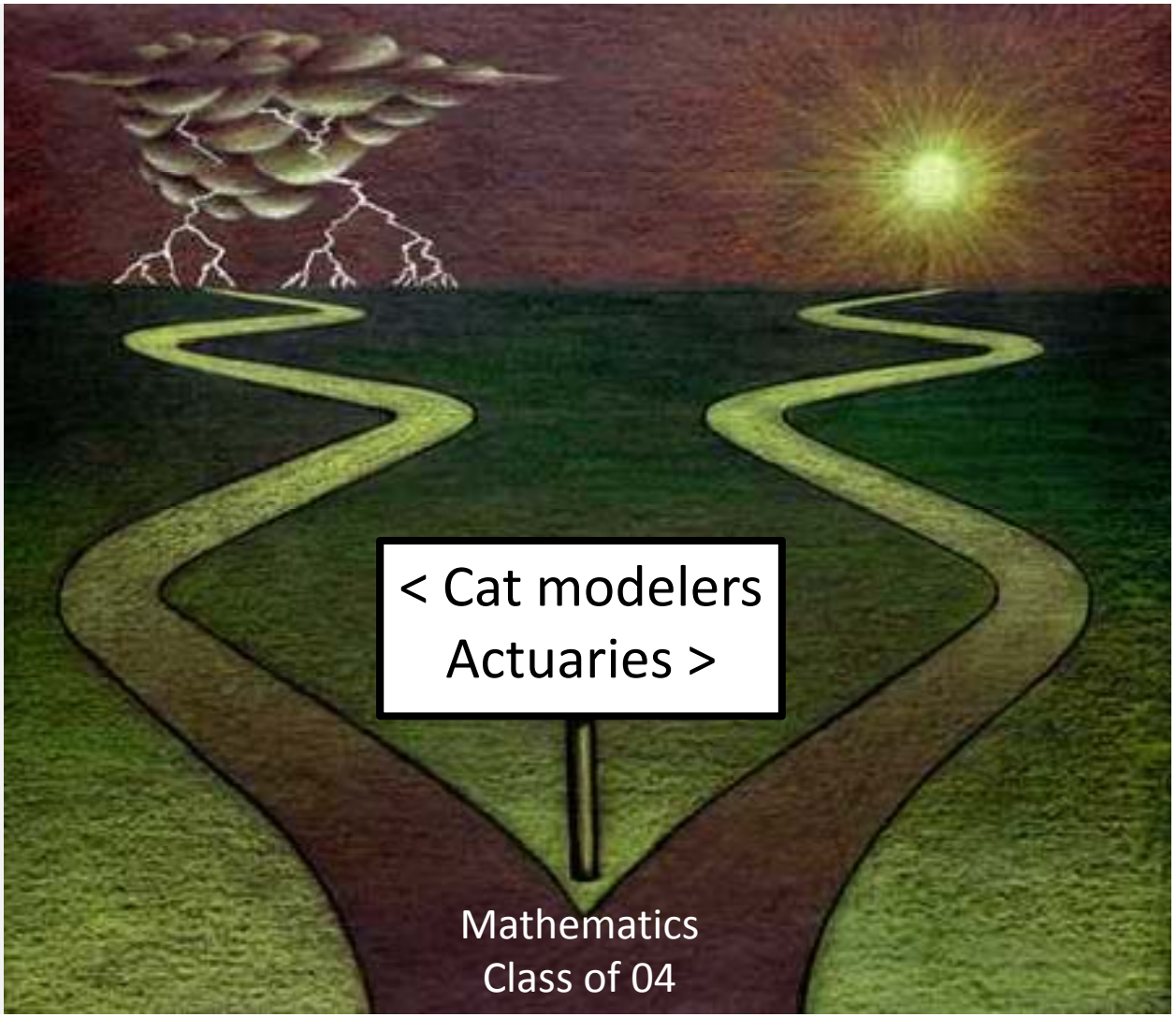
HOW SHOULD AN ACTUARY APPROACH A CAT MODEL?

Robert Muir-Wood

Chief Research Officer

RMS

TWO TRIBES



TAKING OWNERSHIP OF THE MODEL

Calibration

How far upstream should the actuary aim to investigate exactly how the model has been calibrated?

Bespoke tests

How should an actuary consider applying tests around their own portfolio and loss experience ?

Sensitivity Tests

What are the appropriate levers for adjusting the model to achieve relevant sensitivity tests?

Regulators

How could an insurer support their use of an adjusted model for engagements with regulators?

Resilience

What does ‘resilience’ mean when it comes to applying Cat model results?

