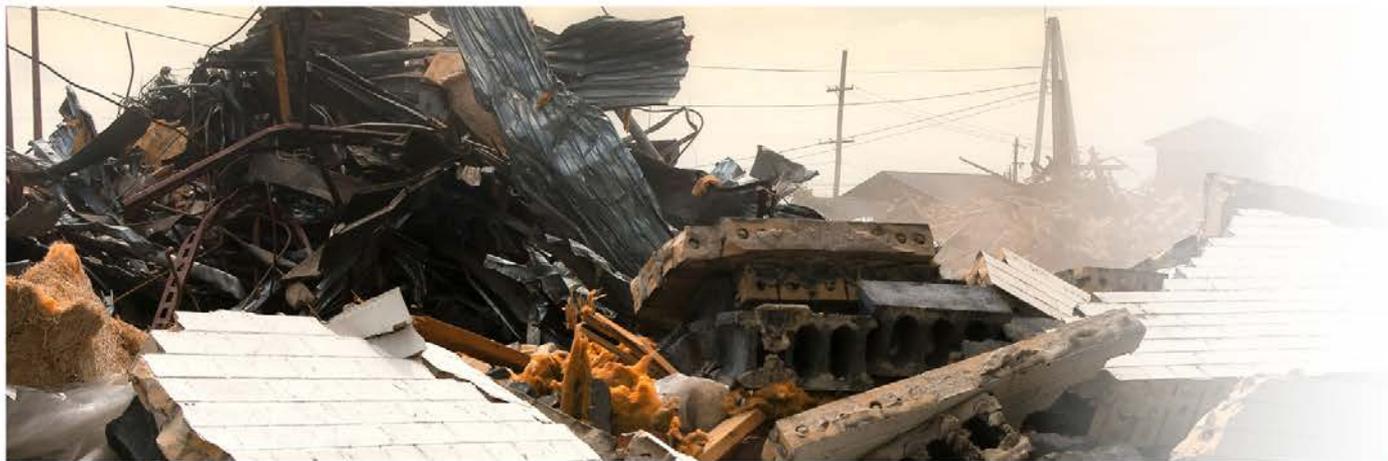


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Fundamentals of Catastrophe Modelling

Ben Miliauskas

Aon Benfield



Models Commonly used in Insurance

Experience
Models

Exposure
Models

Claims
Reserving
Models

GLM Models

Sales and
Distribution
Models

Economic
Scenario
Generators

Asset /
Liability
Models

Remuneration
Models

Catastrophe
Models

- Insurance companies use a multitude of models
- Most models use experience to broadcast potential futures
- Catastrophe experience is extremely limited making these models unique
- This should be considered when interpreting results

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Who Builds Catastrophe Models

- Catastrophe modelling embraces many skill sets outside the traditional gene pool
- A combination of:
 - Engineering
 - Science
 - Experience
 - Maths



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The Steps of Cat Modelling

- | | | |
|---------------|--|--------------------|
| Step 1 | Locate Exposures at Risk | (Geocoding) |
| Step 2 | Model Event Footprint | (Hazard Engine) |
| Step 3 | Estimate the force created at a site | |
| Step 4 | Estimate the damage caused by the force | (Vulnerability) |
| Step 5 | Calculate the loss to interested parties | (Financial Engine) |
| Step 6 | Repeat for all risks | |
| Step 7 | Sum loss | |

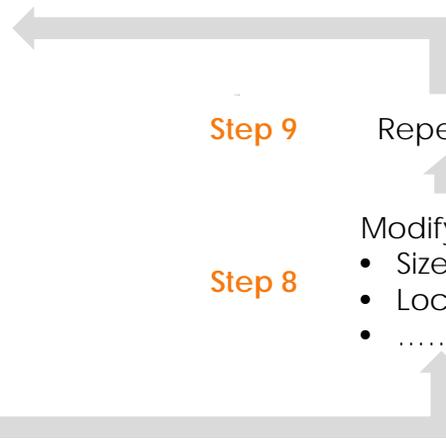
Step 9

Repeat

Step 8

Modify Event :

- Size
- Location
-



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The Steps of Cat Modelling (cont.)

Step 10

Communicate Results

What was modelled?

How rigorous was the analysis?

Do the results make sense?

Step 11

Interpret Results

What is the business context?

What is not included?

What is the impact of the non-inclusions?

What is the error margin in the results?

