How well do you know your catastrophe modeling?
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Three major hurricanes made landfall in the Atlantic region in the fall of 2017. Their human and financial impact is still being tallied, but industry estimates suggest losses of over $100 billion. During the same period, Mexico experienced major earthquakes and several significant wildfires affected California.

The magnitude and range of the model loss estimates from these events has turned the spotlight on catastrophe models, including the skill of the modeling approach and the reasonableness of underlying assumptions. More than ever before, industry stakeholders are calling on insurers to address the validity of the models they use to manage these risks. Did their models include these events beforehand? Did they accurately predict losses when the events occurred? Did different models produce different answers and how did they select the right one? Are they correctly parametrizing their models to accommodate changing climate and environmental patterns?
The validation of catastrophe models deserves renewed attention

With so many uses, are companies adequately considering the total financial and reputational impact and assigning the correct model risk score?

For insurers that underwrite policies exposed to these perils, catastrophe models are deeply embedded in their operations and are part of the model inventory their model risk management efforts address. However, the degree of scrutiny these models receive is often unaligned with their importance and impact on business decisions, profitability, and brand value.

1. Unlike the majority of models in an insurer’s inventory, catastrophe models are used for multiple purposes. The models’ results and view of risk permeate the entirety of the company’s operating practices. For example:
   - Underwriting and pricing of contracts,
   - Economic and regulatory capital setting,
   - Risk appetite/strategy determination and exposure aggregation monitoring,
   - Reinsurance/retrocession management and purchase,
   - Regulatory reporting and rate filing activities, and
   - Rating agency submissions.

2. Catastrophe events show a clear trend to increased frequency and magnitude. This is intrinsically linked to the financial performance of the insurance industry. There is general acceptance that global warming and other long term climate changes are resulting in more extreme weather activity; scientists had been warning that we were overdue for a significant hurricane long before Harvey made landfall. In addition, insurance penetration is increasing, leading to increased exposure bases, which are used as a basis for modeling. Insurers have to consider these factors in combination when setting underwriting strategy and risk appetites. As the chart below shows, not only have losses increased dramatically, but their variability from one year to the next has, as well.
3. **Major physical catastrophes are extremely high profile, and the mainstream media reports on them frequently.** In comparison to other events which might have a significant impact on insurance industry results (e.g., new product development or regulatory change), public awareness of catastrophic events is much higher, meaning there is a greater chance of being an outlier among peers. This means that insurers must carefully consider their losses and response to catastrophic events in order to manage any negative representations in the popular press and impact on brand and stakeholder expectations.

4. **The majority of insurance companies rely on external vendor models to establish their view of risk.** It is therefore of increased importance that these models are appropriately validated and that users understand their underlying assumptions so that companies can reasonably own the model parameterization. This is likely to be an area of shareholder focus after major loss causing events.

Different industry organizations and professional bodies continue to develop guidelines for the use and governance of catastrophe models within insurance companies. At the same time, model vendors are attempting to “open the black box” to assist in these efforts. We present below some ideas on how insurers can respond to the challenges we describe above.
1. There needs to be clear understanding of coverage and exclusion of different sources of claims in the catastrophe modeling results. Commercial catastrophe models allow for some losses in a more robust way than others; secondary perils, non-modelled peril-regions, and some exposure classes are examples of model areas where results are significantly less robust or completely excluded. It is essential that insurers identify and appropriately remediate potential model weaknesses and understand the resulting implications.

2. Risk management should appropriately interpret loss estimates from different vendor modeling companies, and consider the reasons for their differences. The loss calculations which different vendors made after the recent hurricane events varied by degrees of magnitude, potentially undermining confidence in the collective industry understanding of the events. In a market where many insurers license multiple catastrophe models, individual insurers should understand the differences between different model results, the comparative strengths and weaknesses of the models, and the corresponding implications on business decisions.

3. Insurers should appropriately utilize experience from recent events in validation efforts. Extreme event models are useful tools to inform management of catastrophe risk. However, whether or not a model includes a specific event in its event set is not a test of its validity. Rather, the goal of validation activities should be whether or not the distribution of generated losses is appropriate in aggregate, given exposures. Conversely, insurers also should take heed of lessons from “near misses,” as prices and capital levels should have been set to reflect a range of potential events. For example, validation testing should consider hurricanes which changed track at a late stage and narrowly missed causing losses (which would impact capital levels). Consider, for example, if Hurricane Irma’s path had been 100 miles further east resulting in a direct hit on Miami.
4. Management should **appropriately prioritize catastrophe models** so that they are within the overall scope of models in modeling and model risk management programs.

   Insurers will want to decide how best to use their modeling dollars. On which peril/regions should limited model and model validation resources focus in any given financial year? They need to understand the materiality of different peril/regions and appropriately allocate model risk management efforts, considering not only exposures/expected losses, and also target growth regions and the relative maturity of the models they use.
Using external vendor models does not automatically decrease the riskiness of catastrophe modeling programs; in fact the opposite can be true. An inappropriately designed and insufficiently validated modelling process can lead to unexpectedly high losses after events relative to peers, with potentially critical implications.

However, users can achieve a series of positive outcomes by actively pursuing a robust catastrophe model validation program, including 1) an ability to write additional business rapidly in order to capture emerging opportunities, 2) stability/improved categorization by ratings agencies, and 3) improved estimation of catastrophe losses after major events (thereby resulting in greater market confidence).

In their approach to validation of their internal catastrophe models, insurers should strive for the following:

1. In order to promote an appropriate allocation of model risk management efforts, organizations should suitably prioritize and assign a relevant risk ranking score to catastrophe models in comparison to the other models they use. This risk ranking score should link to the loss potential in a given peril-region, as well as growth targets and model individual model maturity.

2. Activities to improve the risk management program for catastrophe models should start immediately. Market leaders are already beginning to focus on addressing gaps in their processes.

3. Companies should help management and boards understand the losses that are in the catastrophe models they utilize, what the model limitations are, and how modeling programs are addressing them. Other jurisdictions, notably Europe, have advanced significantly in terms of senior stakeholder engagement in recent years and US insurers also could benefit from enhancing their relevant training programs.
For a deeper discussion about catastrophe model MRM, please contact:

Graham Hall  
Manager, Actuarial Services  
+1 212 617 8471  
graham.hall@pwc.com

Marta Abramska  
Associate Director, Actuarial Services  
+44 7808 106997  
marta.e.abramska@pwc.com

Henry Essert  
US Insurance Risk & Capital Services Leader  
+1 646 471-4400  
henry.essert@pwc.com