NORTH AMERICAN SEVERE CONVECTIVE STORM MODELS

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WHAT IS NEEDED?
CAT MODEL INPUT AND OUTPUT

Input (from user)

Address

Physical characteristics of insured buildings

- Occupancy
- Year Built
- Construction
- Number of Stories
- Floor Area
- Other characteristics…

Coverages

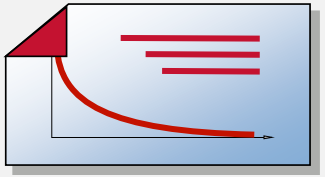
- Structures, Contents, Additional Living/Loss of Use
- Limits, Values, Deductibles
- Reinsurance

Output (key metrics for business decisions)

Average Annual Loss (AAL): the amount of modeled premium an insurer needs to collect in order to cover the average peril loss over time

- Combination of event frequency and mean event loss

Exceedance Probability (EP) curve: the probability of exceeding a loss level in a given year. Most often referred to as 'return period'.



Two types of EP curve:

- Occurrence Exceedance Probability (OEP)
- Aggregate Exceedance Probability (AEP)

MODELING CHALLENGES

Two types of modeling challenges:

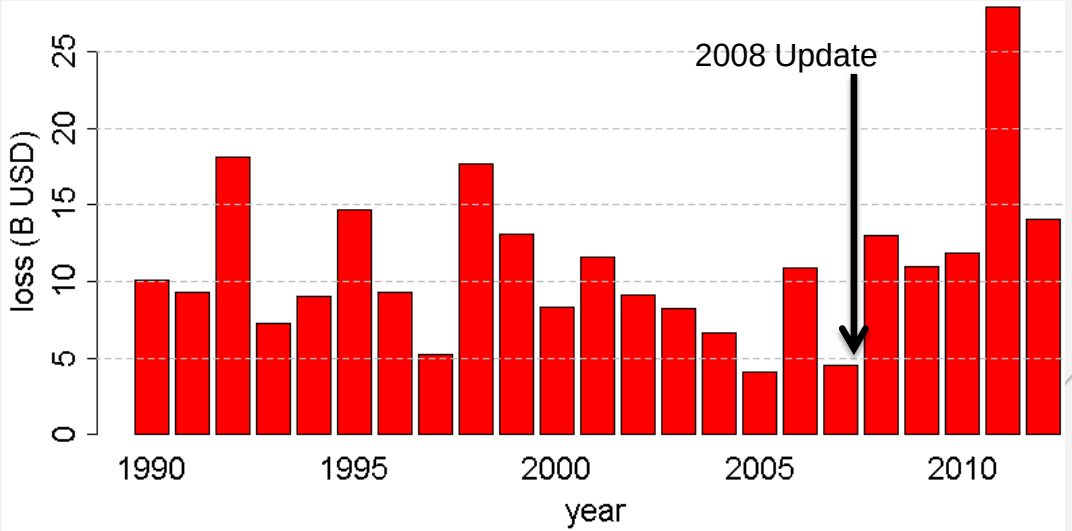
1. Data Challenges:
   - Incomplete observational data record
   - Need for more claims data
   - Changing claims practices

2. Technology Challenges:
   - Trade-off between meaningful results and a model that can be used

LOSSES FROM THE PAST 5 YEARS

- Industry losses leading up to the 2008 update were lower than the long-term average
- 2008 – 2012 experienced over $70 BN in loss to the industry
- These additional years provide additional information that can be used to better calibrate SCS models

U.S. Industry-wide Annual SCS claims (from PCS)
Inflated to 2012 dollars



NEW TOOLS FOR CAT MODELING

New Data

- $70 BN in Industry Loss Data
- $5 BN in Location Level Claims
- New Historical Tail Events

