



Institute
and Faculty
of Actuaries

Catastrophe Model Validation

Junaid Seria

Global Head of Cat Model R&D and Governance
SCOR

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

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The Art & Science of Risk

Business Led Validation



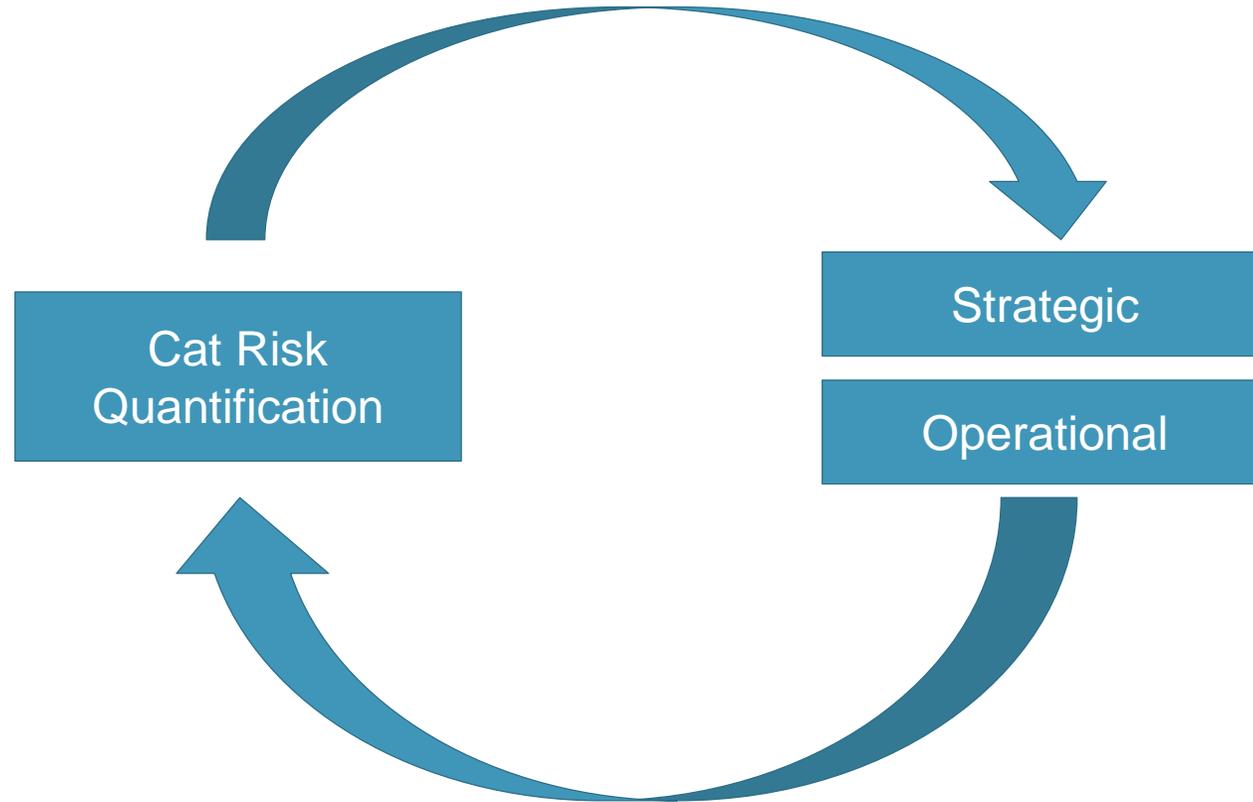
Validation Principles

Business Led Validation



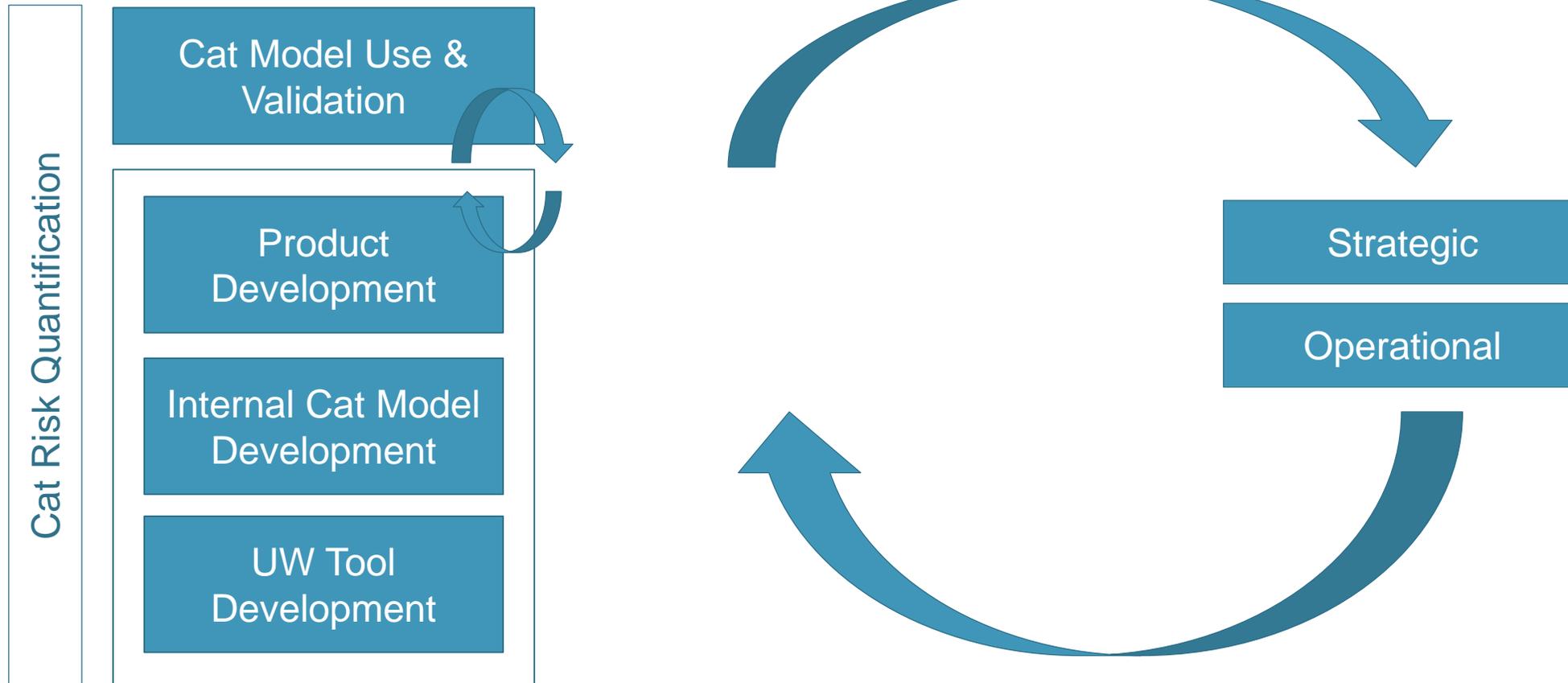