RMS

SCS RISKS

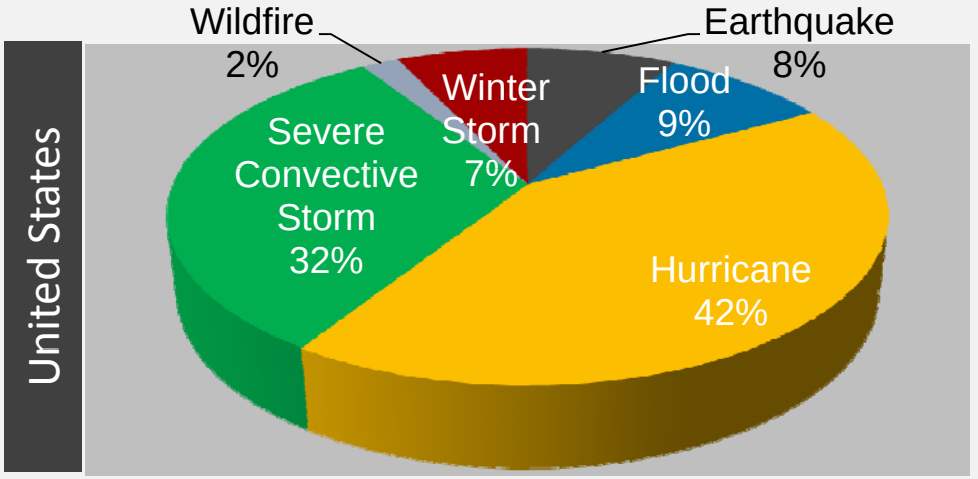
U.S. AAL = $11 Bn

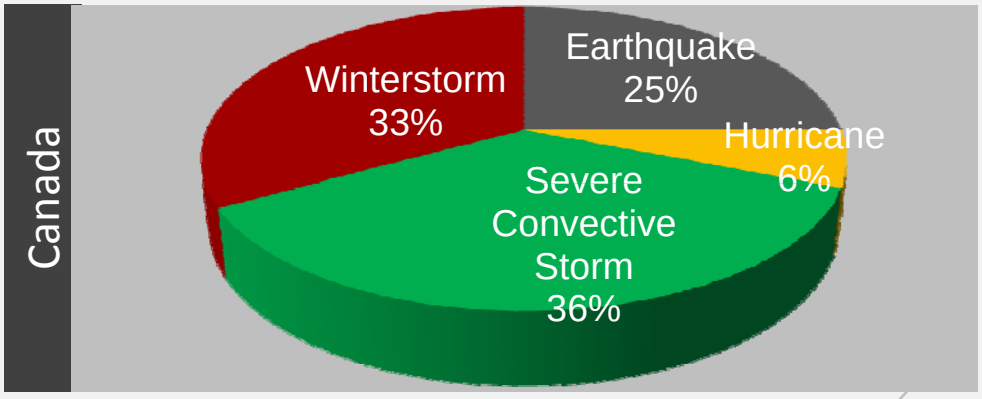
Canada AAL = $325 Mn

Risks from Severe Convective Storms include combination of perils causing damage:

- Tornado
- Hail
- straight-line winds
- lightning

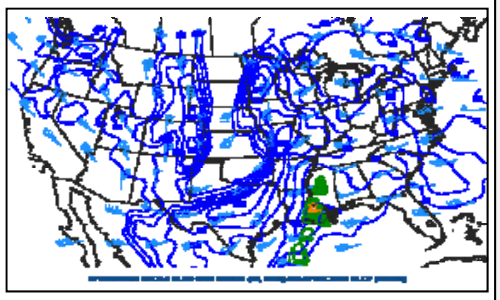
‘Events’ can last from minutes to days





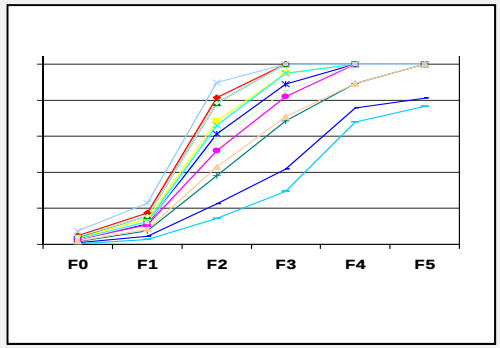
METHODOLOGY

- Hybrid method with numerical modeling and observations
- Multi-peril events
- High frequency Events
- Hazard resolved onto a variable resolution grid (VRG)
- New risk Classifications
- Claims based calibration
- Secondary modifiers
- Updated industry Exposure / Loss Data

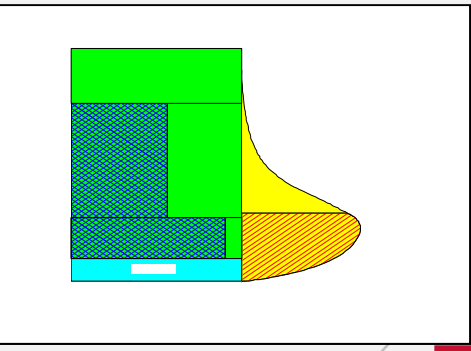


Define ‘Events’