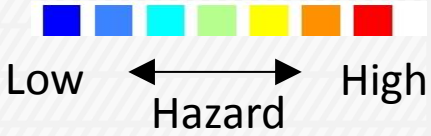
New Methods

- Improved representation of tail risk
- Leverage V11 wind research

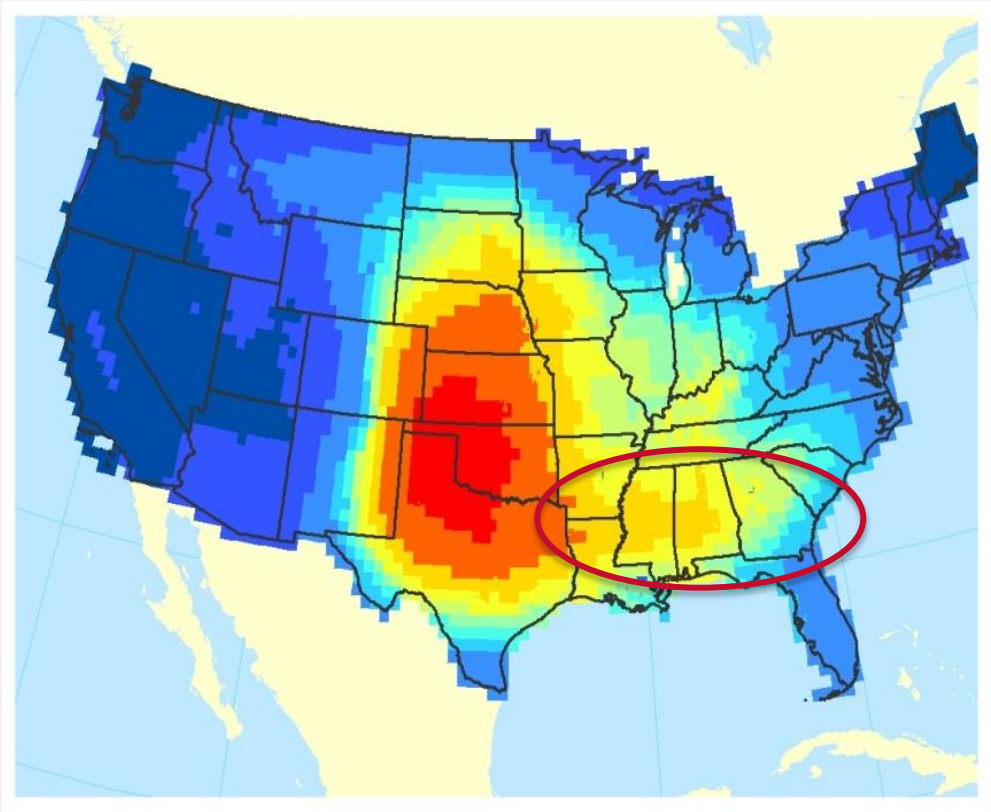
New Insights

- Trends in severity and claims inflation
- Line of Business differentiation

