Benefits of Oasis for catastrophe model research

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It's quite easy to pick up and run a catastrophe model these days. But understanding why the numbers are what they are takes a lot more time and sometimes can be hindered by not being able to get at the inner workings of the model and their interplay.

Having a toolbox to help understand and research the cogs within the workings of a model is very useful for a more in depth understanding of catastrophe models and their underpinnings. This also aids in forming our own view of the model and ultimately the risk – an increasingly important objective in the catastrophe modelling process. This is where a framework such as OASIS is useful, not just to provide another view of risk for a particular peril and territory but also as a research tool.

To explore where having OASIS as a toolbox over and above a catastrophe model, let's take a look at a few examples using the familiar lenses of Exposure, Hazard, Vulnerability, Financial Modelling and the final Loss we get out of the models.

Hazard: Multiple views of risk

Taking an analogy with weather forecasting: every good weather forecaster never just concentrates on a single weather forecast model, as no single weather forecast model is 100% perfect. Instead, weather forecasters use multiple weather forecast model outputs, underpinned by a knowledge of each model's strengths, limitations and historical performance. Drawing a direct parallel, having more than one catastrophe model to offer alternative views of risk is often used in the industry these days.

But where do we benefit most from having additional views of risk? Some of the real uncertainties are in tail events. Extra value can be obtained from being able to look at footprints from other models. Understandably, we often tend to be better at getting the near-term risk right[1] but find out that tail representation is wrong. More models: more tail events to contrast.

An important point here is that we don't necessarily need an end-to-end catastrophe model here: raw hazard footprints can provide plenty of information to compare with catastrophe model hazard components. There is an ongoing project between CatInsight, Lighthill Risk Network, Climate-KIC and the University of Reading that is aiming to unlock 6000 years' worth of climate model data with this very purpose: to have a look in the tail of the curve. Through this project we will be able to do several things, including:

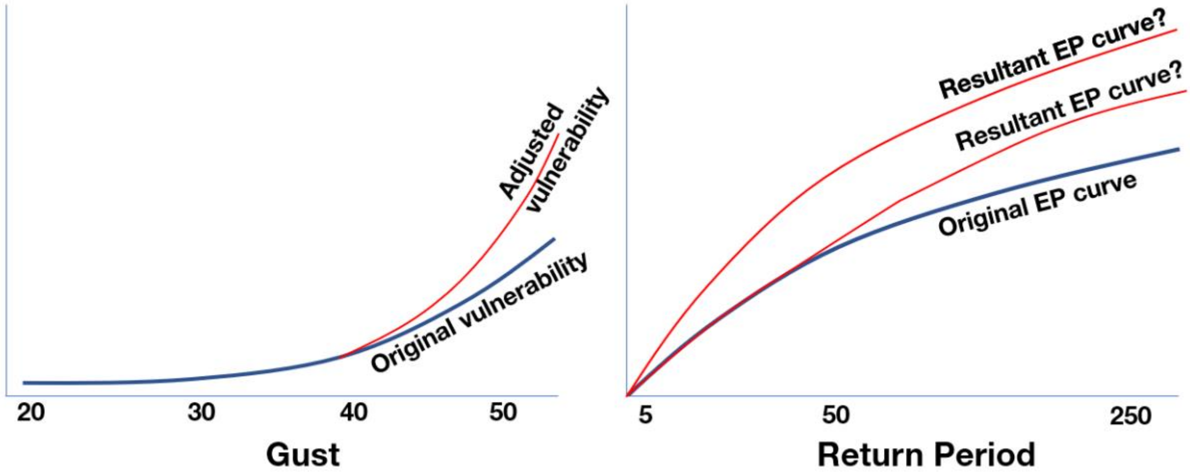
1. Compare extreme hazard footprints to those from catastrophe models: are extreme model footprints realistic?
2. Understanding whether the model replicates history: is the shift of windstorm activity towards France just natural variability or a climate signal?

[1] Even at low return periods there can be disparities between industry loss estimates and model outputs, as noted by Rick Thomas in his recent article on Oasis.

3. Look at the 6,000 years of climate model data to create a view on event clustering for extreme events: this remains a contentious topic.

Vulnerability: The tail wagging the dog?

Let me take a straightforward question on European Windstorm. We have very little vulnerability data that has been verified with loss data above around 35-40 m/s. In the example below, if you make the vulnerability curve above 40 m/s twice as steep (moving from A to B in the example), how does this impact the resulting EP curve?