Hail Intensity,
F Intensity, Wind Speed

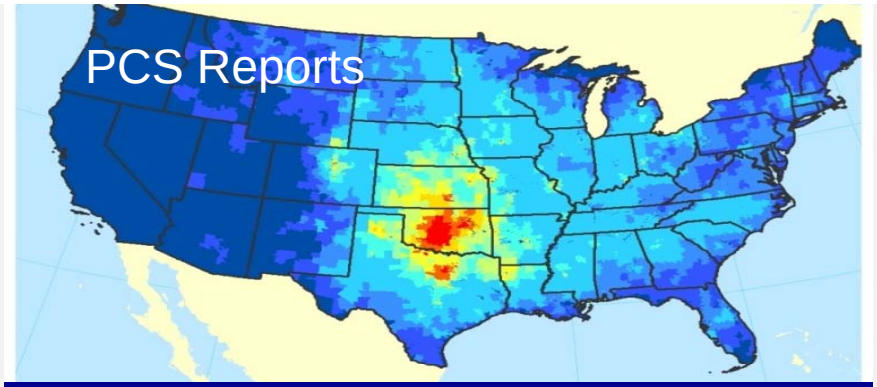


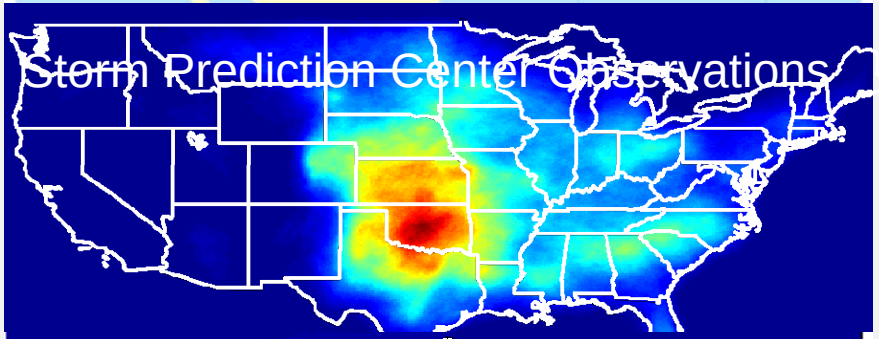
Calculate Damage

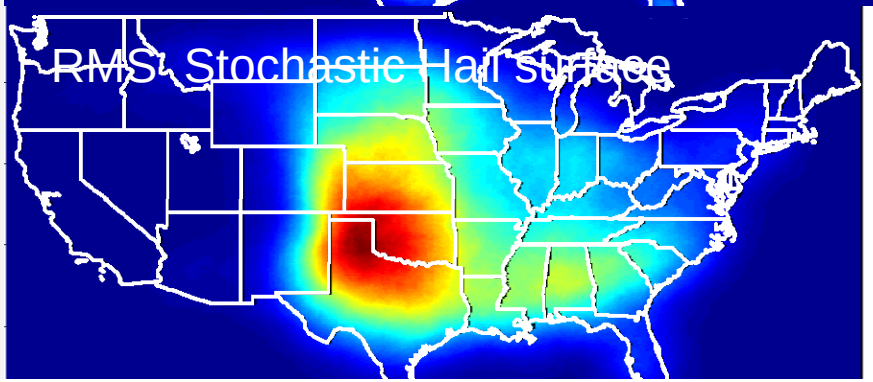


Quantify Loss

STATISTICAL RECORDS AND OBSERVATIONS ARE INCOMPLETE







CREATING THE EVENT SET

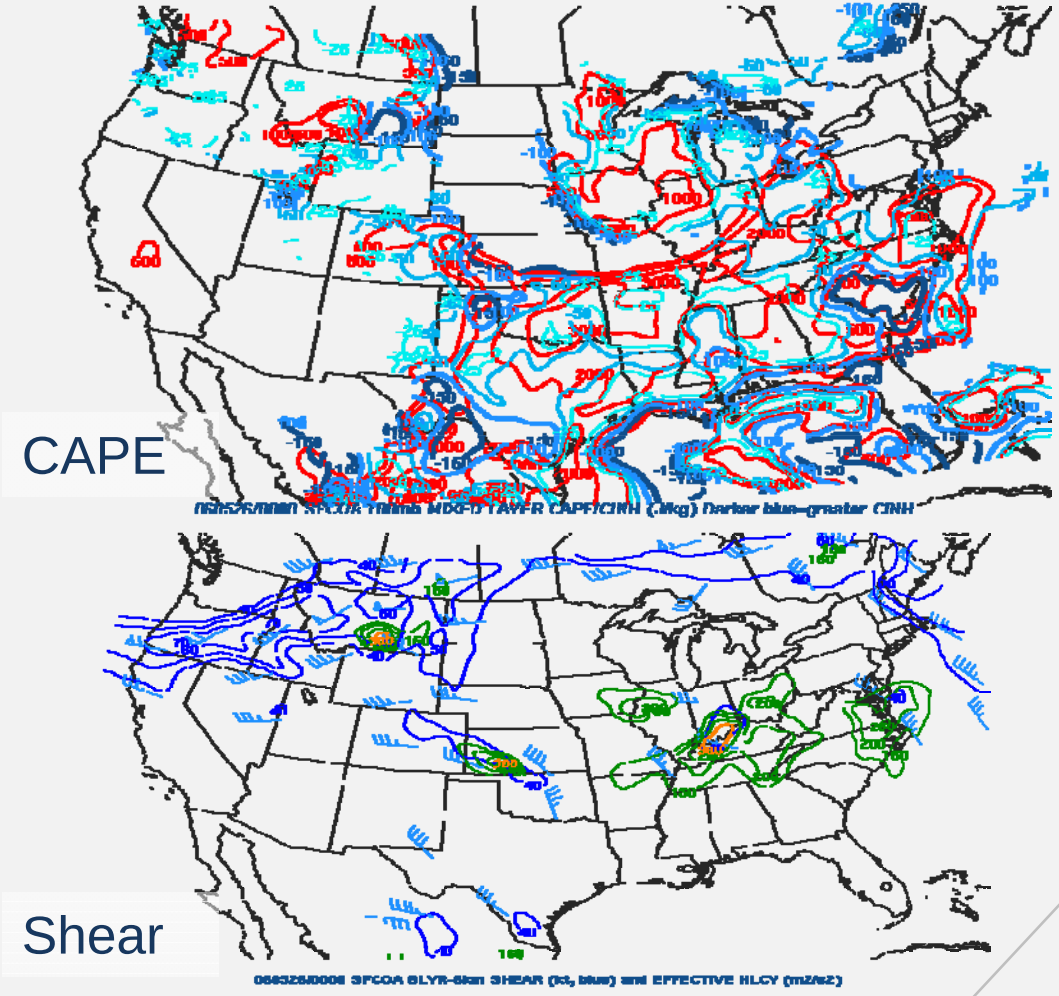
Link storms to atmospheric conditions

- Reanalysis data numerical models
- Fills in areas of missing data using physical models and upper air observations