WHAT WE'VE LEARNED

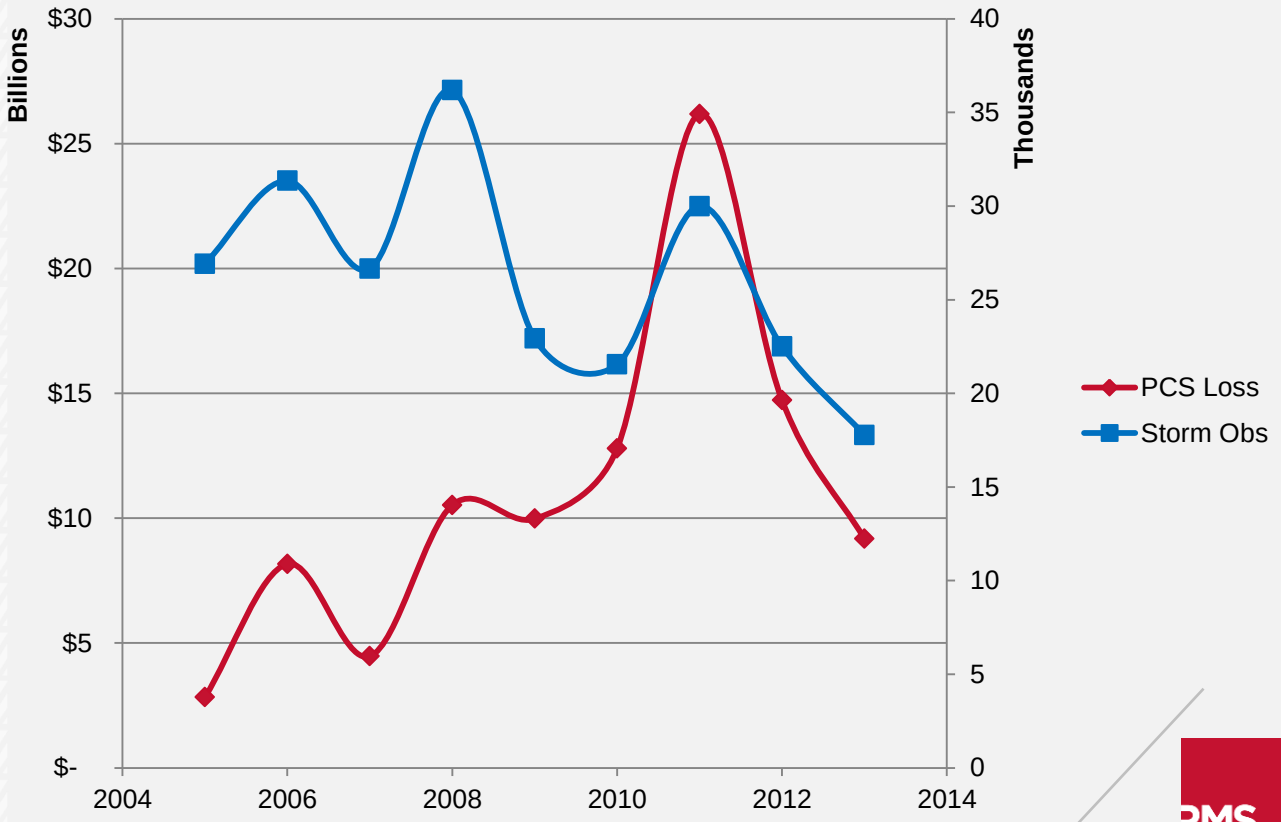


- Example 1: The Southeast US had high risk and was primed to experienced a large outbreak



WHAT WE'VE LEARNED

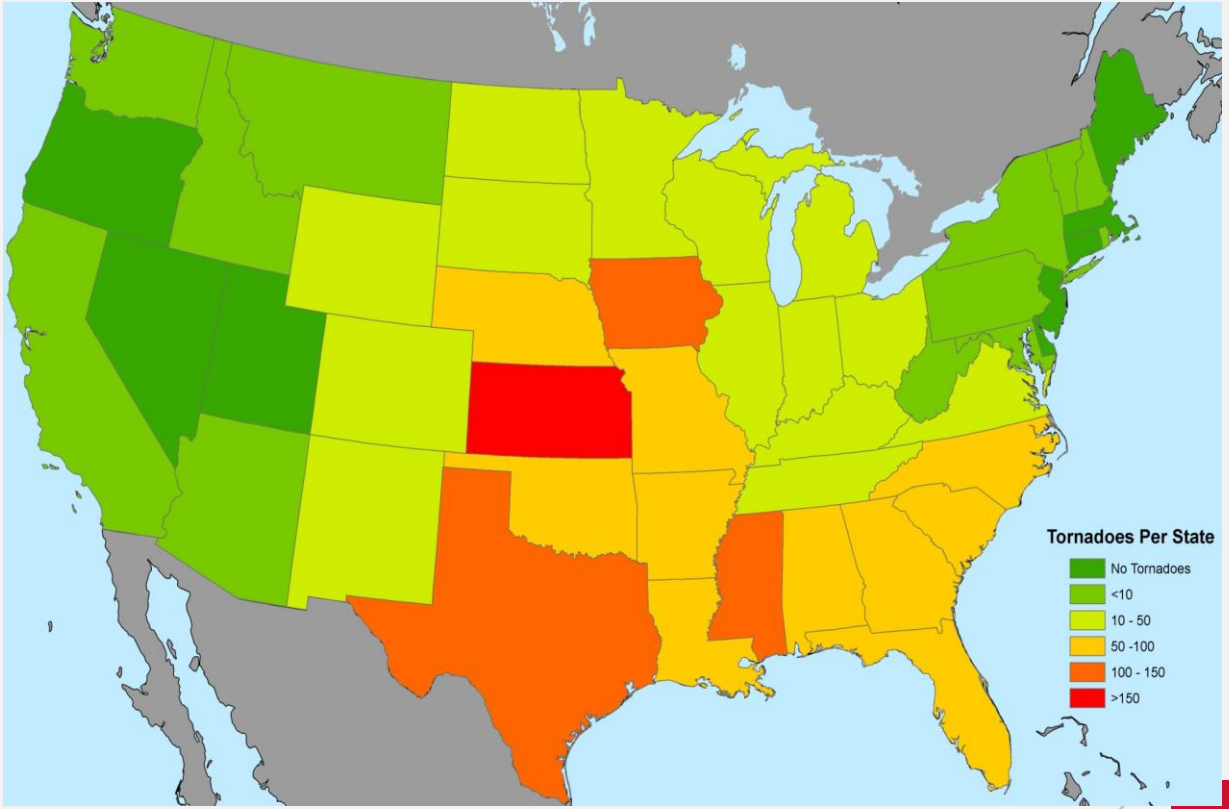
- Example 2: Frequency not as important as location



