LOSS MODELLING FRAMEWORK

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Validating cat models – old tricks for new dogs

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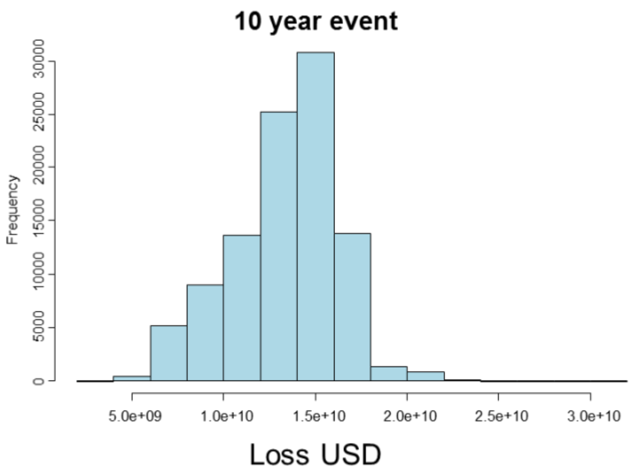
Over twenty years ago, at the start of my career in the reinsurance industry, most of the underwriting pricing models were directly driven by historical loss data. At that time, my role was to introduce underwriters to the relatively new approach of Catastrophe modelling, and to embed that in the underwriting processes and philosophies where I worked. What I was doing on a small scale in a catastrophe focussed reinsurance company, many other modellers and underwriters were doing in parallel across the industry. Catastrophe models are now, rightfully, the standard way to assess catastrophe risk. However, that isn't the whole story.

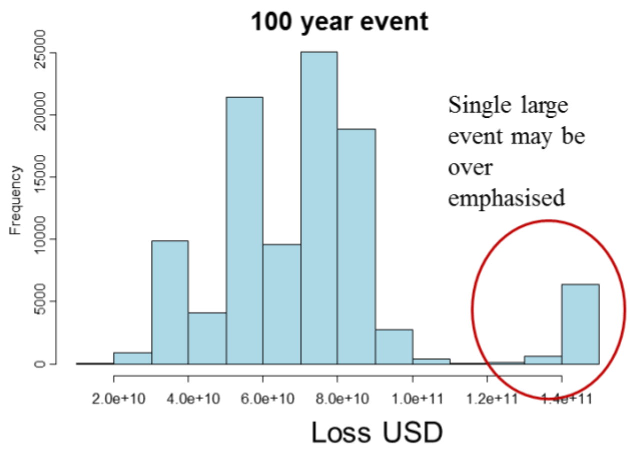
As Junaid pointed out last month in his blog on vulnerability and uncertainty, there is a danger that we have become overconfident in the precision of the models, and blind to the uncertainties. Ironically, returning to the old, often neglected loss data driven methodologies can give us useful insights into uncertainty, and even demonstrate that some models are producing non-sensical results.

The traditional pricing models were generally based on industry loss histories and statistical distributions. Those methodologies can also be used to derive uncertainty estimates and at least constrain the higher frequency end of Catastrophe models.
Historical market loss data, or economic loss estimates are now more widely available than ever, but they are also more frequently ignored. There are at least three categories of loss data that are useful for model validation.

1) Professionally complied market loss data from companies like PCS and PERILS.
2) Academic studies compiling loss data for specific markets and or perils: Pielke, ICA ASIF corrected by Risk Frontiers etc.
3) Historical losses reconstructed using Catastrophe models themselves

A number of statistical techniques can be used to estimate uncertainty bounds in losses at various return periods. The charts show the results of one such technique, a bootstrap analysis, based on resampling the historical losses 100,000 times. This gives a well constrained estimate of the 10-year return period loss, and its uncertainty. In contrast, the histogram of estimates for the 100-year event is spread over a much wider range with multiple peaks, indicating that the estimate for that quantile is very uncertain. This is no surprise given that the dataset is barely longer than 100 years.





The limitations of statistical techniques are one of the key original reasons that catastrophe models were developed, so it is no surprise that the illustrated uncertainty estimation method is not reliable for high return periods. What is more important for this discussion is that statistical techniques often do a good job estimating uncertainty at low return periods, and as a result they are useful for comparison with the higher frequency results of catastrophe models.

Data based uncertainty analyses are most powerful when a long and complete historical dataset is available. This is where OASIS models can potentially be very useful. With an open catastrophe modelling platform academics and industry experts can more easily build their own non-stochastic reconstructions of historical losses. These can be based on very long earthquake catalogues, or records of Hurricane events, and could substantially augment the number of loss catalogues available in the third category above. Publicly available models and data of that sort will be invaluable for cross checking Catastrophe model outputs, and providing benchmarks for broader analyses of factors that drive uncertainty.

As a final point however, let's not forget that when a model is demonstrably inconsistent with history it may still be a better representation of the current reality, as hazard may well be changing with time.