Use reanalysis data from 1979-2005

- Create probabilities for events given an atmospheric condition
- Use combination of CAPE and shear to correlate to events

Simulate 1000s of years of atmospheric conditions



DISTINCT VULNERABILITIES FOR HAIL, WIND & TORNADO

Hail based on kinetic energy

- General roof shape
- Roof cover
- Roof age

Tornado based on F-rating

Straight-line winds based on peak gust

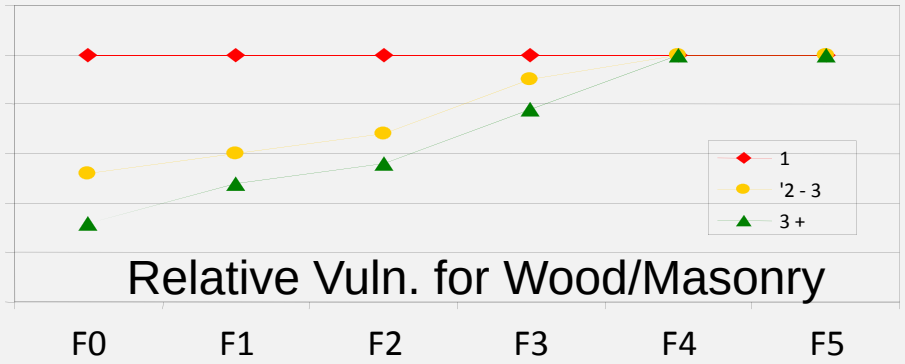
- Use of claims data

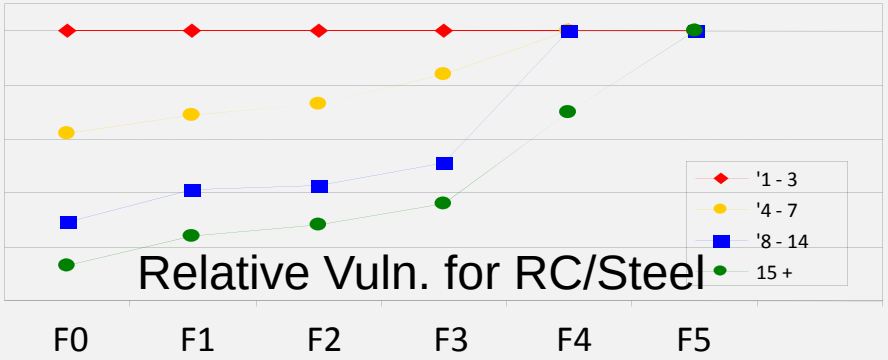
Photos from RMS (Matthew Nielsen)