Validation Principles

Business Led Validation



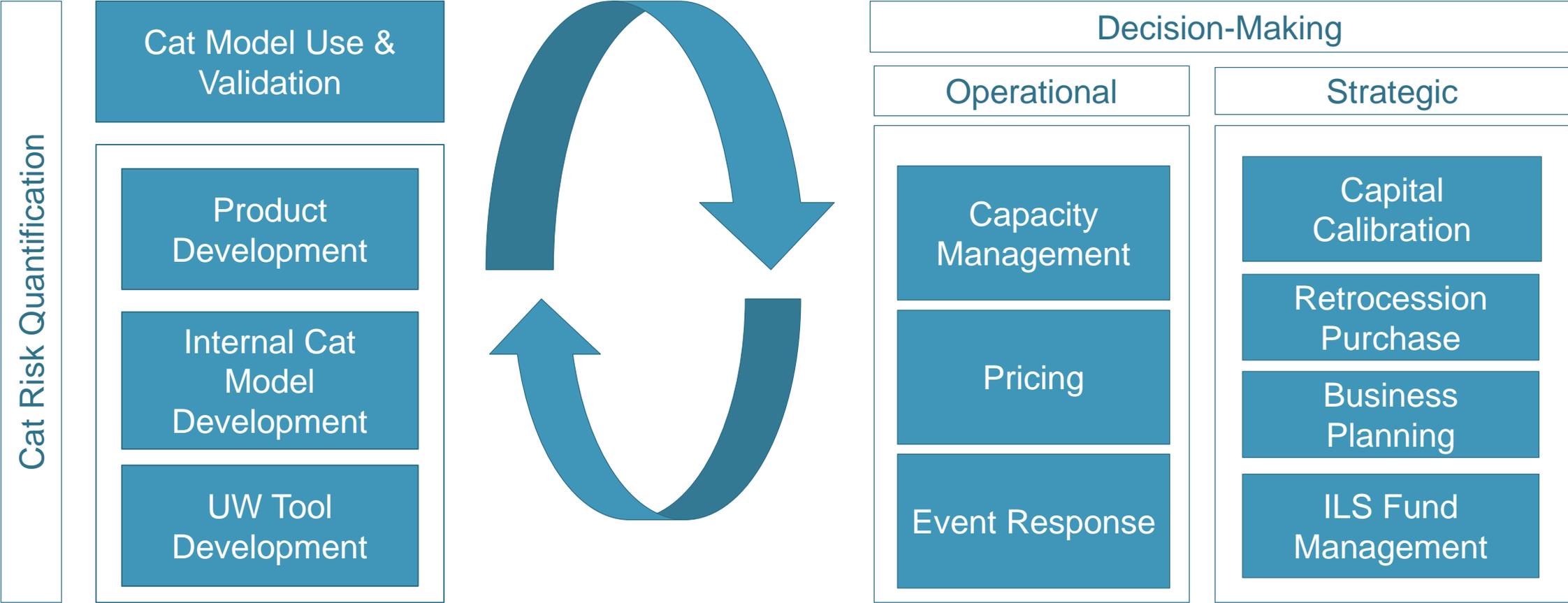
Validation Principles

Business Led Validation



Validation Principles

Business Led Validation



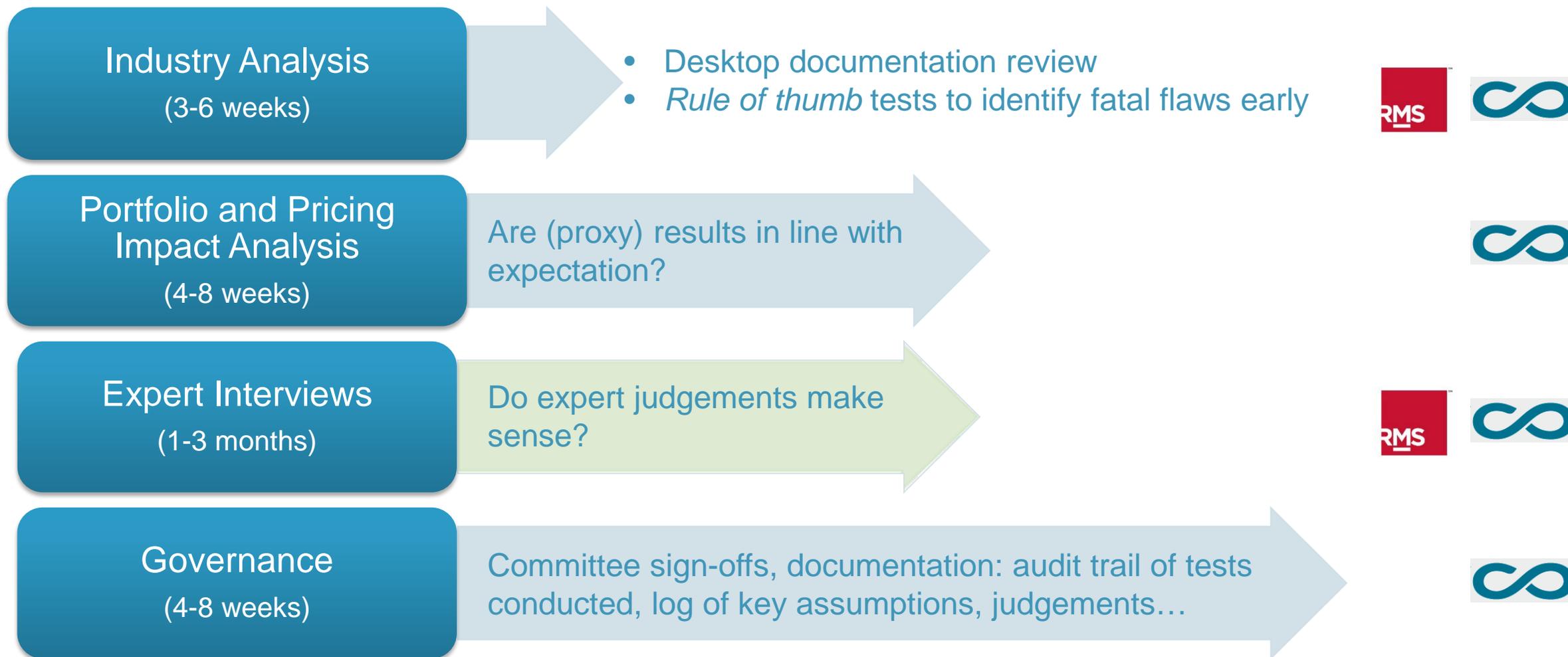


Tips from a recent peak peril
validation

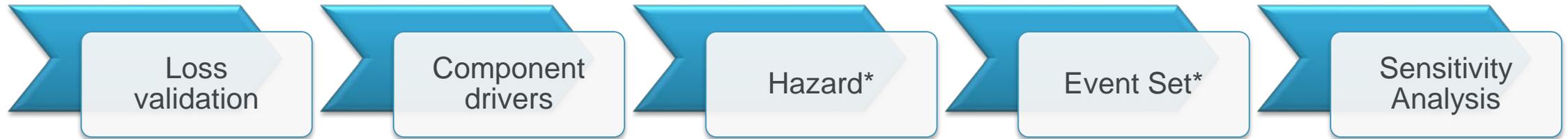


Phased Validation

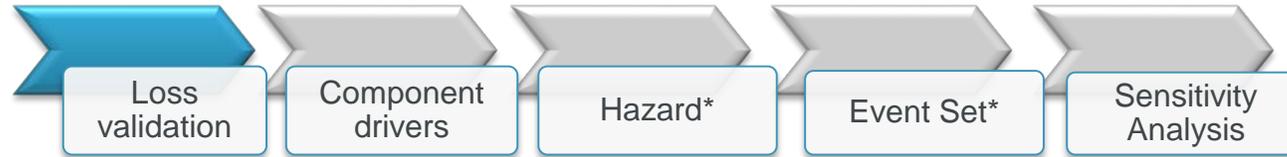
Depth of validation depends on scope of the vendor update and materiality of the region-peril



