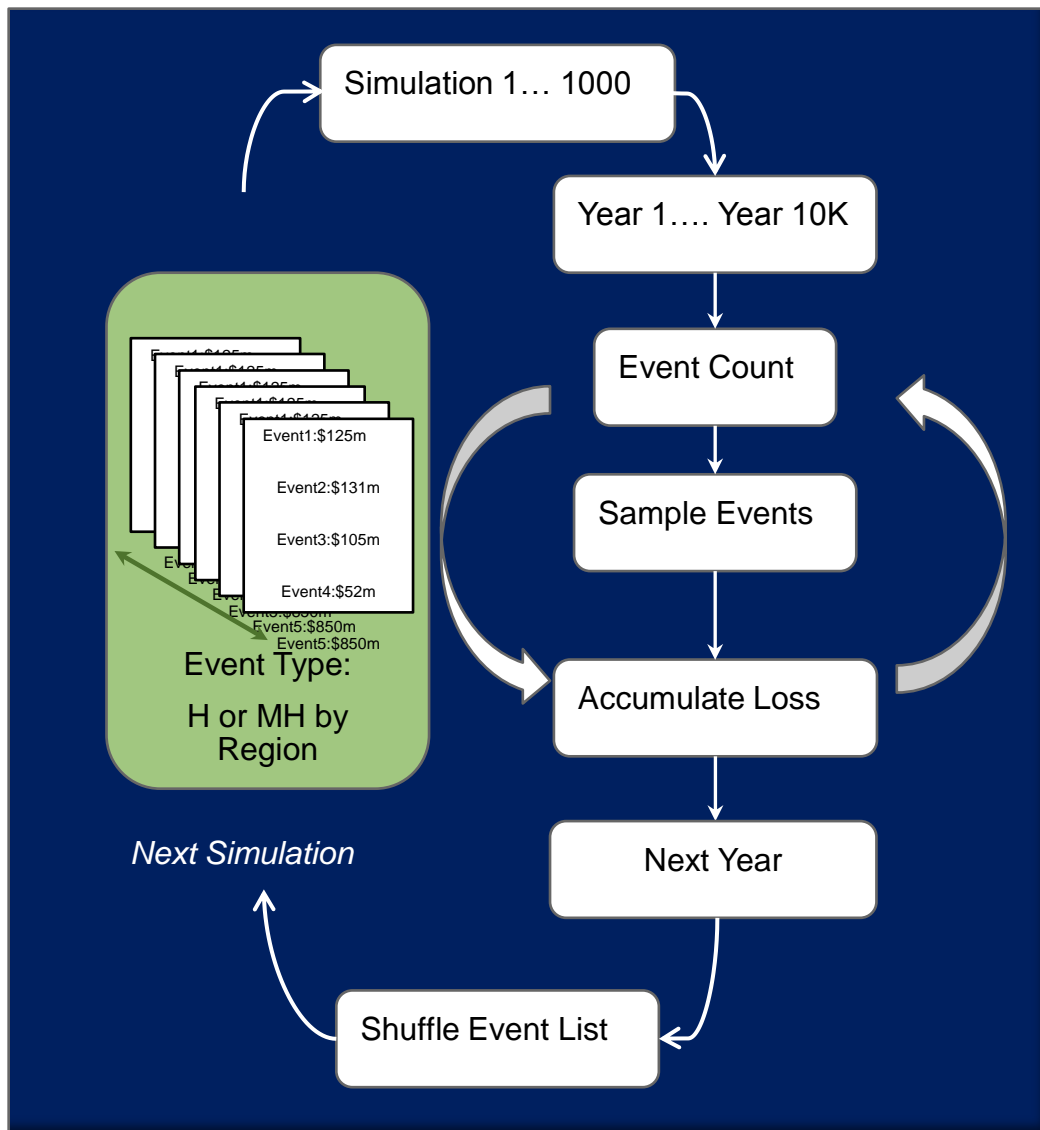
<http://www.nhc.noaa.gov>

# ... Leading to Variability in Hurricane Landfall Assumptions





# Simple Stress Test for Uncertainty in Landfall Frequency

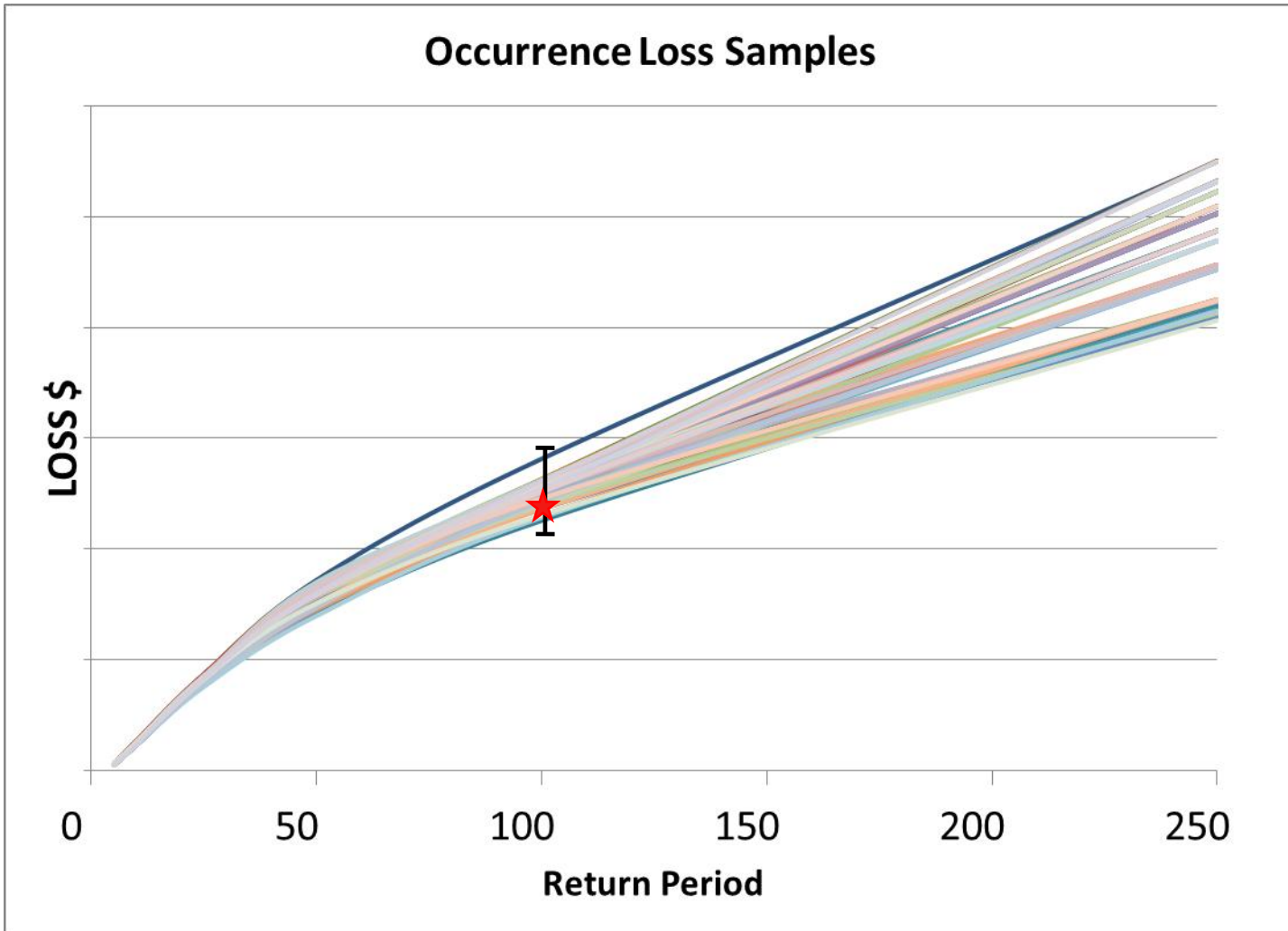


- Straightforward process for frequency-based models

A more general approach:

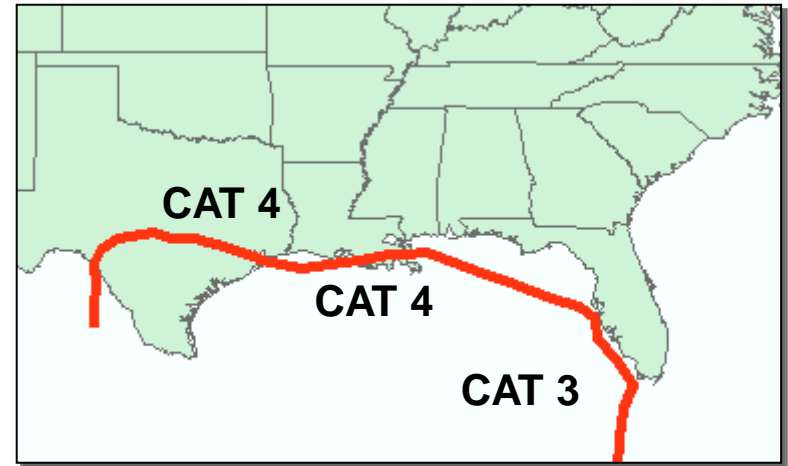
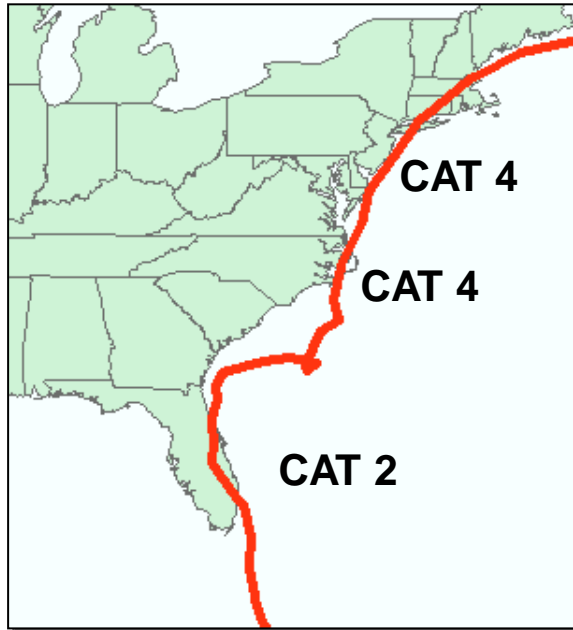
- Separate events into different “pools” by region and category (or H vs MH)
- Simulate Poisson process to generate events
- Event pools
  - Single model
  - Multiple model
  - Open source footprints
- Can be done in Excel