LOSS DRIVERS

Number of stories very critical

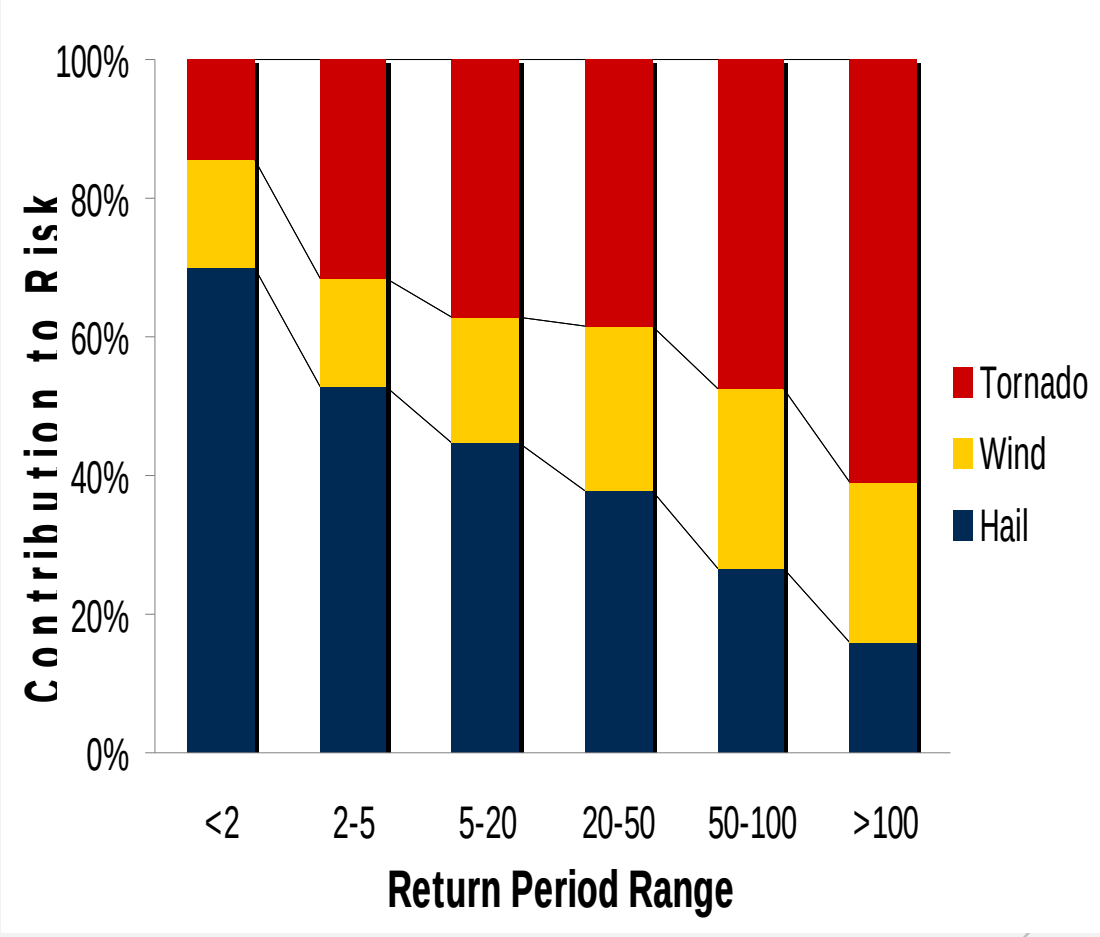
- Also function of Construction class





LOSS DRIVERS

AAL –
Tornado 17%,
Wind 14%,
Hail 69%

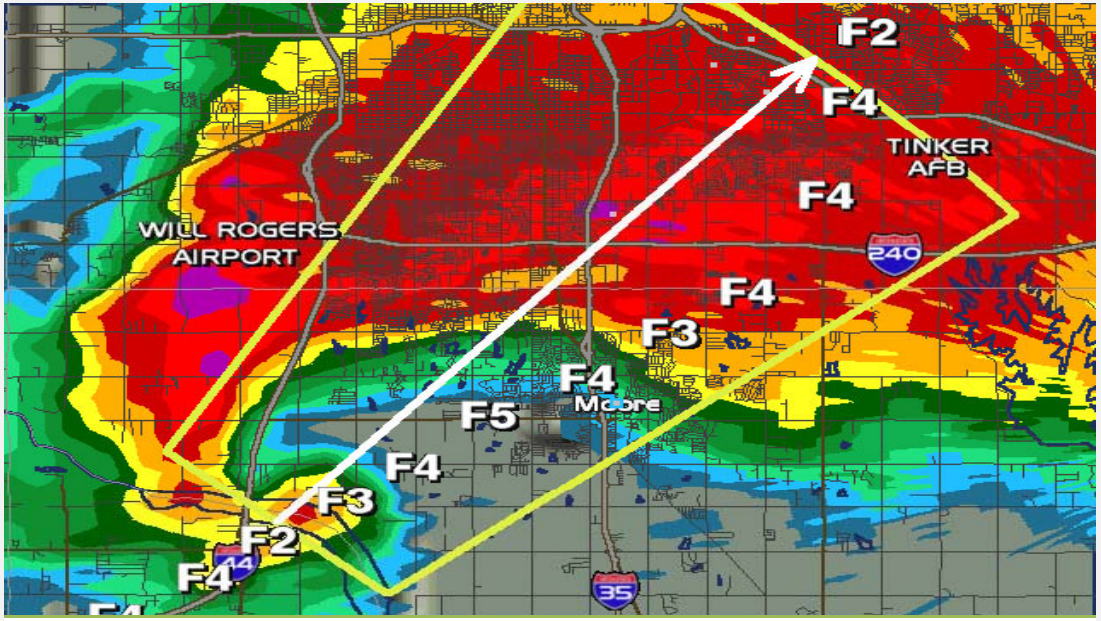


THE BIG ONES

Tornado struck OKC area on May 3, 1999 causing $1.5 bn loss (2009 dollars)

What if it were to occur today? $2.3 bn loss

What if this occurred today in Dallas or Chicago?



City	Tornado Insured Loss (In Billions)	Direct Exposure (In Billions)	Mean Damage Ratio
Oklahoma City	$2.3	$26.8	8.6%
Dallas	$17.5	$189.5	9.3%
Chicago	$25.2	$342.8	7.4%

TESTING THE MODEL (1)

