Agenda

➢ Validation Market Observations

➢ What is Business Led Validation?

➢ Tips from our recent North America Earthquake Validation
Catastrophe Validation – Market Observations

• Less gold-plating for a regulatory audience, more **business led validation**

• Consistent validation framework, applied efficiently

• Proportionate validation

• Leverage vendor validation

• More crowd-sourcing, less validation in a vacuum

• First principles approach to assess suitability of science and its implementation
Business Led Validation
Validation Principles
Business Led Validation

Cat Risk Quantification

Decision Making
Validation Principles
Business Led Validation

Cat Risk Quantification

Strategic
Operational
Validation Principles
Business Led Validation
Validation Principles
Business Led Validation

Cat Model Use & Validation
- Product Development
- Internal Cat Model Development
- UW Tool Development

Decision-Making
- Operational
  - Capacity Management
  - Pricing
  - Event Response
- Strategic
  - Capital Calibration
  - Retrocession Purchase
  - Business Planning
  - ILS Fund Management

Cat Risk Quantification

Decision-Making
Tips from a recent peak peril validation
Phased Validation

Depth of validation depends on scope of the vendor update and materiality of the region-peril

- Industry Analysis (3-6 weeks)
  - Desktop documentation review
  - Rule of thumb tests to identify fatal flaws early

- Portfolio and Pricing Impact Analysis (4-8 weeks)
  - Are (proxy) results in line with expectation?

- Expert Interviews (1-3 months)
  - Do expert judgements make sense?

- Governance (4-8 weeks)
  - Committee sign-offs, documentation: audit trail of tests conducted, log of key assumptions, judgements…
US Earthquake Validation
Approach

*Topics / Tests chosen depends on the scope of vendor model update and materiality of region-peril. The aim is to identify a manageable list of key topics that the team can work through in a few weeks
Back-testing

Are modelled losses in line with experience?

How does the implied (modelled) return period of events compare with expert expectations?

Industry
Portfolio
Contract
Vendors provide component attribution analysis that helps identify drivers of change arising from updates to model components such as:

- GMPEs*
- Seismic sources
- Amplification
- Secondary perils (PLA, liquefaction, landslide),
- Vulnerability,
- Soil

*Ground Motion Prediction Equations
Comparison of 475-year PGA generated using:
A) RMS time-independent catalogue
B) USGS National Seismic Hazard Maps

Consider:
- Location of hazard hotspots
- Graduation of hazard
- Could be repeated at regional level for CA, PNW and NM
Exposure
• Key primary characteristics

Hazard
• Time-independence
• Contribution from secondary perils
• Higher / Lower ground motion
• Induced seismicity

Event Set
• Unoptimised event set

Vulnerability / Financial
• High / Low percentile damage factors
• Secondary Uncertainty
• Illustrates uncertainty of building vulnerability given hazard intensity within plausible upper / lower bounds relative to a mean damage ratio

• Due to differences in EQ-resistant building design / construction and response to ground-shaking

• Also due to availability of data to calibrate vulnerability curves

• High (Low) alternatives correspond roughly to 80th (20th) percentile damage ratios

• Useful relative measure of where models are likely to be more / less wrong
Expert Interviews

The USGS 2014 NSHMP is termed a consensus-based model – where are the main areas of disagreement among scientists?

What lessons learnt from recent events e.g. Tohoku & NZ were incorporated in the update?

For large events such as NM1811-12 and SFEQ 1906, what is driving the change in modelled losses?

How have you ensured your optimised event set is still representative of plausible but unobserved events?

What are the most important / fundamental expert judgements that we should be aware of that are changing?

What sensitivity tests are available to assess the materiality of expert judgements?
Validation Principles
Overview

Capabilities
- Validation Framework
- Training

Effectiveness
- Focus on Consistency
- Business Led Validation

Process
- Phased validation
- Leverage vendor /broker validation
Validation Principles
Validation Framework

Topics
- Data
- Model Design
- Loss Results
- Drivers
- Governance

Structure
- Test specification
- Quantitative / Qualitative
- Results
- Pass / Fail criteria
- Conclusions & Rec.