# Illustrates Uncertainty in “PML” Estimate



# Methodology Allows Control over Event Catalog

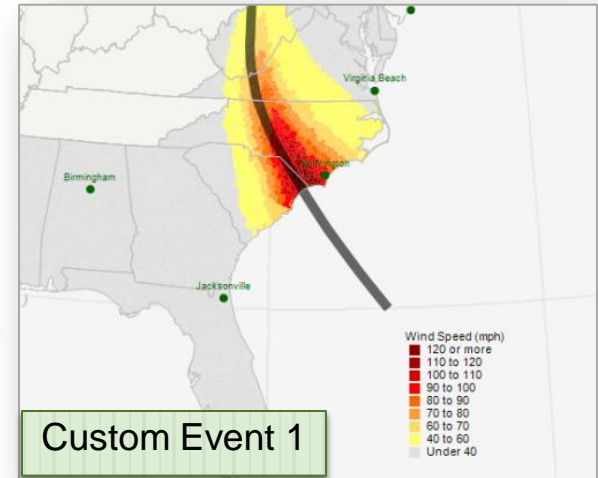
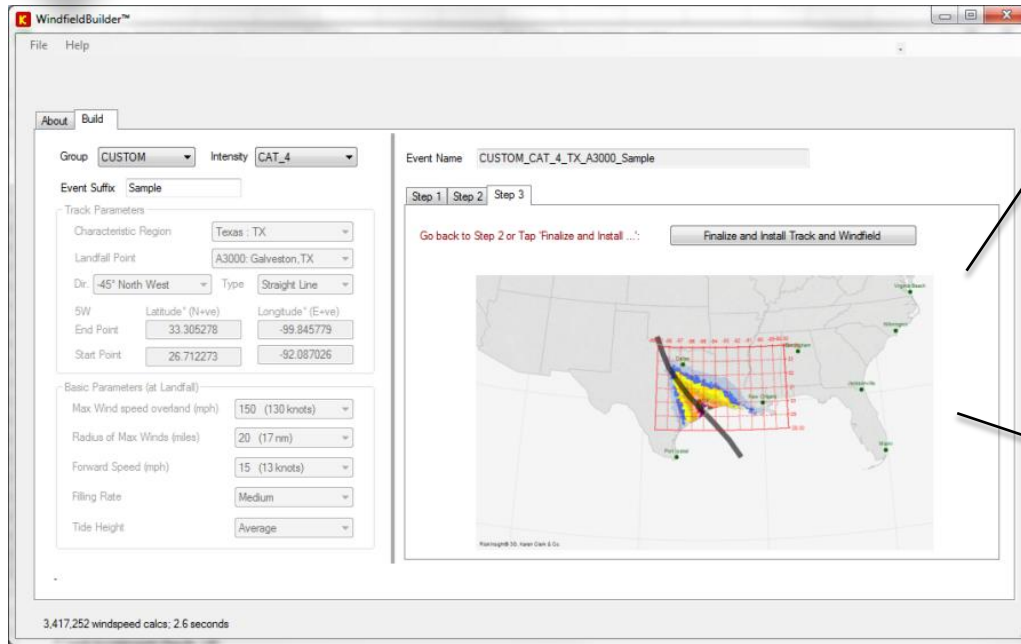
- Remove Events
  - Non-plausible tracks
  - Inconsistent parameters



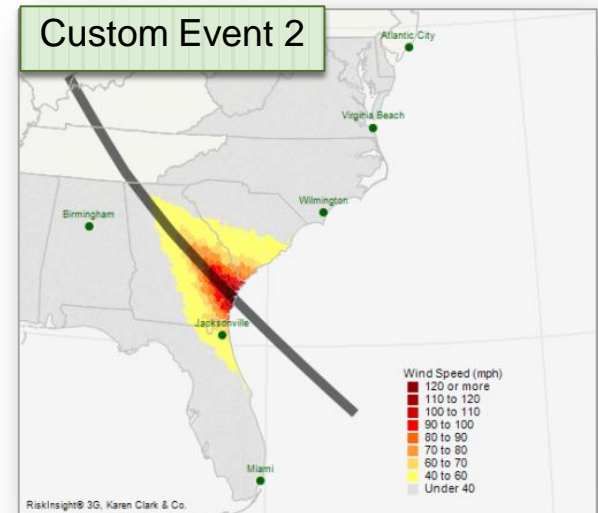
- Open source models allow greater control
  - Add events that may be missing
  - Damage functions tuned to your claims

