### WHAT IS NEEDED?

**CAT MODEL INPUT AND OUTPUT**

<table>
<thead>
<tr>
<th>Input (from user)</th>
<th>Output (key metrics for business decisions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td><strong>Average Annual Loss (AAL):</strong> the amount of modeled premium an insurer needs to collect in order to cover the average peril loss over time</td>
</tr>
<tr>
<td>Physical characteristics of insured buildings</td>
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<tr>
<td>– Occupancy</td>
<td>– Combination of event frequency and mean event loss</td>
</tr>
<tr>
<td>– Year Built</td>
<td></td>
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<tr>
<td>– Construction</td>
<td></td>
</tr>
<tr>
<td>– Number of Stories</td>
<td></td>
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<tr>
<td>– Floor Area</td>
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</tbody>
</table>
| – Other characteristics…                               | **Exceedance Probability (EP)** curve: the probability of exceeding a loss level in a given year. Most often referred to as ‘return period’.
| Coverages                                              | Two types of EP curve:                    |
| – Structures, Contents, Additional                      | – Occurrence Exceedance Probability (OEP) |
| – Living/Loss of Use                                    |                                            |
| – Limits, Values, Deductibles                          | – Aggregate Exceedance Probability (AEP)  |
| – Reinsurance                                          |                                            |
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
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
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
• Example 1: The Southeast US had high risk and was primed to experience a large outbreak.
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 Decision Technology, 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**

October 5, 2010 hailstorm
Phoenix, Arizona

- Storm Prediction Center Hail Reports
- WDT radar-derived footprint (hail size = more than 2 inches)
- WDT radar-derived footprint (hail size = 0.75 to 2 inches)
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
Vulnerability updates validated by
1) Joplin 2011 tornado reports
2) Tuscaloosa 2011 tornado damage reports
3) Moore, OK 2013 tornado recon
SCOPE OF US + CANADA SCS MODEL UPDATE

- Recalibration of high-frequency event set
- Refine and add several vulnerability functions for key LOBs
- Improve tail risk representation in hazard event set
- Update secondary modifier credits/penalties to match NAHU v11 framework
- Re-calibrate hazard and vulnerability components for U.S. and Canada SCS
- Addition of new vulnerability regions for both the U.S. and Canada

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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