US Earthquake Validation Approach



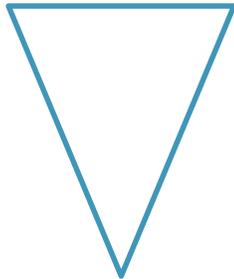
**Topics / Tests chosen depends on the scope of vendor model update and materiality of region-peril. The aim is to identify a manageable list of key topics that the team can work through in a few weeks*



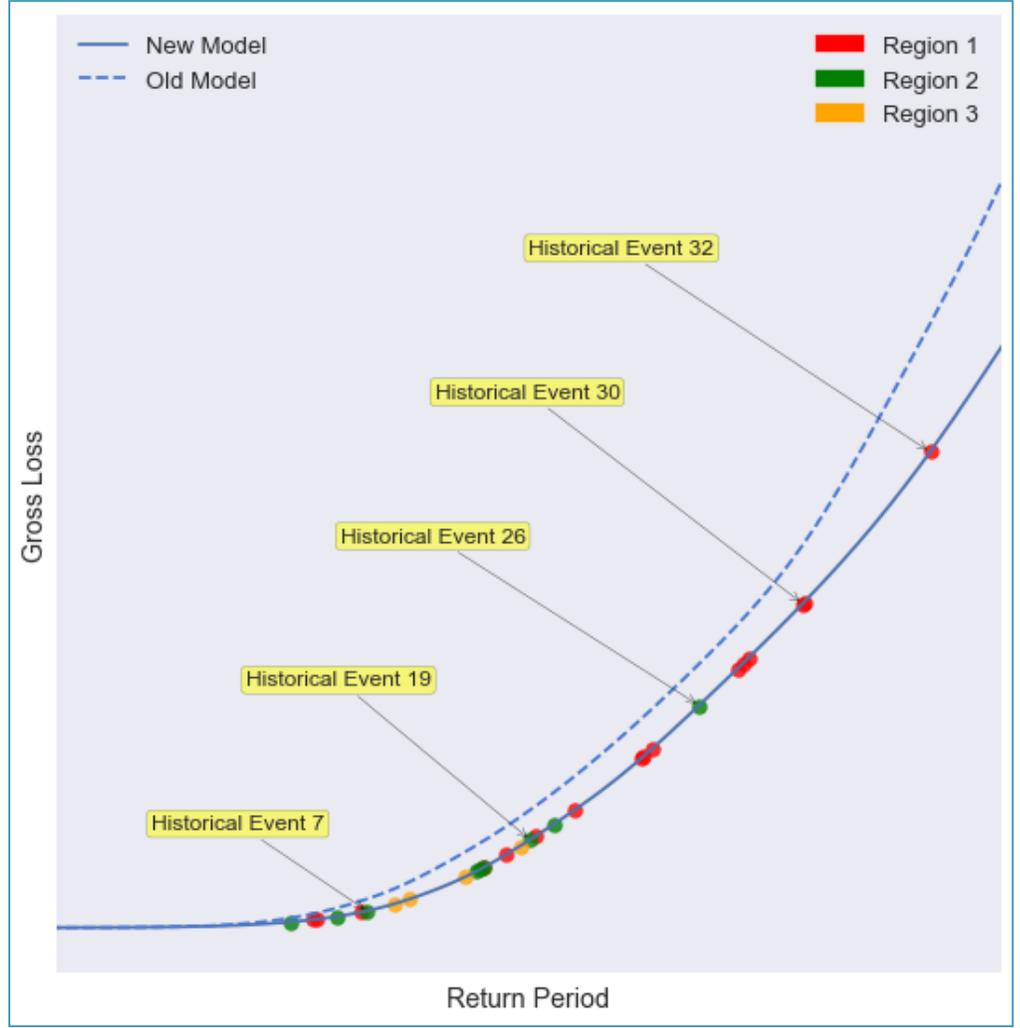
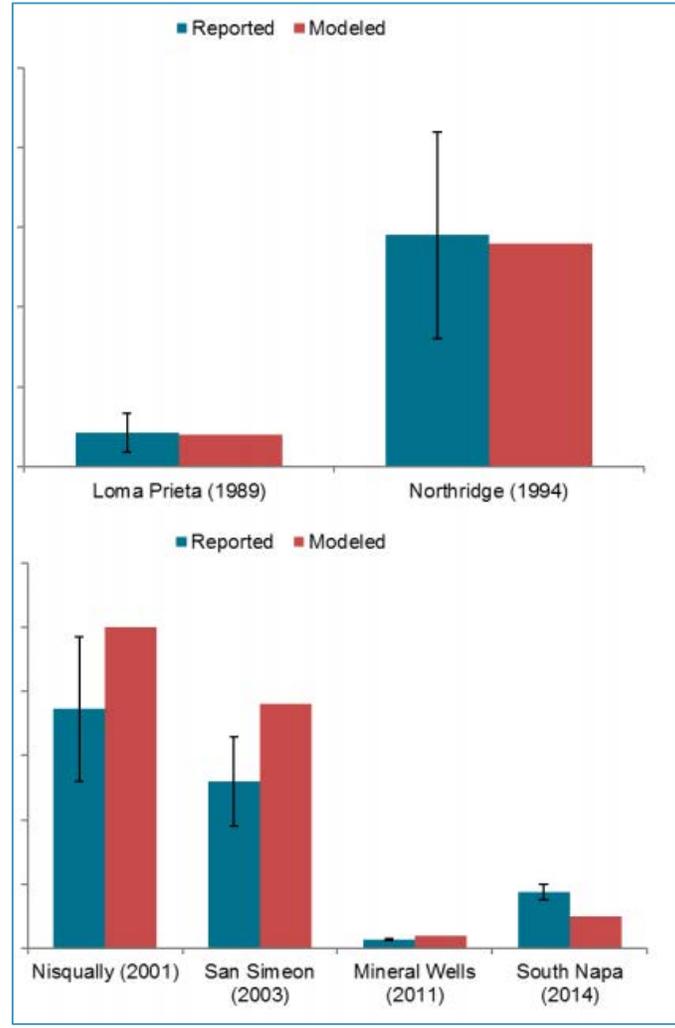
Back-testing