# RiskInsight® Provides Efficient Tools for Creating Custom Event Footprints

Enter desired event parameters to generate high-resolution event footprints



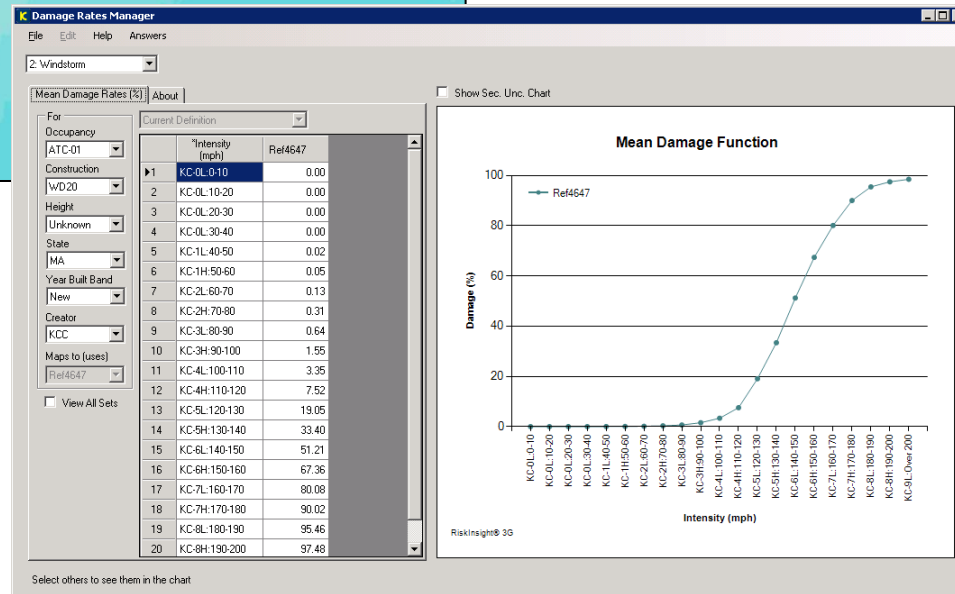
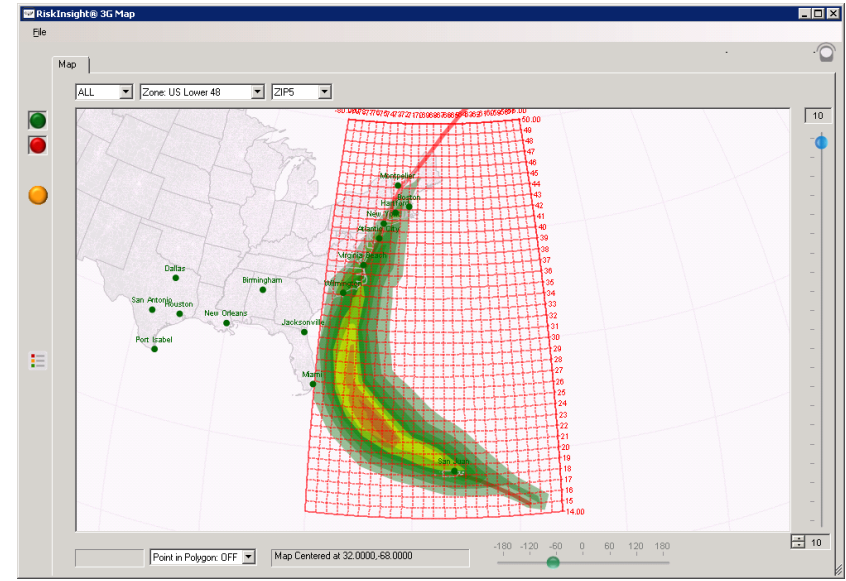
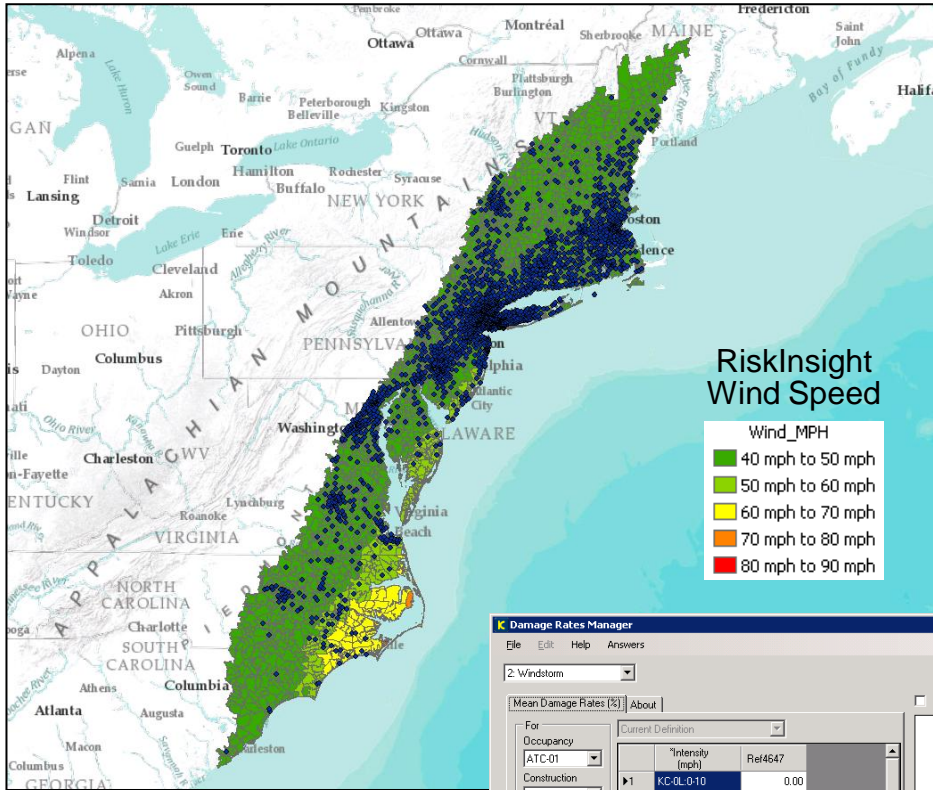
Custom Event 1



Custom Event 2



# Transparent Hazard and Vulnerability Enables Claims Analysis



# Example Application – Storm Surge Modeling With SLOSH

- SLOSH (Sea, Lake, and Overland Surge from Hurricanes)
  - Model developed by the National Weather Service to estimate storm surge depths used by the NHC, USACE, FEMA, and NOAA
  - Used in evacuation planning studies
- SLOSH Overview
  - Composite modeling approach using hypothetical hurricanes under different storm conditions
  - Uses geographical basins with known topography and bathymetry characteristics
  - Each grid cell within a basin has an associated surge depth: data points include MEOW (Maximum Envelope of Water) and MOM (Maximum of the MEOWs)