Tools
- Analysis of Change
- Back-testing, lessons learnt
- Stress & Scenario Testing
- Sensitivity Testing
- Benchmarking
- Functional testing
Validation Principles
Leverage external validation
Validating Model Adjustments
Guidance for Validators

- Adjustments address data / model limitations and should be based on credible benchmarks
- Internal as-if claims history is a credible basis for adjusting models at low return periods
- At high return periods, model comparison and qualitative expert judgement is required to surface potential limitations
Validating Model Adjustments
Guidance for Validators

1. What limitations does this adjustment address?

2. How is the adjustment applied:
   a. EP load or explicit distribution from in-house model
   b. Linear or non-linear EP load

3. What benchmarks did the modeller consider in quantifying the adjustment factor / calibrating the in-house model and how were they applied?

4. Is the adjustment / model risk sensitive (to changes in hazard, building stock or policy conditions)?

5. Were generally accepted actuarial principles employed? (parsimony, goodness of fit, freq-sev models, etc)

6. Is the approach proportionate given the materiality of the limitation?

7. Is the approach easy to communicate?

8. Is the approach easy to govern?
# Guidance for Governance Sign-Off

<table>
<thead>
<tr>
<th>Motivation for changing current approach</th>
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<tbody>
<tr>
<td>• Provide Context:</td>
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<tr>
<td>• How material is the region-peril to which the change request relates? [quote current stand-alone 1% TVaR, expected loss, 1:100 / 1:250 OEP / AEP VaR]</td>
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<tr>
<td>• State the current method / model used in production</td>
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<tr>
<td>• If relevant, list limitations of current approach, else justify why you are proposing the change: e.g., post-loss review, new model/science, general update, etc.</td>
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<tr>
<td>• Market context: what is the market adopting and when?</td>
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<table>
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<tr>
<th>Proposed approach</th>
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<tbody>
<tr>
<td>• Describe the proposed method stating explicitly how the method addresses the weaknesses / limitations identified in the motivation for change</td>
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<tr>
<td>• Clearly state the scope of impact of the proposed method:</td>
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<tr>
<td>• Treaty</td>
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<tr>
<td>• D&amp;F,</td>
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<td>• Business underwritten at Lloyd's,</td>
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<tr>
<td>• Pricing,</td>
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<tr>
<td>• Capacity Management,</td>
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<td>• Cat Risk SCR calibration</td>
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<th>Impact Assessment</th>
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<tr>
<td>Scope: for affected business activities:</td>
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<tr>
<td>• <strong>Timing:</strong> if implemented, for which renewal will this change be effective / implemented?</td>
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<tr>
<td>• <strong>Pricing:</strong> what is the anticipated impact on SCOR’s portfolio / impact on major cedants relative to prior year pricing?</td>
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<tr>
<td>• <strong>Capacity:</strong> what is the impact on the scope / modelling basis for monitored region-perils?</td>
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<tr>
<td>• <strong>Cat Risk SCR:</strong> How do you anticipate the method will affect the calibration method and / or adjustments applied in the Cat Risk calibration process?</td>
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<tr>
<td>• <strong>Systems:</strong> what changes are required? (for instance, default adjustments to be updated)</td>
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<th>Next Steps</th>
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<tr>
<td>What are the next steps with regards:</td>
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<tr>
<td>• Handbook / Manuals / SII docs</td>
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<tr>
<td>• Cat Capacity Monitoring</td>
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<td>• Cat Risk SCR calibration</td>
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<td>• Systems</td>
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<td>• Pricing</td>
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<td>• Communication to underwriters</td>
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<td>• Risk Management, Regulator Communication</td>
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<th>Compliance</th>
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<td>• Did you use the Validation test plan templates &amp; abide by the principles set out in External Model use Guidelines?</td>
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<td>• If applicable, state if there has been peer review by other technical specialists and outcome of this review</td>
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<td>• Has the proposal been endorsed by the Regional Cat Manager?</td>
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<tr>
<td>• Did you insert links to shared folders / more detailed documentation on the proposed method / model?</td>
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