BY TIM FEWTRELL

The perils of a modelled world: technical challenges for catastrophe modelling

The adoption and incorporation of catastrophe models and their outputs into the enterprise risk management frameworks and processes of (re-)insurance companies for property and associated lines has developed apace since the early 1990s (see the article on catastrophe modelling on page 26 by Marc Melsen). Solvency II in Europe and similar regulatory regimes around the world have further accelerated this process.

Despite the widespread adoption of these models from direct underwriting to reinsurance and capital modelling, challenges remain; challenges related to data, model complexity and model validity amongst many others.

> ***"You can have data without information, but you cannot have information without data"*** **– Daniel Keys Moran**

As catastrophe models have become increasingly widespread, but also complex, driven by advances in the scientific community, this has encouraged, and to some degree required, (re-)insurers to collect increasingly granular data on their exposures, such as:

1. Location – detailed address level information for precise geolocation is becoming the norm
2. Occupancy & Construction – detailed specification of the usage of the building and construction materials are expected
3. Building Characteristics – data relating to building height, age, and size are increasingly differentiating insurers
4. Financial conditions – knowledge of deductibles and limits of cover for all lines of business is expected

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Catastrophe models are constructed in such a way that more granular data makes the outputs increasingly precise. This trend towards data granularity has created further challenges for the industry. In many instances, insurance companies have invested heavily in IT and underwriting systems capable of holding and using these data. Another approach has been to streamline the experience for policyholders and source the required data from third party providers. Regardless of the approach, this data revolution has put increasing strain on existing underwriting systems and processes.

A further challenge in the pursuit of granularity and precision is the disconnect between exposure data and claims data. Identifying the cause of loss and associating claims with exposure information has traditionally been a challenge. This is particularly acute in the Netherlands where underwriting agent, or *volmacht*, business has traditionally suffered from poorer data quality than direct channels. Therefore, whilst it is possible to enter almost infinite combinations of exposure characteristics into catastrophe models (e.g. occupancy, construction, height, etc...), the likelihood is low that claims data robustly underpin an associated vulnerability curve in the model.

In this respect, there is a distinct possibility that the current generation of catastrophe models are over-parameterised. The challenge for new vendors and models is to tailor the model granularity to the data available and ensure that data capture has a purpose.

> ***"Never before in history has innovation offered promise of so much to so many in so short a time"*** **– Bill Gates**

The continual improvement in computational power, coupled with industry initiatives, like the Willis Research Network, are bringing cutting edge research to market in a more efficient manner. These have enabled the development of larger, compound models as well as models covering a wider array of more granular perils. For instance, the latest generation of models are based on event catalogues of hundreds of thousands of stochastic events including sampling of uncertainties at multiple stages and the representation of hazard at spatial scales of meters rather than kilometers. Despite this drive, the industry and models need to improve at incorporating key lessons learnt from recent large catastrophic events, especially where these have been market changing. Model complexity and data granularity are redundant unless there is feedback into the model design process in a timely manner.

However, such advances come at a cost. Currently, the IT requirements to access and run these platforms and associated models mean that the barrier to entry is substantial. As a result, there is an emerging trend towards the distinction between platform and model. Industry-wide initiatives, such as the OASIS Loss Modelling Framework, aim to reduce these barriers to entry by providing a common platform as well as model development standards to enable a wider array of model developers to release their view of risk to a broader community. The challenge herein is that many companies do not have the resources to operationalize multiple platforms or evaluate the new models.

As platforms and models multiply, practitioners will need a clear framework to assess the options and a robust strategy to ensure a view of risk is customizable and credible.

> ***"All models are wrong, but some are useful"*** **– George Box**

Although catastrophe modelling has instilled a discipline into the industry, it has, in many ways, generated an over-reliance on modelled output. In response to substantial model change, model miss, and new regulatory frameworks, a shift in approach has emerged. Insurers and reinsurers are moving away from simply accepting model output towards a core model strategy adjusted to fit the company's own risk profile and view of the risk.

This view of risk approach requires a detailed understanding of- and judgement on- the model components and assumptions. Catastrophe model vendors have become increasingly open and transparent to address this challenge and the wider industry has invested heavily in research teams and programs to deliver objective assessments of models. This has enabled companies to develop a robust view of risk and, in some instances, embed this view in the underwriting process.

But a further challenge remains. As more complex models are developed for increasingly interconnected and potentially correlated risks, independent data and claims experience are more difficult to obtain. Furthermore, as the climate changes, the dynamics of these risks will change making it even more complex to assess the validity of models in both the short and long term. Many regulators, such as the Prudential Regulation Authority in the UK and Australian Prudential Regulation Authority in Australia, are already requiring insurance companies to stress test their model outputs to incorporate projected climate change. In these instances, robust approaches to model evaluation, validation, and assessment become even more important.

In recent years, the transfer of ideas and approaches from natural catastrophe models into terror, cyber, pandemic, and casualty lines has also been increasingly evident. The challenge for these emerging lines of business will be to avoid some of the pitfalls that befell the catastrophe modelling world. ■