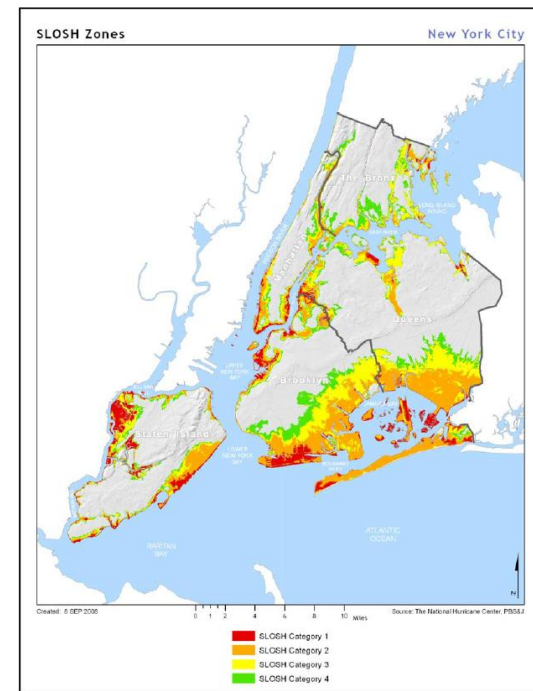
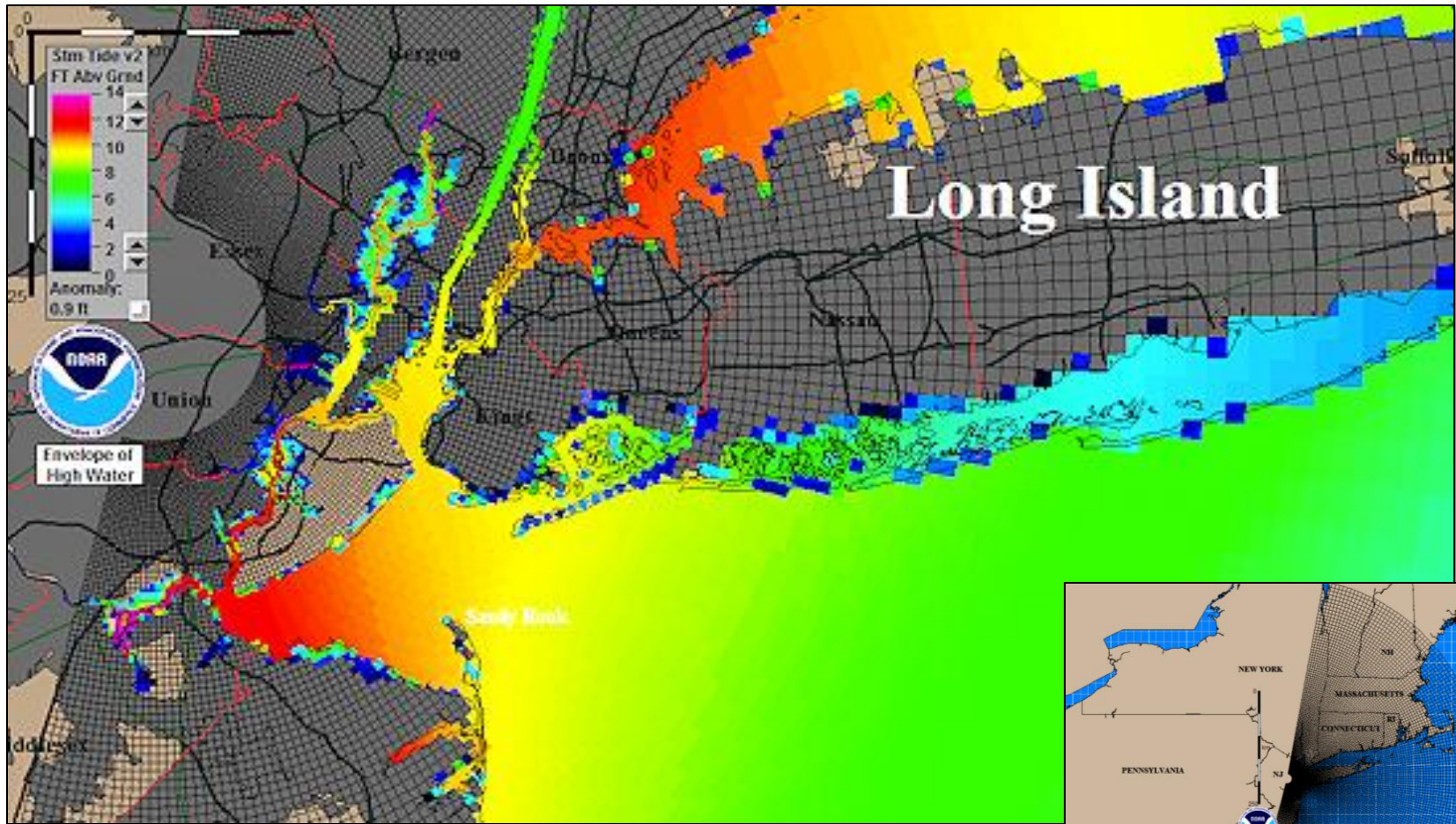


Figure 42: New York City SLOSH Model

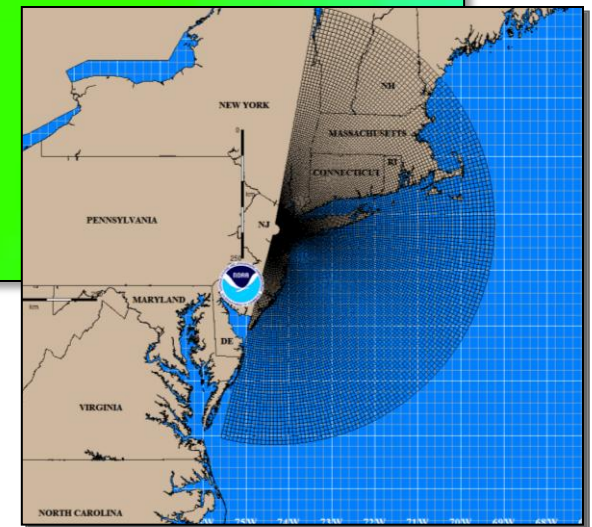
<http://www.nyc.gov/>



# SLOSH Hurricane Sandy Estimate



*Forbes, C. et al., Predicting the Storm Surge Threat of Hurricane Sandy with the National Weather Service SLOSH Model, J. Mar. Sci. Eng. 2014, 2(2), 437-476*

