EXTERNAL CATASTROPHE MODEL VALIDATION
EXAMPLES OF MODEL LIMITATIONS & WEAKNESSES

MODEL VENDOR: RMS

The scope of this document is restricted to the Solvency II requirements as they apply to using an external cat-model within an Internal Model.

RMS have reviewed the limitations and weaknesses below, and provided both commentary and additional material. However, text and opinions represent the personal opinion of the authors.

v1.0

INTRODUCTION

The purpose of this document is to provide examples of the limitations and weaknesses of catastrophe models which may need to taken into account while validating an external cat-model for use in an Internal Model under Solvency II.

Pages 38-40 of “Supplementary Document for Undertakings Responding to Solvency II Directive” provided on the RMS documentation website lists a brief summary of the common limitations of the RMS RiskLink models. More region/peril specific issues are included in the list below.

1. GENERIC LIMITATIONS

All models are a mixture of data-driven empirical and engineering or scientific principles based assumptions. Therefore uncertainty varies throughout models (varies by region and by line of business), by return period (higher at longer return periods than shorter), and between models (e.g. US hurricane versus Australia earthquake).

For extreme events, the event frequencies are more uncertain than higher-frequency events, due to the paucity of observed data.

1.1 ANNUAL VARIATIONS IN CONDITIONS

Catastrophe models available today are not designed to estimate annual variations in conditions:

- for hurricane models, the near-term view is blended forward looking view which estimates the probable average activity over the following 5 year time horizon. The model is not designed to provide seasonal forecasts or annual variations;
- for earthquake, time-dependency is incorporated on major faults, but is not designed to capture event clustering, and often lags significant events due to the complexity of understanding stress transfer post event.

As such, the model cannot be used an a tool for annual prediction or to provide strict guidance on single-season pricing

1.2 PRECEDING CONDITIONS

Preceding conditions are not incorporated. For example, if a major disaster has already occurred, there would likely be an increase in the demand surge component of loss, but the model is not updated on a live basis to handle preceding conditions of this nature On the aggregate loss basis, a subsequent modelled event impacting the same region has the severity calculated on the basis of no previous damage to the structures and as such could over or under-estimate the loss.

1.3 SOURCES OF LOSS NOT INCLUDED

Within each model there potential sources of loss that are not covered, or only subject to important limitations. These include:-

- Contingent business interruption losses are not modelled
- Loss adjustment expenses are not included
- Some Complex exposure types are not modeled, e.g. Cargo
- Whilst RMS models include a post-amplification component where relevant, which models demand surge, claims inflation and super cat (evacuation impacts etc), certain client-specific aspects of claims inflation are not covered. Post-Event Loss Amplification and loss settlement practice can be a major source of uncertainty.
- Time element losses are connected to the physical damage to a building, and no business interruption losses will be calculated where there has been no physical damage loss

2. US HURRICANE (RMS RISKLINK V11)

The region specific validation and calibration documents are some of the key sources, e.g. "U.S. Hurricane Model Validation and Calibration: Gulf Region and Texas", "U.S. Hurricane Model Validation and Calibration White Paper" (this document covers Florida), etc. Residual uncertainty and non-modeled loss is covered in multiple documents including those above. "North Atlantic Hurricane Model v11 Activity Rates: The Medium-Term Perspective" and some of the associated references on page 40-43 (e.g. Eisner) offer information around the rate and SST elements.

- Levee failure is not included in the storm surge component outside of New Orleans and the Galveston Sea Wall (which are modelled explicitly)
- Inland flooding from rainfall, often a major contributor on small events, is not modelled
- Wind and flood losses in certain non-coastal states (e.g. Ohio, Kentucky, Indiana) are not included in the model
- Pollution/mould is not explicitly included
- The small amount of observed data for North-Eastern and Mid-Atlantic storms means that changes to the model in these regions are based upon the extrapolation of observed data from other regions, and thus there is greater uncertainty around both the frequency and severity components in these regions.
- Similarly, individual vulnerability functions are often based upon very small amounts of supporting data, or are extrapolations from related vulnerability functions for which data was available. Thus greater uncertainty exists around commercial vulnerability functions due to less detailed individual claims data being available
- There is extensive data which shows cycles of increased/decreased Hurricane activity over the last 100 years. However, the understanding of the impact of changes in SST on hurricane formation and intensity continues to evolve rapidly, and there is ongoing uncertainty in the mechanisms and feedback loops in play.
- There is scientific debate around whether increased hurricane activity in the basin can be directly transferred to landfall rates
- Off Premises Power Losses
- Losses not covered in insurance Policies and hence not in claims data
- Rainfall Infiltration is implicitly included in vulnerability functions, as it is in claims data which the model is calibrated to. However, it is not explicitly modelled, and would not capture a storm wetter than those that have been included in the calibration.
- Tree fall is implicitly included in vulnerability functions, as it is in claims data which the model is calibrated to. However, it is not explicitly modelled, and would not capture a storm with more treefall than those that have been included in the calibration.
- Any undervaluation is not accounted for, and has been seen to contribute to gaps between model and actual losses in some events.
- Wind Pool Assessments are not accounted for.

3. US EARTHQUAKE (RMS RISKLINK V11)

"U.S. Earthquake Model: Data Source and Validation Matrix" is a summary document available on the RMS.com Client Resources website that contains links to the relevant key document references.

- The majority of event rates are assumed to be time independent. Time dependent recurrence is incorporated only for active faults in California, the Wasatch Fault in Utah, and for major structures in Alaska
- Validation through claims data is limited due to the small number of recent events. Claims data from the 1994 Northridge Earthquake is the source of loss validation of the vulnerability functions
- Tsunami is not included
- Water damage due to dam breakage, broken water mains, and other forms of water expulsion are excluded, apart from sprinkler leakage which is modelled as a specific option.
- Explicit modelling of secondary consequences of tail events, such as nuclear incidents, evacuations, or other disruptions to the impacted region and its infrastructure
- Leakage of EQ losses into fire policies -given partially burnt structures
- Land damage is not included

4. EU WINDSTORM (RMS RISKLINK V11)

"European Windstorm Model: Data Source and Validation Matrix" is a summary document available on the RMS.com Client Resources website that contains links to the relevant key document reference.

- Storm surge is only modelled for a portion of the U.K. east coast
- The industry exposure database and the aggregate loss module do not include profiles for cars or for infrastructure, Forestry is only incorporated for Sweden, glasshouses only for the Netherlands, summerhouses only for Sweden and Norway
- There are territories where the number of observed storms has been low
- As with all models, the amount of claims data for calibration is limited, and varies by territory and line of business. As one example, for the UK:-
    - limited detailed loss data was used to calibrate the vulnerability functions. See page 6 of "The 2011 RMS Europe Windstorm Model: United Kingdom Validation"
    - Industrial and agricultural data was lacking for UK vulnerability calibration
    - UK vulnerability at high windspeeds calibrated using aggregate data, engineering judgement, wind design studies, and vulnerability relativity to other countries
    - Heavily revised north/south regionality for UK based on calibration using the Christmas 98 storm losses. Calibration from a single event may lead to greater uncertainty in the result
- Builders Risk
- Water-ingress and other flood-related damage is not explicitly accounted for, there may be some inclusion in claims data used for calibration, but extreme events would fall outside that.
- Hail damage from summer thunderstorms
- Land and crop vulnerability
- Claims inflation does not account for the possibility of Super Cat events which are considered to be unlikely for European windstorms due to the nature of damage.