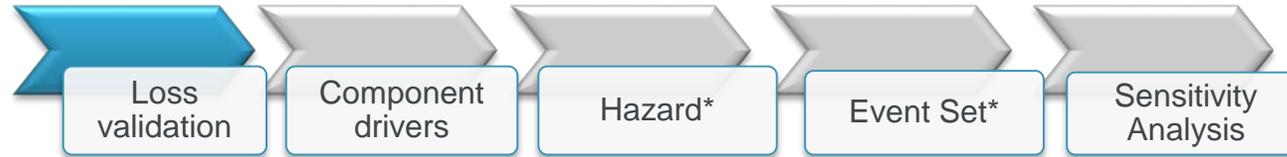
Are modelled losses in line with experience?

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

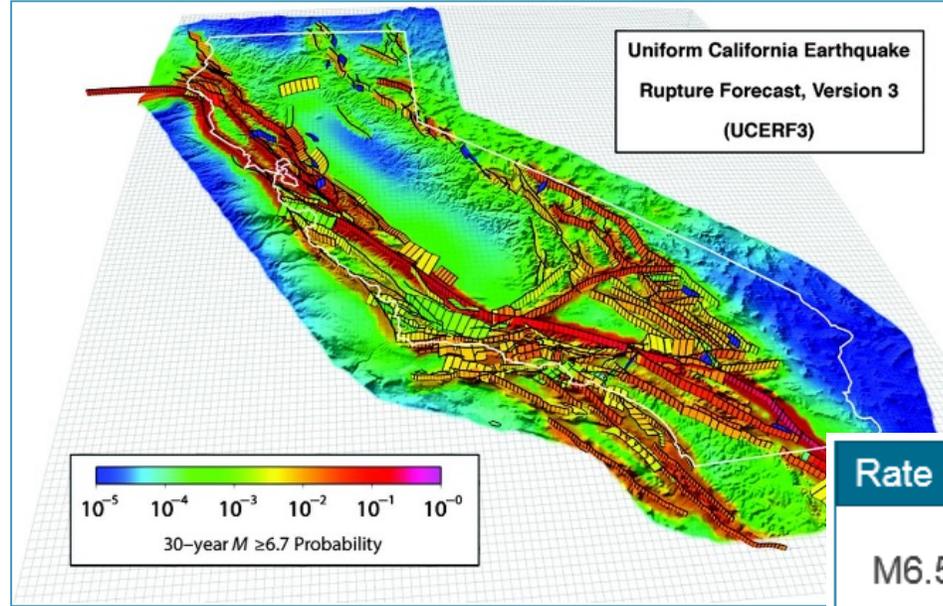
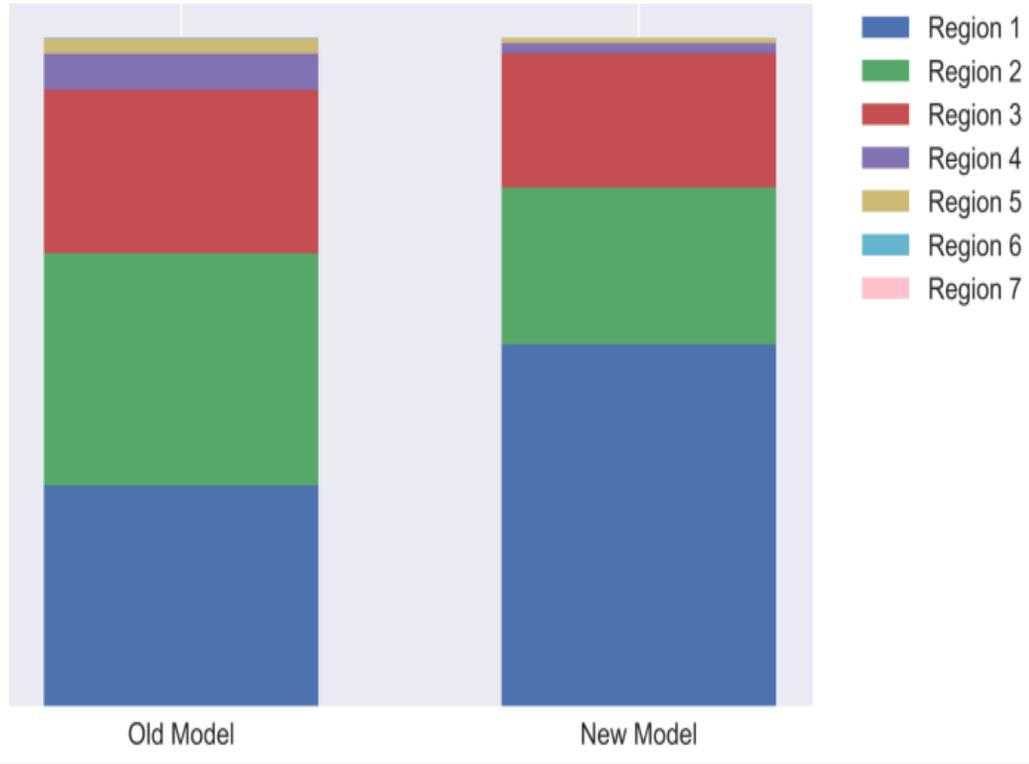