TORNADOES PER STATE 2008

Storm Obs: 36k+

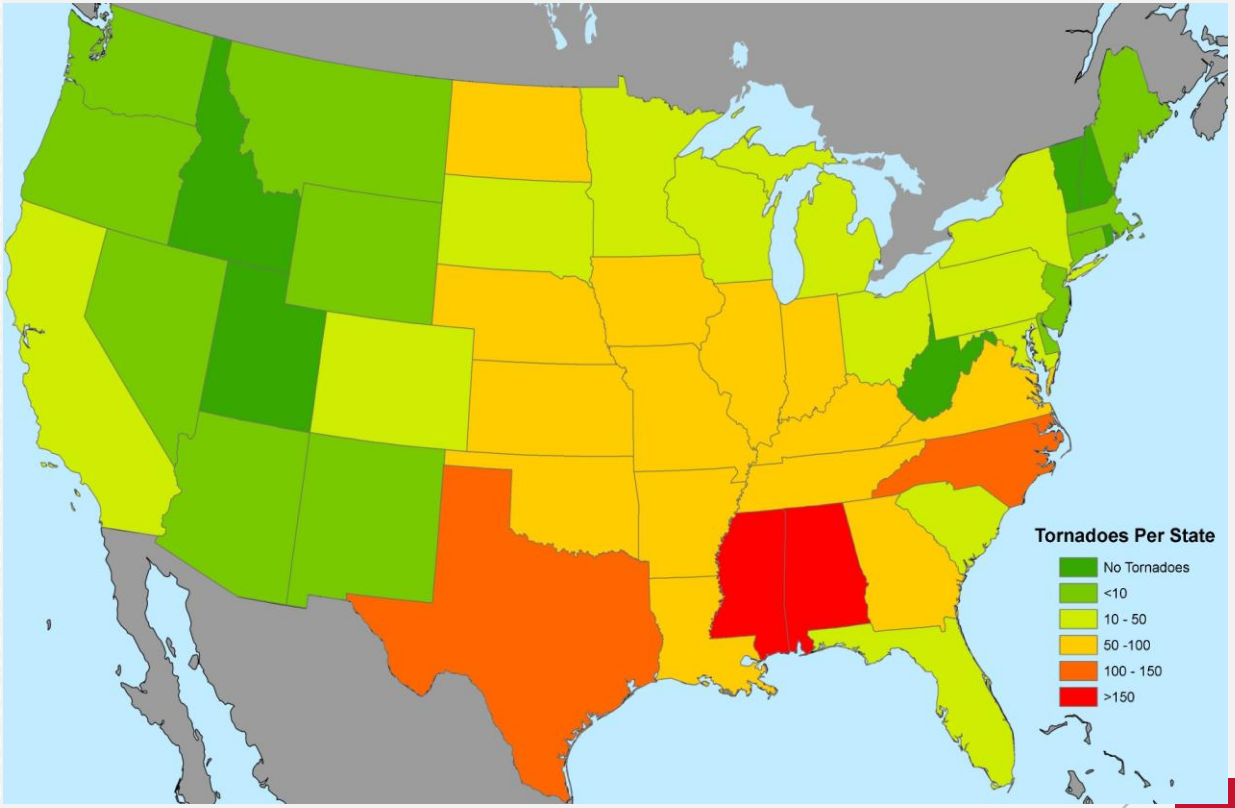
PCS Loss: $10.5 BN



TORNADOES PER STATE 2011

Storm Obs: 30k

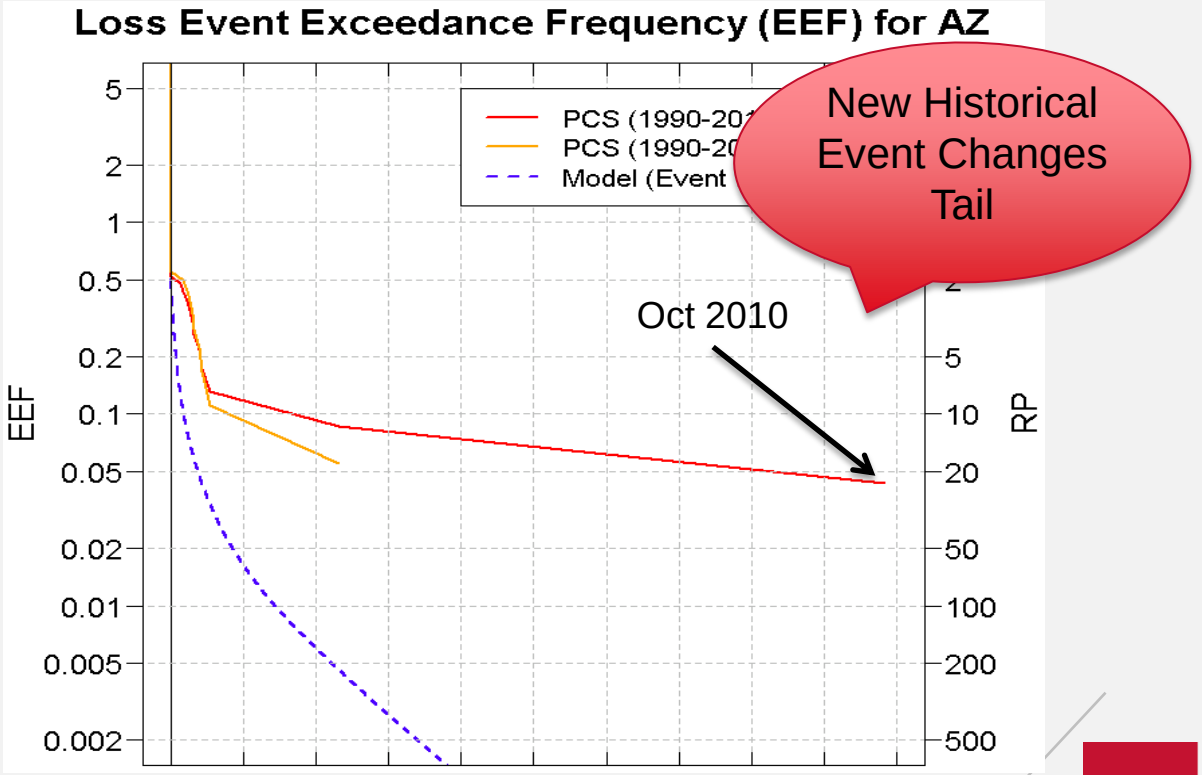
PCS Loss: $26.2 BN



WHAT WE'VE LEARNED

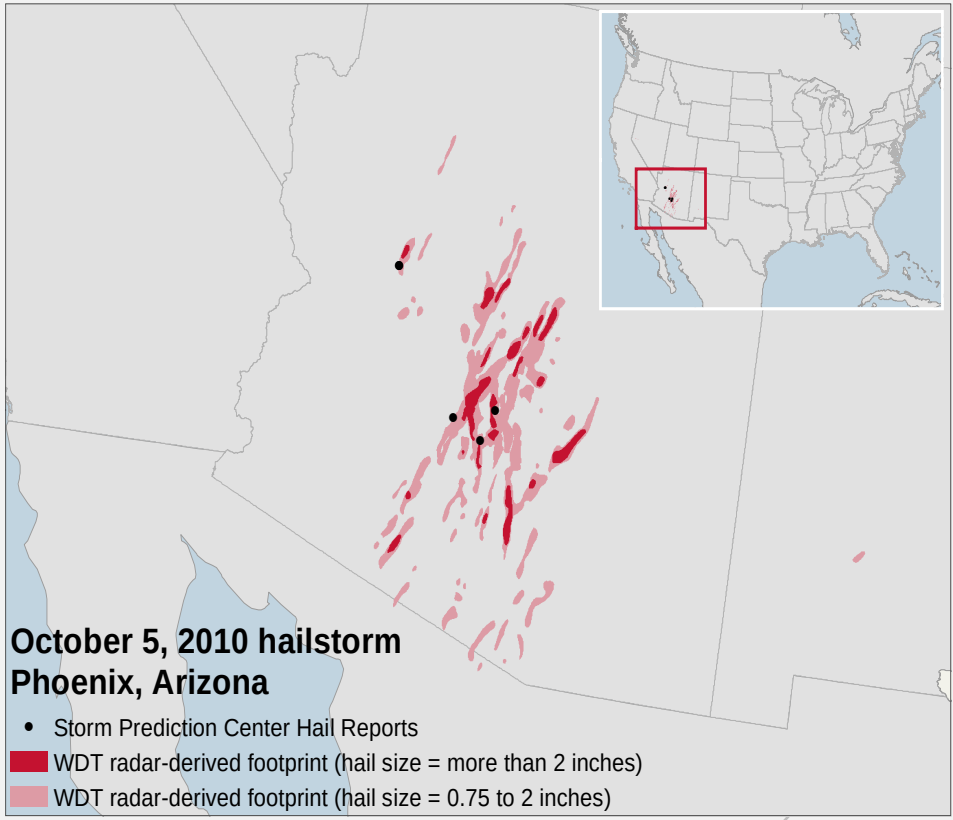
- Some states experienced unprecedented SCS events since 2008
  - 2010 hailstorm in AZ
  - 2011 tornadoes in AL, MS and MO

- Example 3: Large, damaging events less rare than we understood



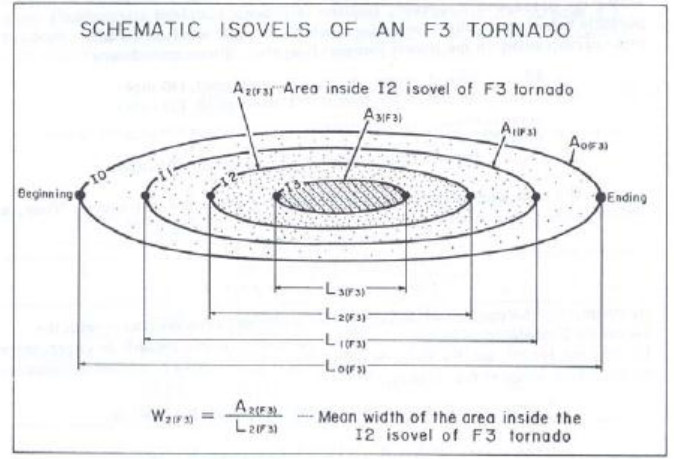
HAIL HAZARD ASSESSMENT

- Storm Prediction Center dataset does not have the spatial detail to define local hazard severity
- E.g., map shows the $3B Phoenix hailstorm in October 2010
  - *4 or 5 point observations in SPC archive*
- Radar data from Weather DecisionTechnology, Inc also shown on map
- One km spatial resolution, for two hailstone size categories
  - H1 (0.75" to 2") and H2 (> 2")
- **New radar data enables more accurate estimates of event severity**



TORNADO HAZARD ASSESSMENT

- SPC lists the length and width** for all observed tornadoes
- Assume tornado is ellipse and compute total area
- What is the distribution of F scale in the whole footprint?
- Combine with total tornado area to obtain the area of tornado at the six different severities
- Do this for all tornadoes in SPC archives, 1973-2012
- **The methodology and new events since 2008 form a new target for SCS-Update, resulting in increases for some regions and decreases for others**