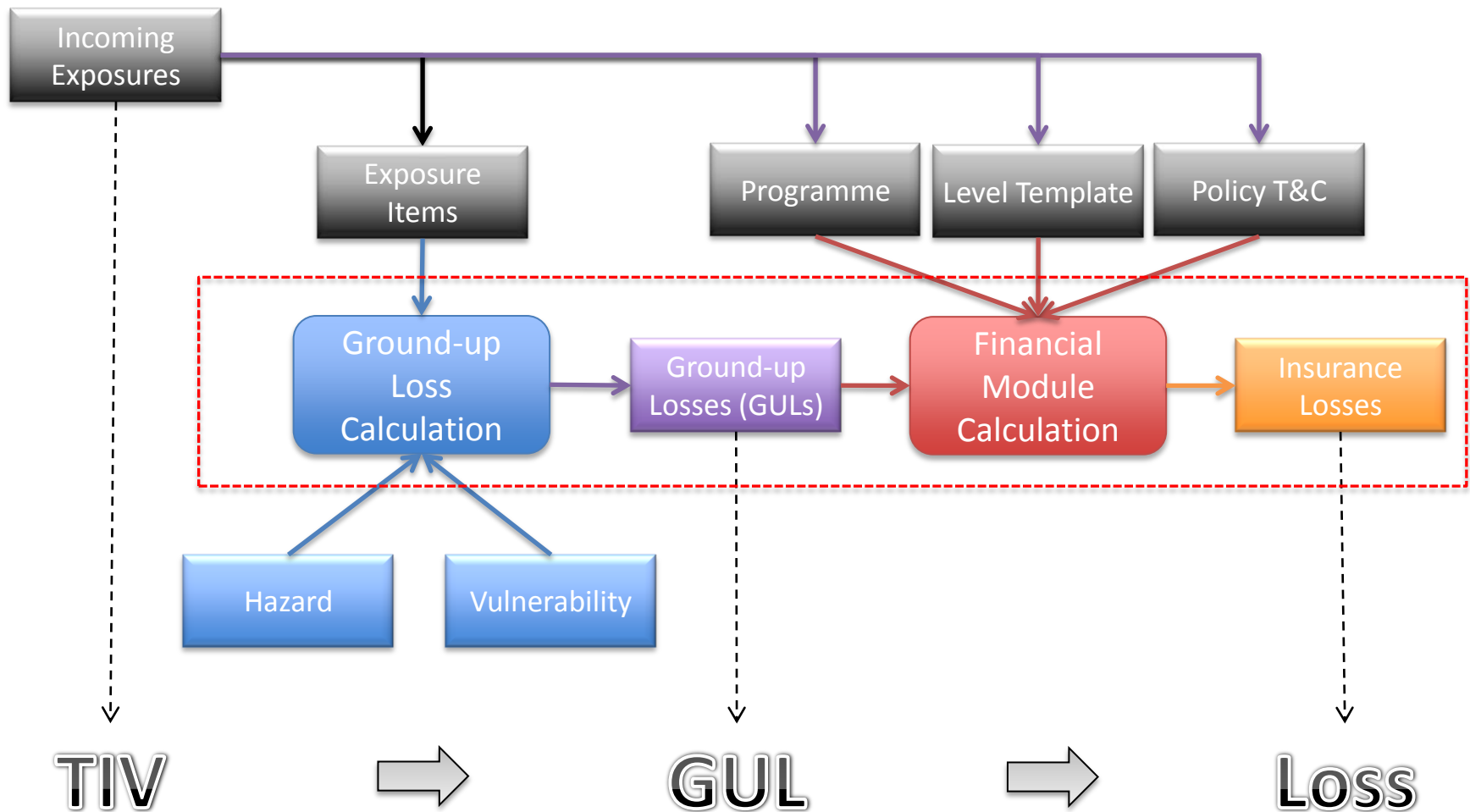


# The Event Paradigm

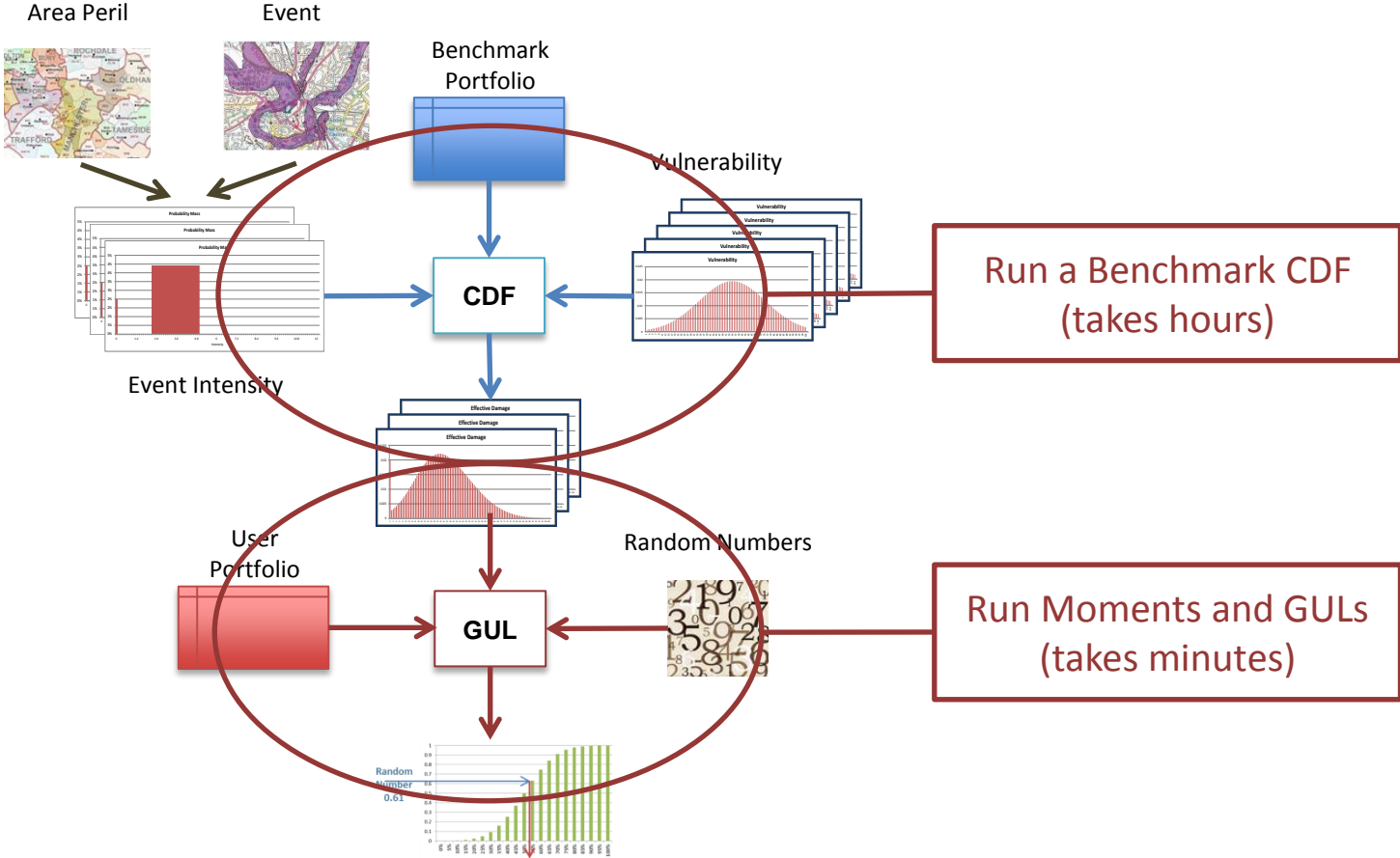




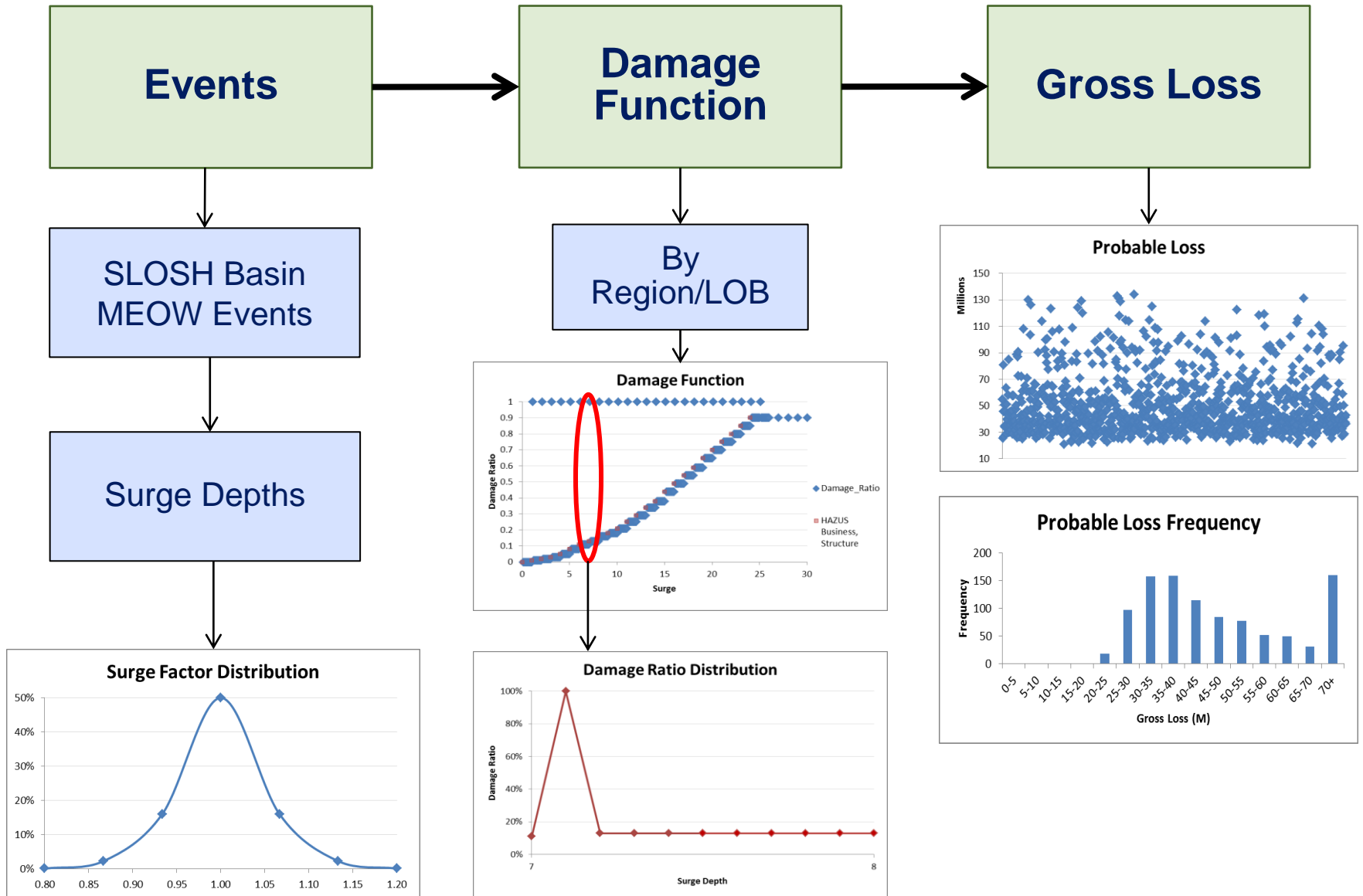
# Oasis Functionality



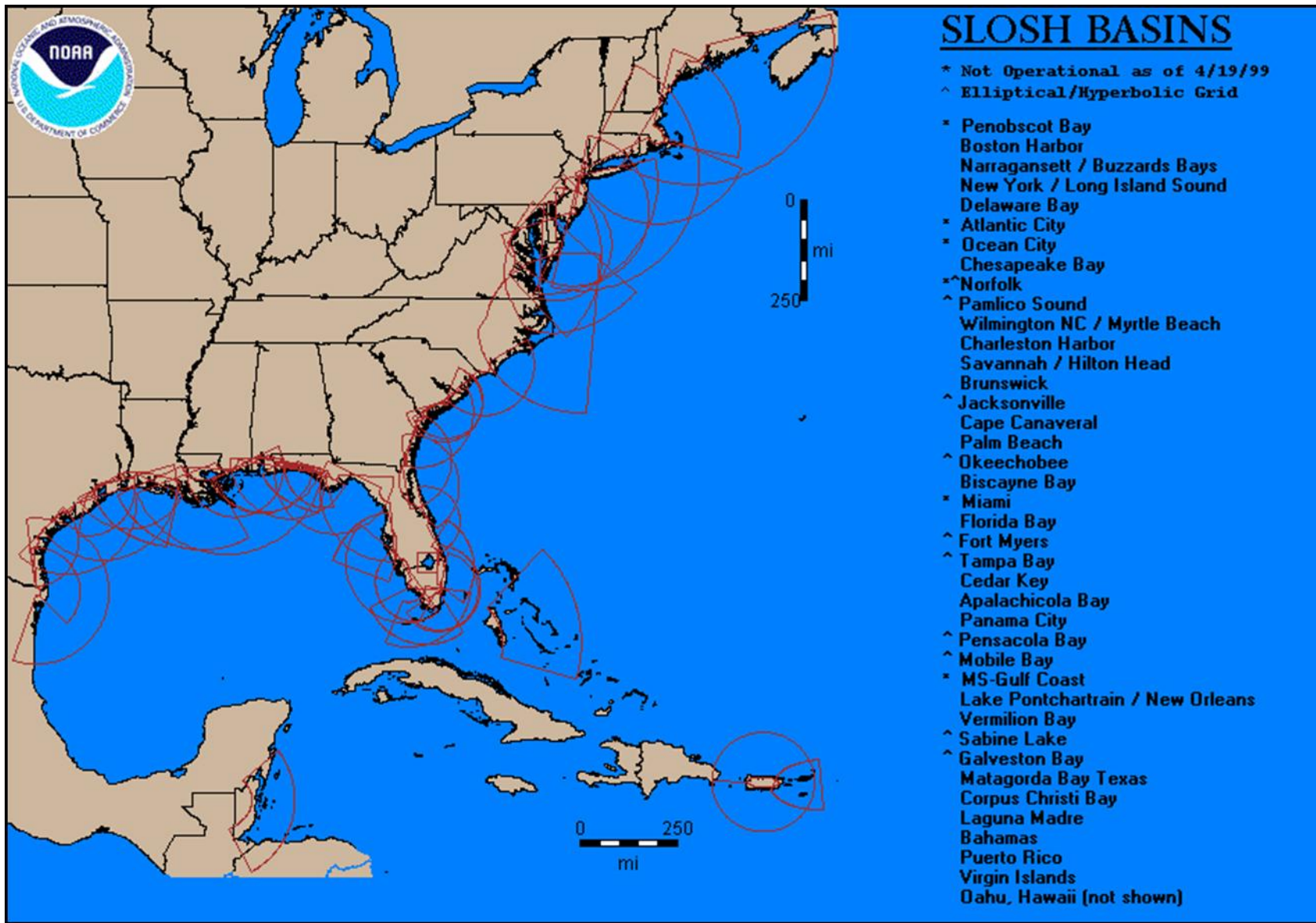
# CDF and GUL Processes



# OASIS Framework: Single Event Uncertainty



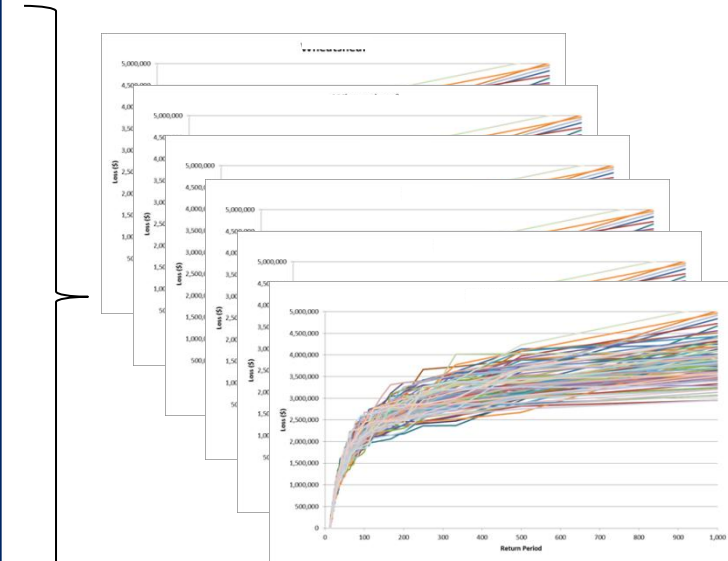