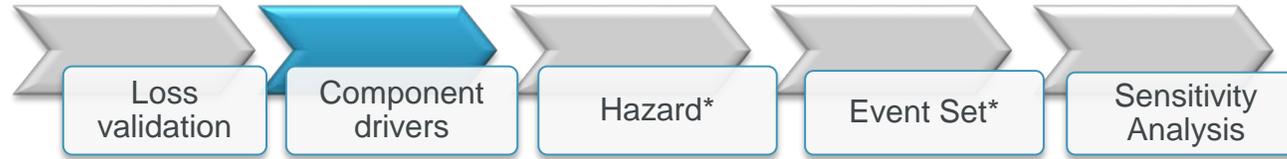
Industry Portfolio Contract





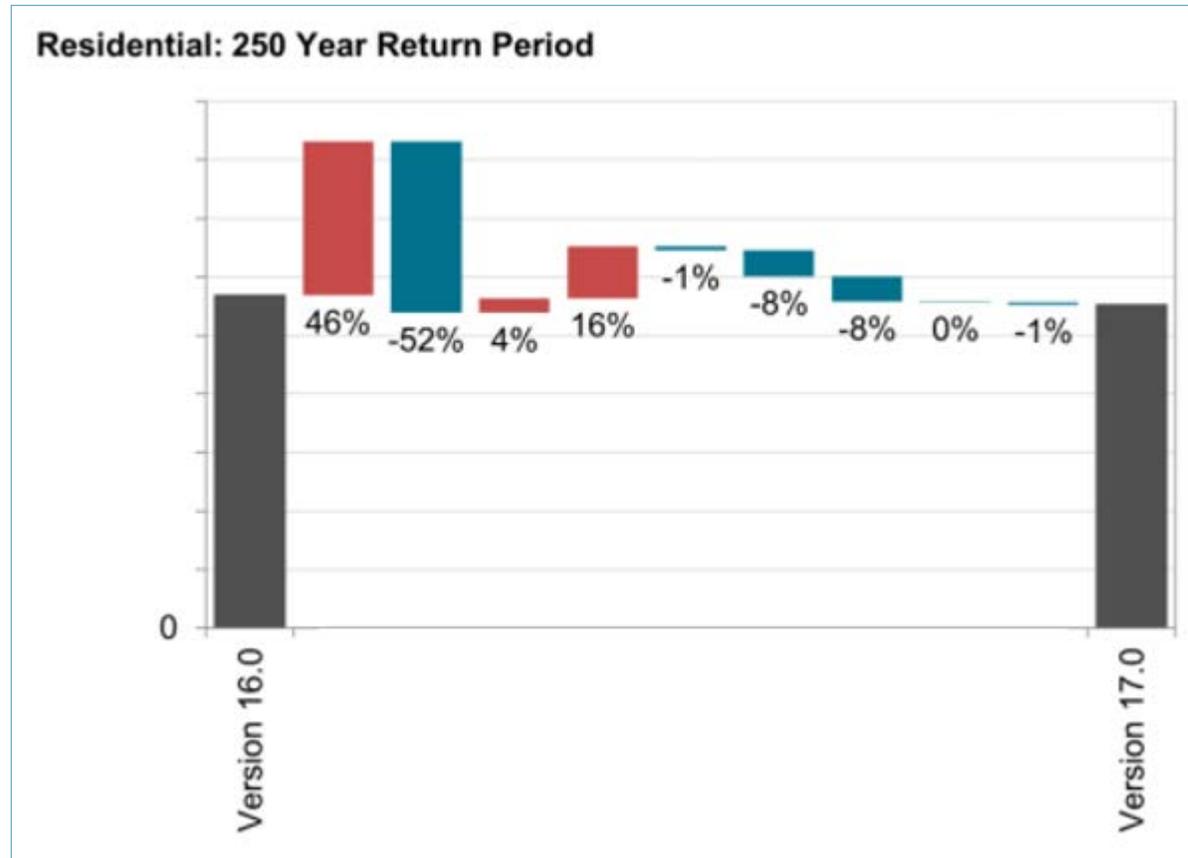
1% TVaR Loss Contribution by US Region

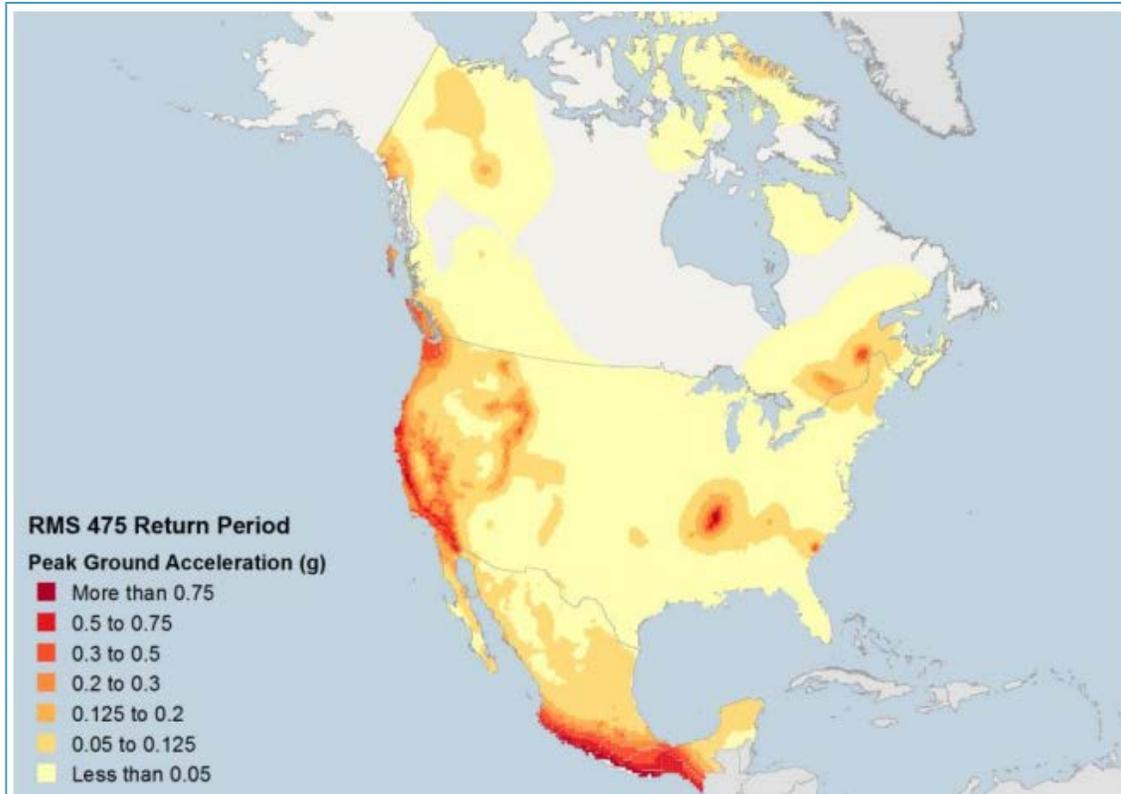
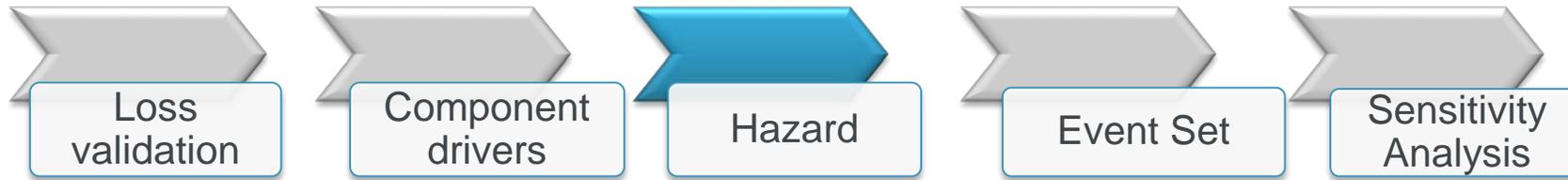