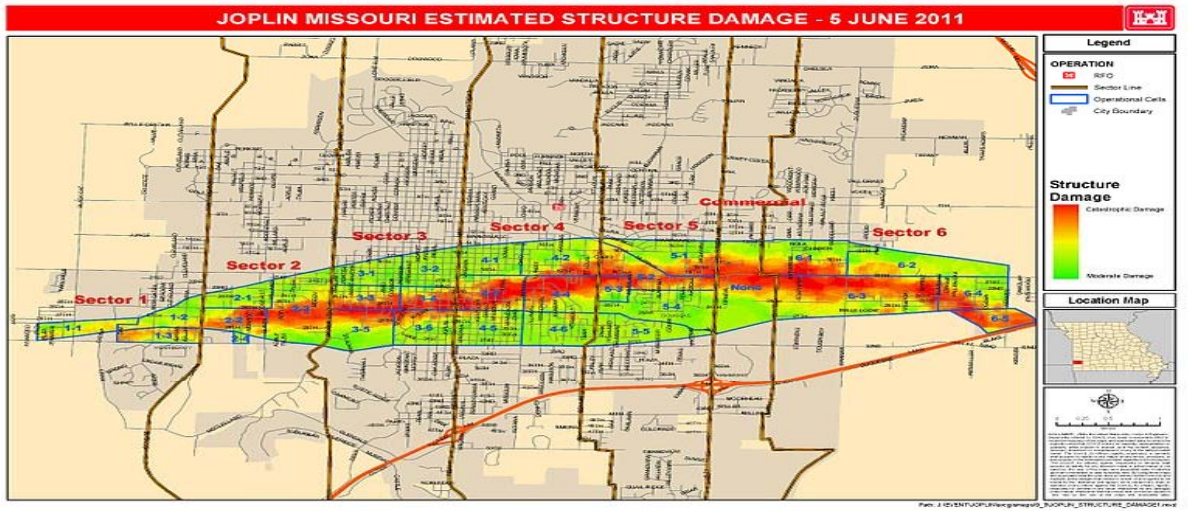
Deadliest tornado since 1947

EF-5 tornado struck a heavily populated area

- 2nd (E)F-5 tornado recorded in Missouri since 1950

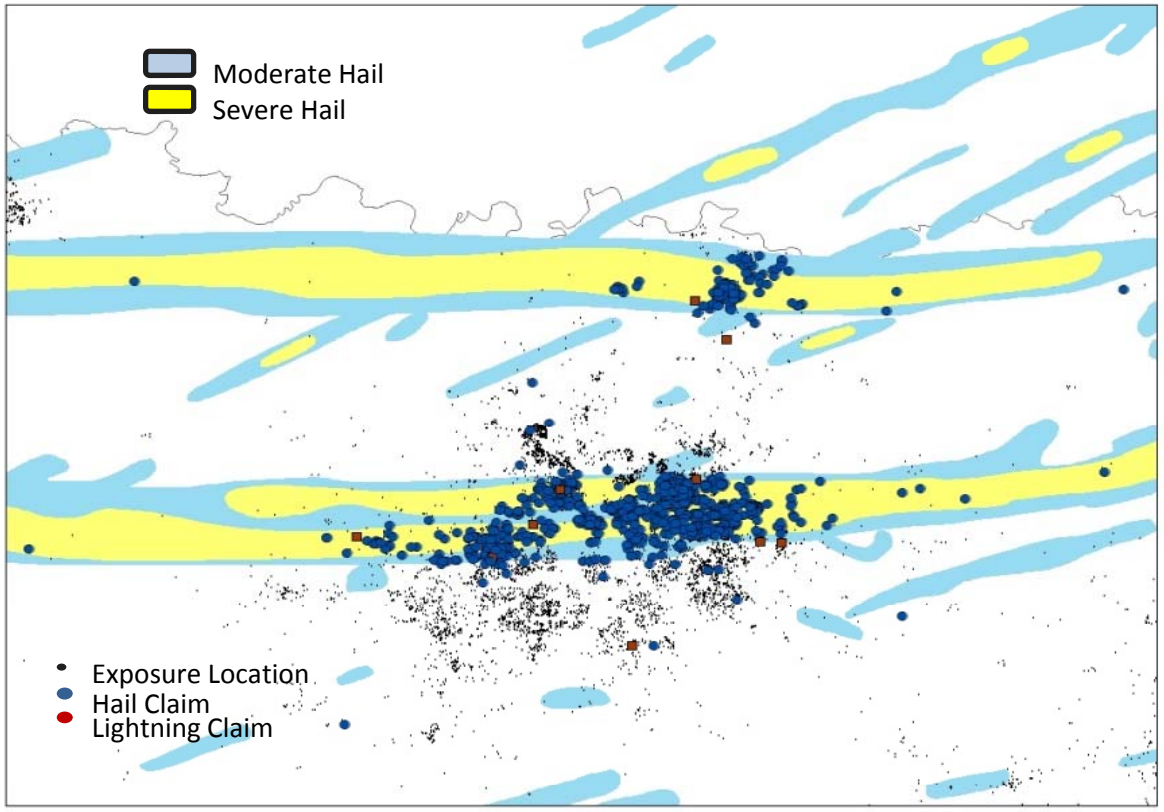
Insured loss to exceed $2 bn

- Current estimate of ~$4.9 bn for entire outbreak (PCS)



TESTING THE MODEL (2)