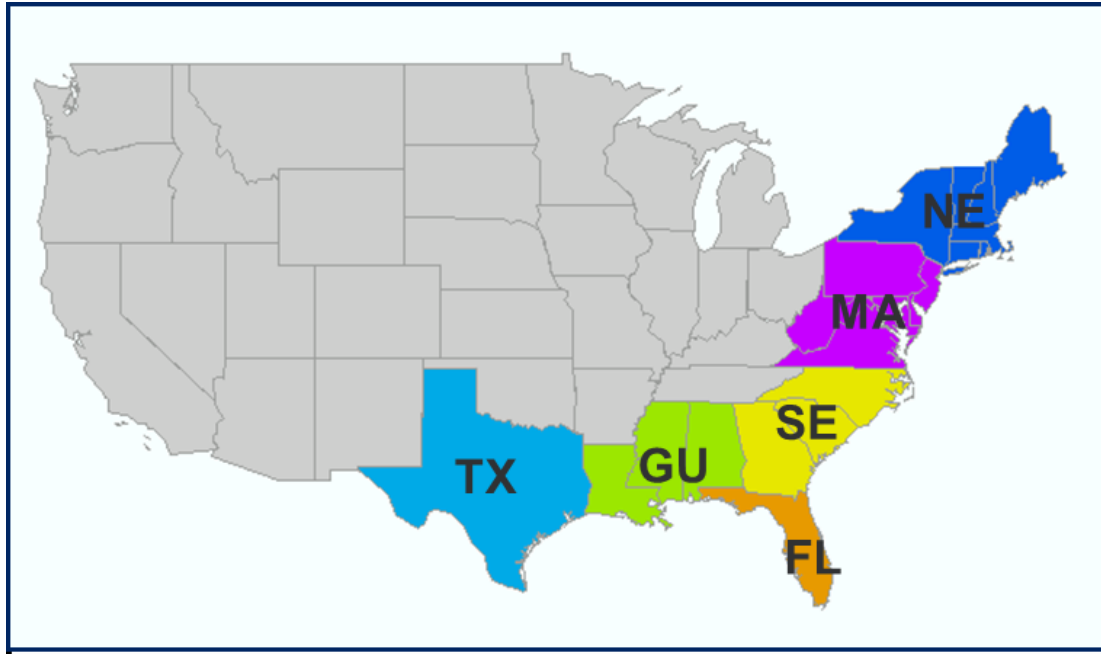
# Prototype Surge Model Using SLOSH with Oasis



<http://www.nws.noaa.gov/mdl/marine/Basin.htm>



# Scale Up to Simulate Surge Exceedance Probabilities



# Summary

- Advances in computing will lead to more “Hi-Res” cat models
  - Potential benefit for some perils (notably flood)
  - Uncertainty remains, especially in vulnerability and financial components
- Alternatively, technology can be applied towards probing assumptions and stress testing results
- Open source models and platforms are important tools in enabling transparency and improving understanding of catastrophe exposure