Vendors provide component attribution analysis that helps identify drivers of change arising from updates to model components such as:

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

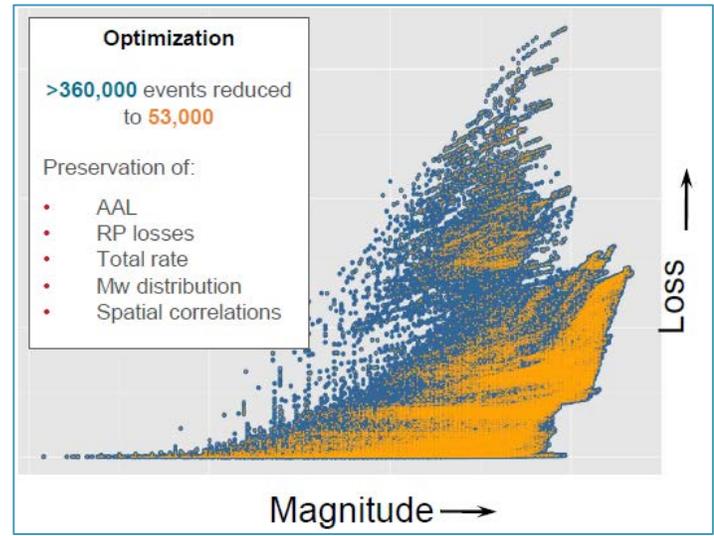
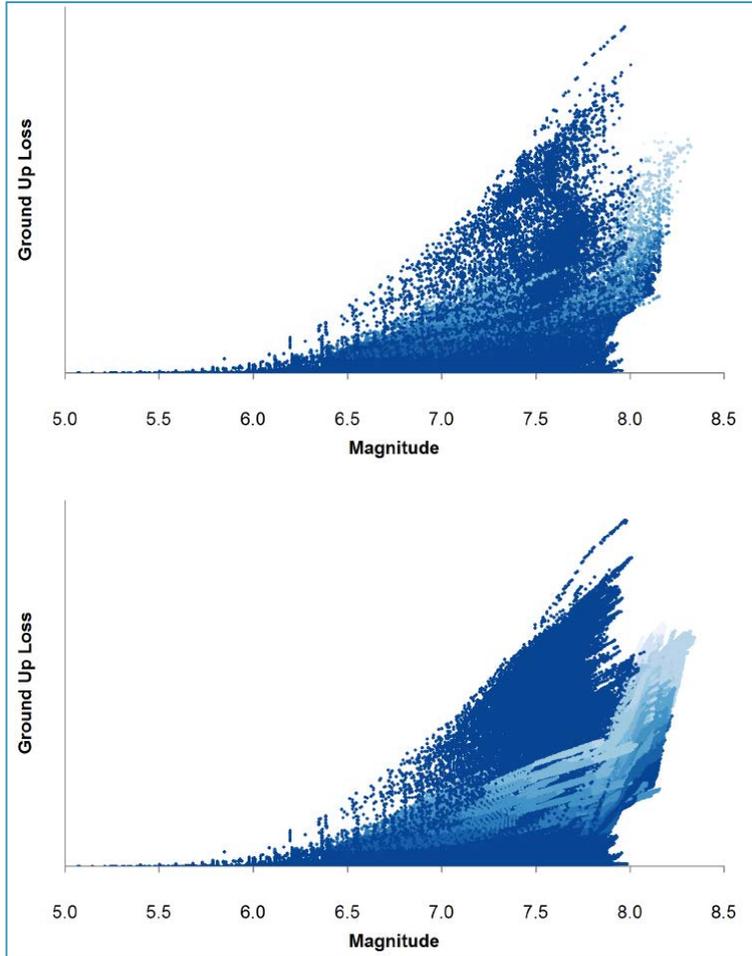


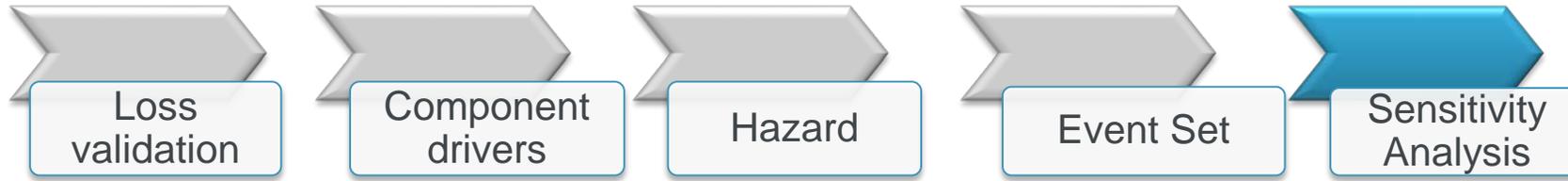


Comparison of 475-year PGA generated using:
A) RMS time-independent catalogue
B) USGS National Seismic Hazard Maps

Consider:

- Location of hazard hotspots
- Graduation of hazard
- Could be repeated at regional level for CA, PNW and NM





Exposure

- Key primary characteristics

Hazard

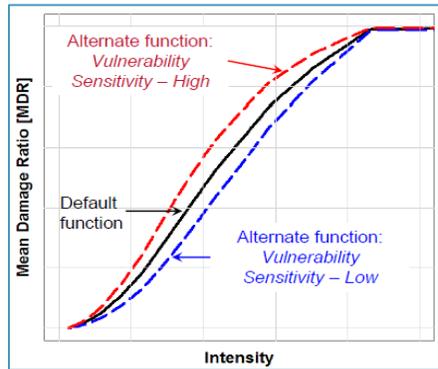
- Time-independence
- Contribution from secondary perils
- Higher / Lower ground motion
- Induced seismicity

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?