Adjacent losses can highlight relativities of risk

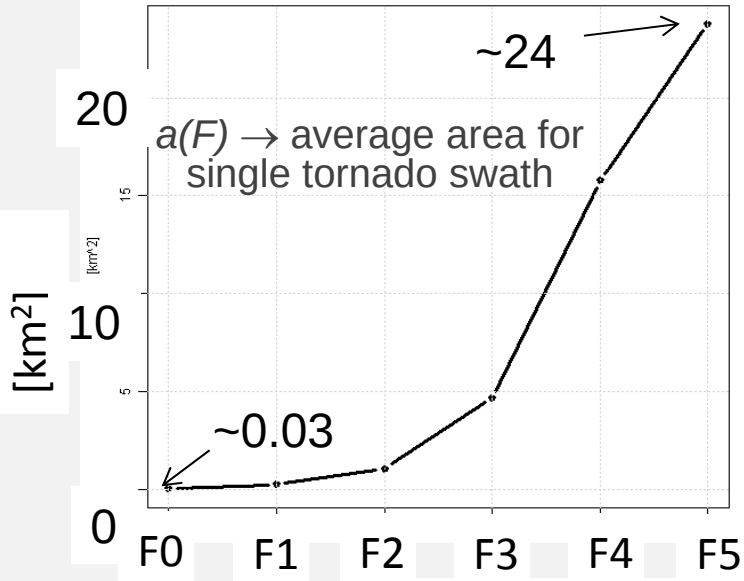


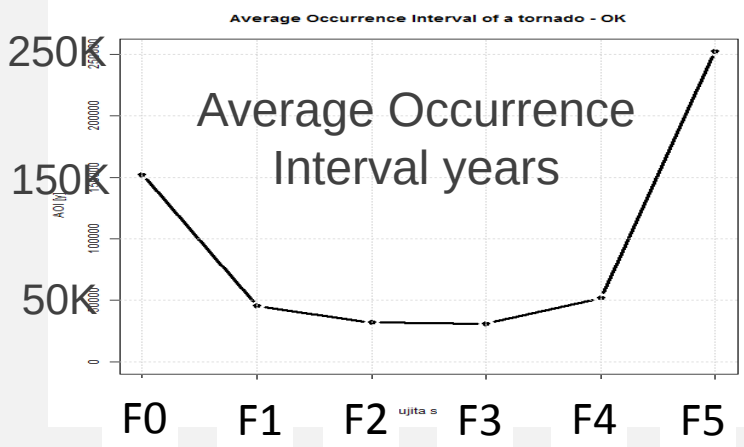
TESTING THE MODEL (3)

How long would it take to measure tornado risk from actual losses in Oklahoma at a single property?

(OK surface area $1.81*10^5$ km^2)

F scale	T [1/y]
0	38.09
1	17.02
2	5.38
3	1.26
4	0.22
5	0.03
TOTAL	62.00

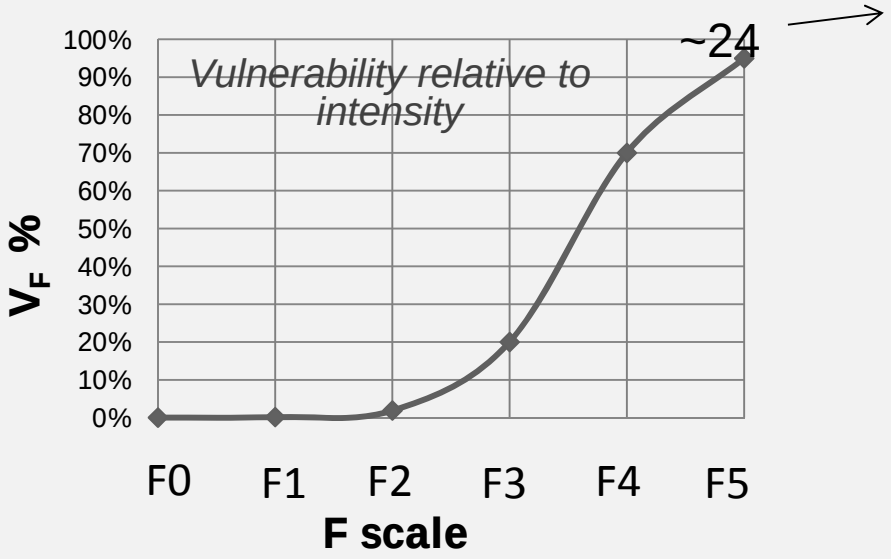




AOI [yr]	
F scale	
0	152,340.51
1	45,066.91
2	31,813.02
3	30,935.49
4	51,683.86
5	252,494.34

TESTING THE MODEL (3)

What drives Tornado AAL in Oklahoma?



% contribution to Tornado AAL

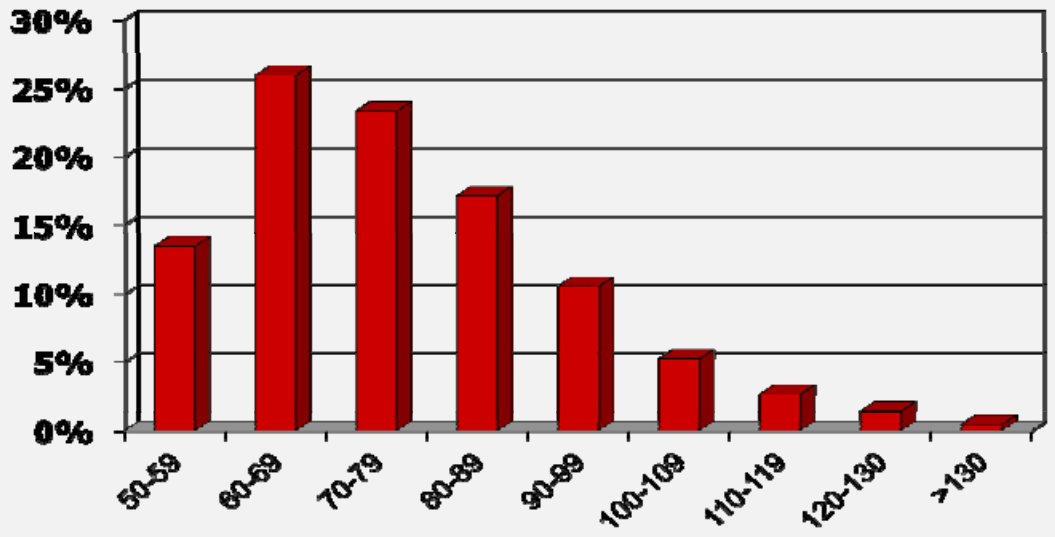
F0	**0.0%**
F1	**0.2%**
F2	**2.4%**
F3	**26.5%**
F4	**55.5%**
F5	**15.4%**

TESTING THE MODEL (4)

AAL by windspeed for straight line wind.