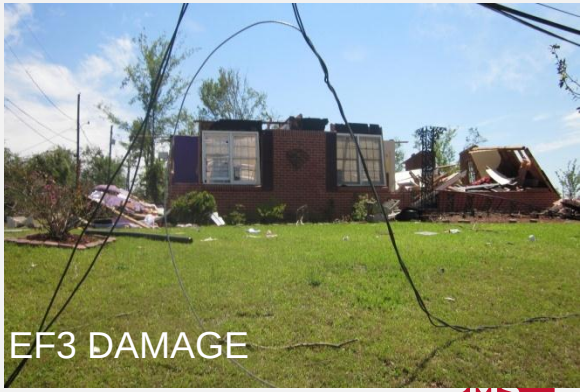


** *- SPC measured widths are inhomogeneous due to change in observing practice*
- Observed widths were modified

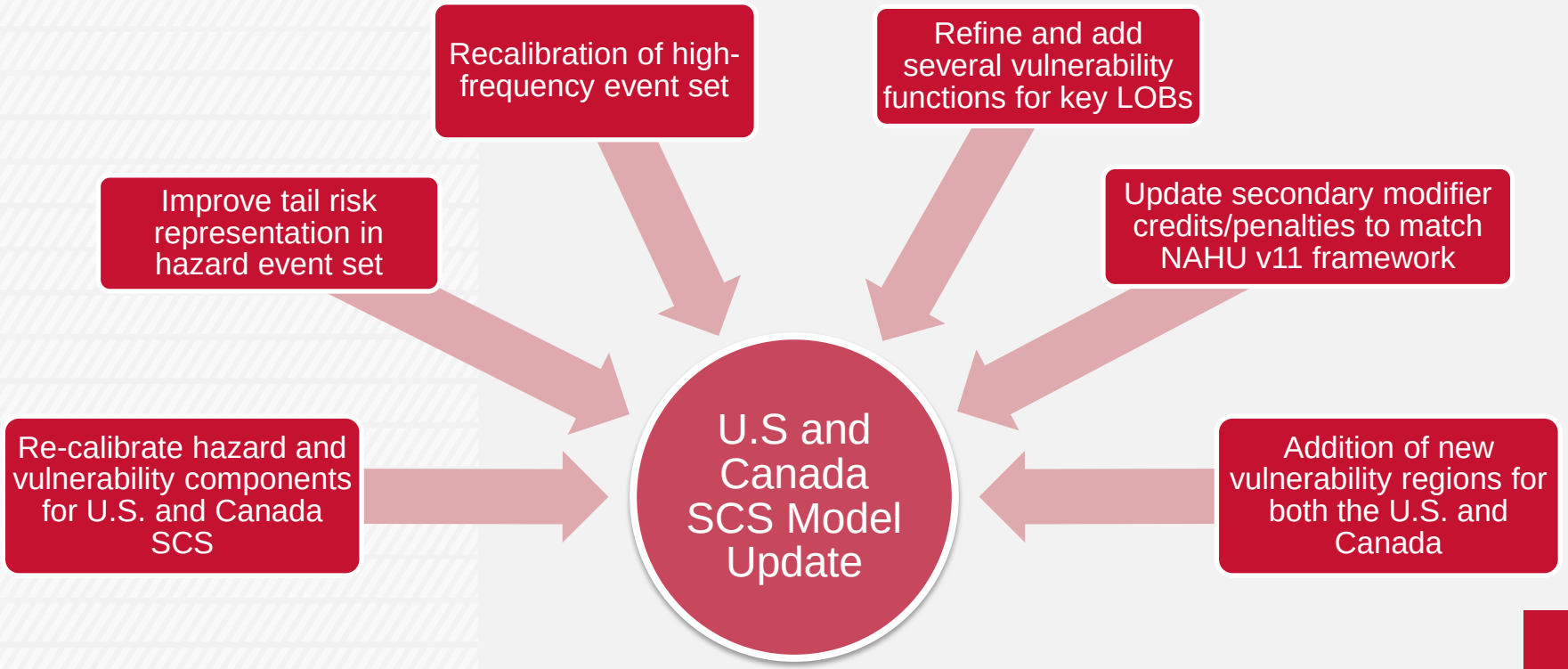
TORNADO DAMAGE VALIDATION

Vulnerability updates validated by
1) Joplin 2011 tornado reports
2) Tuscaloosa 2011 tornado damage reports
3) Moore, OK 2013 tornado recon

JOPLIN TORNADO FOOTPRINT



SCOPE OF US + CANADA SCS MODEL UPDATE



IMPLICATIONS

Improved Tail Risk

Recent large events have given us more data points

Better reflection of possibility of major SCS catastrophe

Improves model usage for reinsurers and large single location risks

Enhanced Risk Diff.

Given additional data, differentiation is easier to quantify between varying occupancies, years of construction, floor area, and construction

Improves model for users who capture detailed location information

Better Match to History

Comparisons of model to incurred ratio for industry and individual client portfolios in much better agreement

Leads to more meaningful results for all users