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

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



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

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

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

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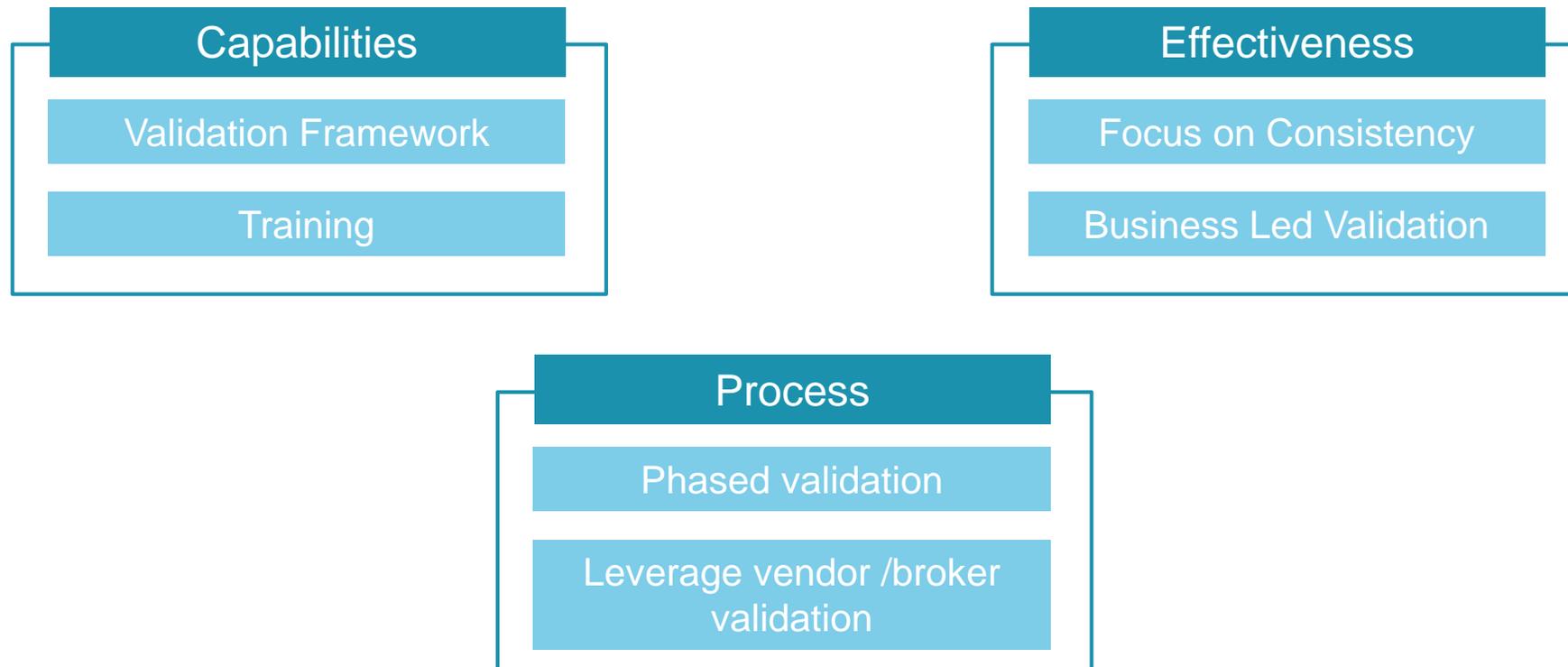
The Art & Science of Risk

Supporting material

jseria@scor.com

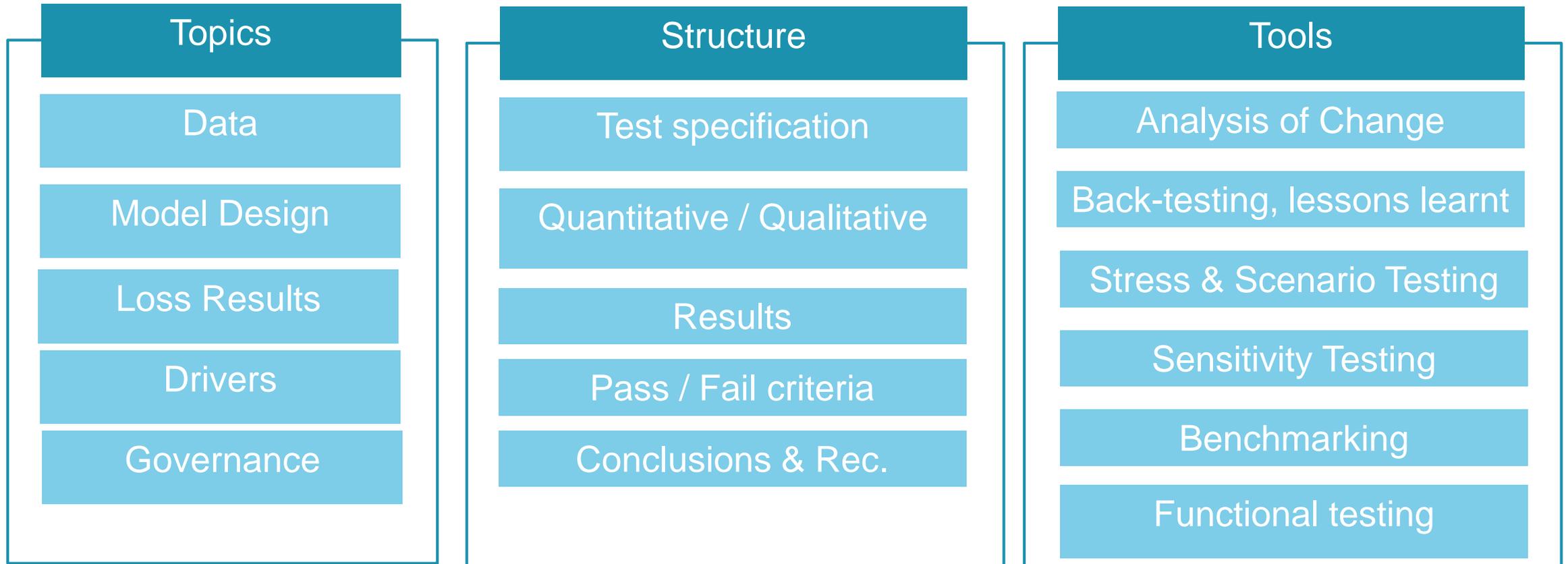


Validation Principles Overview



Validation Principles

Validation Framework



Validation Principles

Leverage external validation

North America Earthquake Models Methodology Version 17.0

May 3, 2017

North America Earthquake Models Historical Loss Validation Version 17.0

May 12, 2017



LMA Exposure Management Working Group

New Science in Earthquake Risk Modelling - Panel Discussion - 11th July 2017

Panelists:

- Vitor Silva - Global Earthquake Model
- Robert Muir-Wood - RMS
- Peter Stafford - Imperial College
- Claire Pontbriand - AIR
- Maiclaire Bolton - CoreLogic
- Siamak Daneshvaran - Impact Forecasting
- Tiziana Rossetto - UCL

Summary of key themes and issues raised

Many of the speakers focussed on similar themes related to the specifics of the new earthquake formulations. These included:

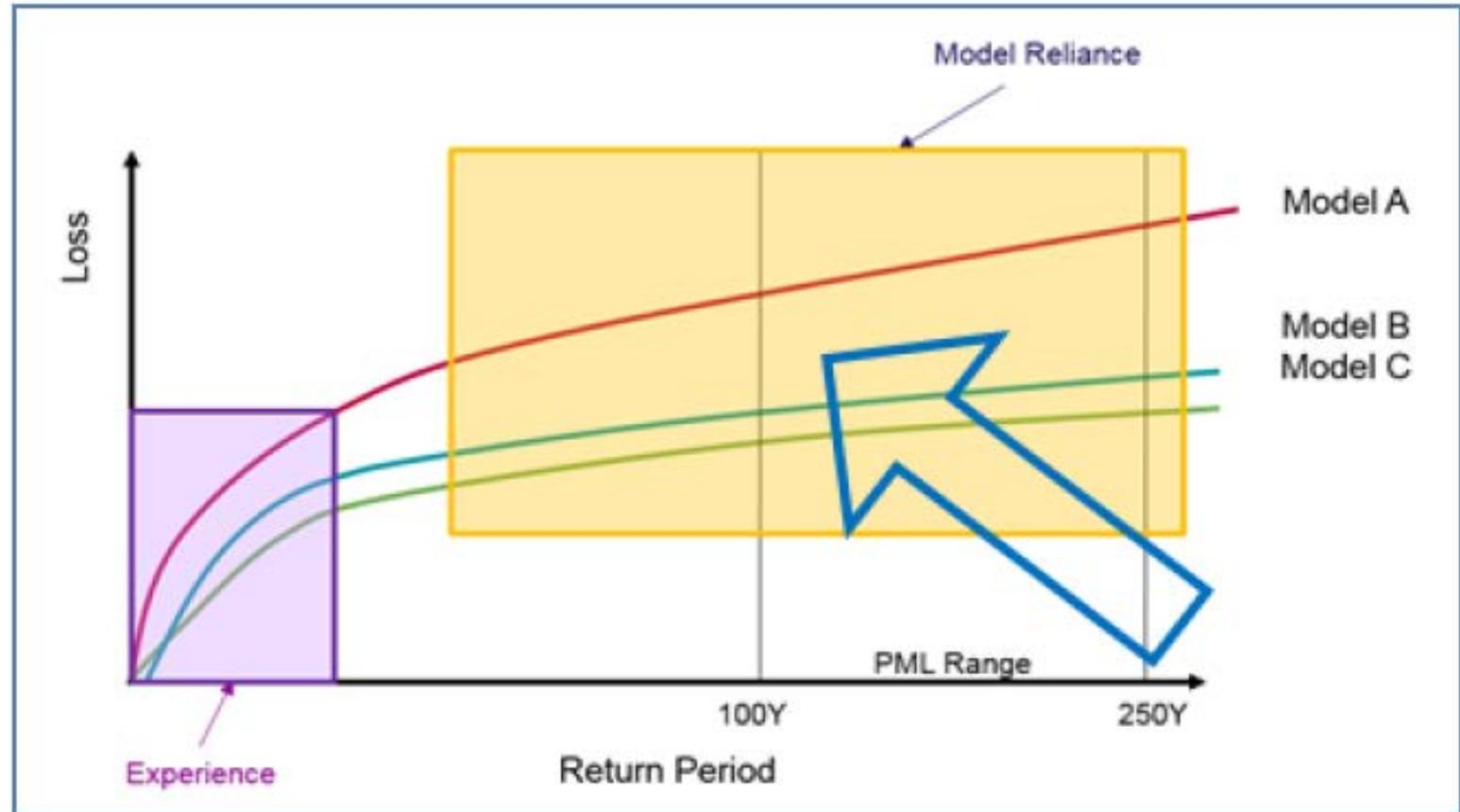
- Uncertainties associated with the subjective weightings applied to the logic tree formulations underlying the fault and ground motion components of the new USGS methodology.
- The incorporation of experience from recent international seismic events caused by multiple-segment ruptures have significantly influenced the distribution of event severity/recurrence within catalogues across the US. These have generated larger extreme tail events, across much larger geographic areas, including for the first time, 'whole California' fault ruptures which are influencing losses in the tail.

The panellists represent both vendor catastrophe modelling companies and academic experts. Questions will focus on how the new USGS formulations are being applied by the vendor companies in their new models, and how industry users should interpret the model change in light of both the USGS views, as well as vendor model approaches to their inclusion in the models, as well as other factors.

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

Motivation for changing current approach

- Provide Context:
 - 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]
- State the current method / model used in production
- 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.
- Market context: what is the market adopting and when?

Proposed approach

- Describe the proposed method stating explicitly how the method addresses the weaknesses / limitations identified in the motivation for change
- Clearly state the scope of impact of the proposed method:
 - Treaty
 - D&F,
 - Business underwritten at Lloyd's,
 - Pricing,
 - Capacity Management,
 - Cat Risk SCR calibration

Impact Assessment

Scope: for affected business activities:

- **Timing:** if implemented, for which renewal will this change be effective / implemented?
- **Pricing:** what is the anticipated impact on SCOR's portfolio / impact on major cedants relative to prior year pricing?
- **Capacity:** what is the impact on the scope / modelling basis for monitored region-perils?
- **Cat Risk SCR:** How do you anticipate the method will affect the calibration method and / or adjustments applied in the Cat Risk calibration process?
- **Systems:** what changes are required? (for instance, default adjustments to be updated)

Next Steps

What are the next steps with regards:

- Handbook / Manuals / SII docs
- Cat Capacity Monitoring
- Cat Risk SCR calibration
- Systems
- Pricing
- Communication to underwriters
- Risk Management, Regulator Communication

Compliance

- Did you use the Validation test plan templates & abide by the principles set out in External Model use Guidelines?
- If applicable, state if there has been peer review by other technical specialists and outcome of this review
- Has the proposal been endorsed by the Regional Cat Manager?
- Did you insert links to shared folders / more detailed documentation on the proposed method / model?