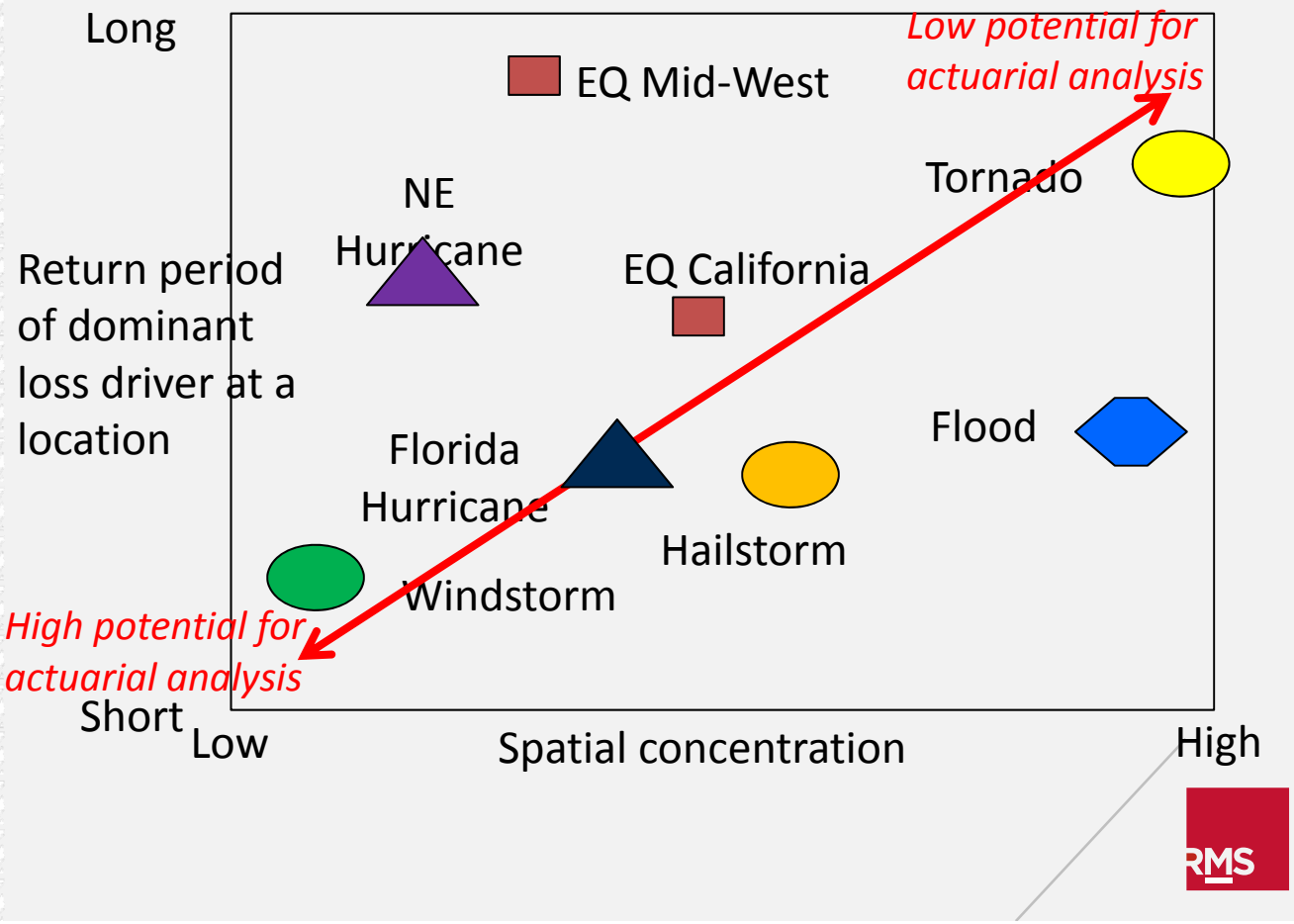
Unlike the situation for tornado, risk cost is not dominated by extremes.

Therefore greater prospect to measure the costs actuarially



MODEL VALIDATION

Degree to which the insurer can hope to validate the model with their own claims data



ALTERNATIVE PERSPECTIVES ON THE HAZARD MODEL

- Overall Frequency
  - Robust datasets
  - Exploration of trends? Climate change impacts?
- Relative severity
  - Relatively short record for which one has all F values
  - Test evidence of trends in relative severity?
- Geography
  - On margins there will be less data
  - Assume higher volatility in event rates?

REUNITING ACTUARIES WITH CAT MODELS

- Potential to analyze the three perils of Tornado, Hail and Straight Line Winds independently
- Could employ own losses for short RP & Hail wind alongside modeled Tornado and long RP Wind and Hail
- Potential to explore comparative % claims and mean losses with those in the model
- To refine the match with experience for losses in the 1-5 yr RP range the user could adjust high frequency event rates
- To stress test extreme losses in the model for some geography, rates of key regional events can also be adjusted
- RMS supports efforts by re/insurers to take ownership of the model and can assist in showing the degree to which (scientifically and empirically) there is a credible range in some parameter.
- When dealing with a rating agency the insurer will need to present strong supporting arguments with empirical data in defence of any of these modifications