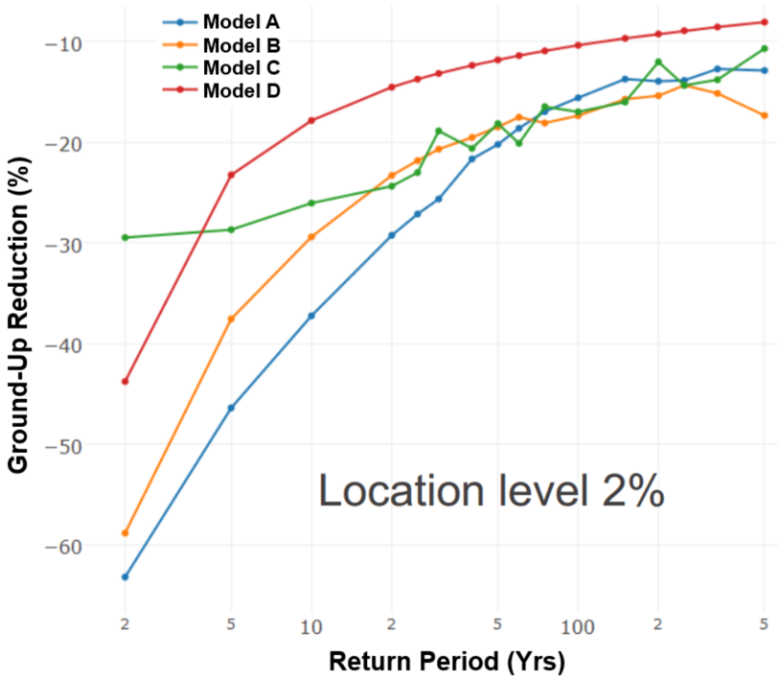


Where do you think the numbers on the EP would start changing notably? 5 years? 50 years? 250 years? It's the sort of question it would be useful to know the answer to. If much of the curve is very sensitive to winds above 40 m/s then a lot of the curve is being informed by vulnerability curves un-validated by loss data - and our uncertainty in the resultant loss curve could therefore be sizeable.

In addition to the above, for which lines of business, and what ages of buildings are the vulnerability curves calibrated to loss data, and which are based on assumptions and extrapolations? Catastrophe models today provide 10s, sometimes 100s of vulnerability curves for a single peril-region. However, many of these are not calibrated to very much, if any, data at all. The reality is that it remains not as straightforward as one might hope in many catastrophe models to easily test the impact of changes to vulnerability on loss results.

Financial models - an additional source of variance and uncertainty

One of the more eye-opening discoveries presented in recent years was at the Cat Risk Management conference in 2016 where Ariel Re's Federico Waisman presented a wide-ranging model comparison presentation, ending with a notable issue regarding significant differences in the impact of deductibles on loss results: one such example shown here, highlighting the impact of deductibles on the ground-up loss for a 2% location deductible.



Wouldn't it be useful to contrast multiple model ground-up views of risk on the same financial engine basis? Given the size of differences in the example shown here, it could help us explain at least some of the divergence between model results. Each catastrophe modelling platform today has its own different approach to financial modelling, each with different strengths and weaknesses. The consistent loss simulation engine of Oasis allows comparison across models produced by different developers, with different hazard and vulnerability assumptions, taking one source of variance and uncertainty out of the equation.

Losses: Where are the sensitivities?

In an ideal world, we'd be able to know from where exactly within the cat model process the uncertainty around our final, say, 250-year loss comes from. This would allow valuable and scarce research and development time to be focused on understanding these parts of the model and the data and assumptions behind them.

To this end, work is in progress for the "SAFE" toolbox (an automated model sensitivity testing tool) developed at Bristol University, to be integrated into OASIS, under the steering of XL Catlin. This will allow users to understand better the sources and magnitudes of model uncertainty as we move through from exposure to hazard to vulnerability to loss.

In addition, there is a powerful extension here that links back to the first of the “lenses” I spoke about - exposure - and how we manage and obtain this information. Part of this method can highlight sensitivities not just in the model workings, but in the inputs that lead to most variability in the end numbers. The power here is in highlighting those model input variables (be it year built, number of storeys and so on) that pass notable uncertainty through the modelling chain. This provides us with a knowledge of what building characteristics need to be reported better in insurance schedules to help reduce uncertainty in model results.

More models are always good to help understand the catastrophe world better, but we must remember that this in itself is not sufficient to fully understand catastrophe risk and how it is modelled.