Expect the unexpected

Catastrophe modelling is not an exact science, but its outputs still hold sway with risk takers. Bill Keogh, president of cat modelling firm Eqecat, urges us to take a leaf out of Donald Rumsfeld's book…

For the global (re)insurance industry the 2011 underwriting year is off to an astounding start with unprecedented levels of catastrophic activity. Market-changing events have occurred in New Zealand, Australia, Japan and now in the US, potentially incurring over $50bn of insured losses in just four months.

Perhaps unsurprisingly, each of these events has contained unique and unexpected circumstances.

This has increased discussions regarding the efficacy of catastrophe risk modelling and raised important questions about risk management practices. We applaud the discussion and appreciate that there are some players on the fringe who will always question whether catastrophe risk models are a worthwhile pursuit.

It appears, however, that the debate has already been settled. With each significant event of the last 20 years, especially those with surprises, we have seen an increased use of catastrophe risk models.

Why is that the case? If we start with market expectations of catastrophe risk models, we can ask "what do people expect from a model?"

Why uncertainty?

As modellers, our goal is to set rational expectations about risk. Models are essentially an analytical framework for exploring, quantifying and managing the uncertainty associated with catastrophic risk. So why is there uncertainty? Is it because modellers are unsure of themselves? Is it because we don't have enough information?

We employ many PhDs, scientists and engineers, mathematicians and insurance professionals; one might wonder why there would be any uncertainty. It seems like a reasonable expectation that a model would be accurate given all the brainpower we have. So what is going on?

The fundamental problem we're trying to solve is one of uncertainty, that's what we're modelling. We don't know what events will happen. We know what has happened in the past and we know what might happen in the future, but we don't know what will. We also don't know for certain how every building type responds to a specific ground motion or wind speed.

From the billions of dollars of claims and exposure data we have analysed, we know building response is highly variable. This is exactly why we need models. And, of course, there are many consequences that either cannot be anticipated or parameterised in a model.

Among the many benefits they bring, including increased discipline and transparency, risk models have started countless robust discussions that have increased the (re)insurance industry's understanding of risk.

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Rumsfeld's wisdom

In 2002, Donald Rumsfeld suggested a framework for thinking about uncertainty where he discussed known knowns, known unknowns and unknown unknowns. Models characterise the known knowns and the known unknowns. They don't characterise the unknown unknowns.

Let's put this in the context of catastrophe risk models. Known knowns are events that have occurred. These events inform us about a given peril in a given region. They are a rich source of data that provides insight into the nature of extreme and rare events.

Known unknowns are those events we can infer from what has already happened. For instance, there haven't been any intense landfalling hurricanes in northern Florida for the past 100 years, but that doesn't mean it can't happen, just that it hasn't. Creating a stochastic model is essentially building a robust set of possible events informed but not constrained by what has happened. The constraints are based on our understanding of the physical world.

And the unknown unknowns? These are the things that either cannot be anticipated or cannot be parameterised in a model.

To expand on Rumsfeld's thought –in the realm of catastrophe risk there are more things that we don't know than things we do: there are few known knowns, there are more known unknowns, and even more unknown unknowns. We learn from every event, but we will never stop learning!

With the maturation of the modelling process (re)insurance companies have an understanding of risk and uncertainty that includes models as an intrinsic part of a robust risk management process. Companies have embraced having their own view of risk that is informed by models – a shift in thinking that is a strategic asset.

WorldCat Enterprise event loss table

Event ID	Location	Peril	Frequency	Damage mean
45501	US	Hurricane/Typhoon/Cyclone	9.999	6798.55
39776	US	Hurricane/Typhoon/Cyclone	8.599	6720.75
45376	US	Hurricane/Typhoon/Cyclone	6.41	62222.35
45485	US	Hurricane/Typhoon/Cyclone	8.991	5213.65
45607	US	Hurricane/Typhoon/Cyclone	4.458	5045.65
45503	US	Hurricane/Typhoon/Cyclone	9.999	4998.39
45272	US	Hurricane/Typhoon/Cyclone	1.707	4830.51
45263	US	Hurricane/Typhoon/Cyclone	1.707	4829.86
45602	US	Hurricane/Typhoon/Cyclone	4.012	4691.51
45271	US	Hurricane/Typhoon/Cyclone	1.78	4564.85
45709	US	Hurricane/Typhoon/Cyclone	1.296	4552.75
45265	US	Hurricane/Typhoon/Cyclone	1.707	4487.56
45386	US	Hurricane/Typhoon/Cyclone	2.783	4414.97
45599	US	Hurricane/Typhoon/Cyclone	4.012	4183.93
45389	US	Hurricane/Typhoon/Cyclone	6.41	3888.217

Source: Eqecat Inc

Output from the model includes a full range of probability weighted simulated events, informed by what has happened and constrained by Eqecat's understanding of the physical world