How do the results fit with alternate views?

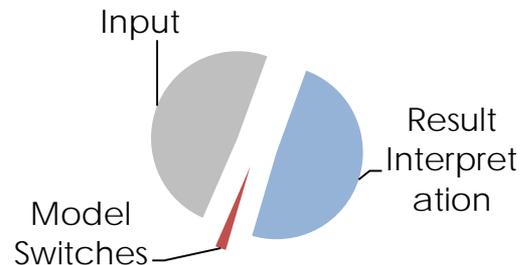
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4 Things to Note About Cat Models

1. We influence a cat model in three ways



2. When we receive a cat model it is simply a large database
3. Cat models must represent the (re)insurance contract being modelled (e.g. hours clause and Cyclones)
4. Modelled uncertainty is (generally) variability in loss, not a means for capturing unknowns

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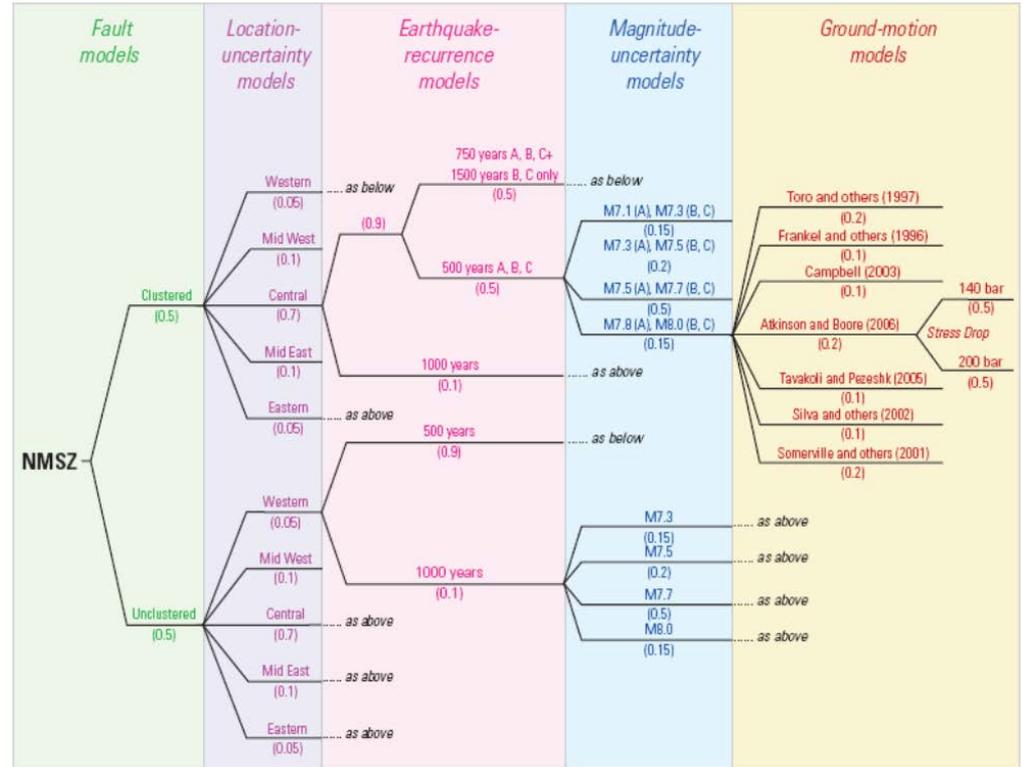
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An example of Hazard Uncertainty

USGS 2008 New Madrid Seismic Zone Logic Tree

- An area of known seismicity
- Known geology



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Features of a (good) catastrophe model

Representative of the hazard

- Results should be immune (as much as possible) to the modeller's decisions (e.g. software architecture).

Speed of use

- Must be fast enough to run so as not to impede business.

Scalable

- Data must be accepted and be logically consistent at different geographic resolutions (e.g. street address, post code etc).

Comparable

- The models must be comparable across geographies, perils and risk types to allow a true comparison of risk in a portfolio.

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Where does Cat modelling* become difficult

* Lets park what we
aren't modelling

- Uncertainty (i.e. choice) exists at every step of the process
- The data used for calibration is limited
- The population and its assets keep changing
- Claims management is not formulaic
- Communication on modelling has often been overly simplified



5 misconceptions clarified

1) Cat models weren't developed for reinsurance

2) Not every cat model adds value

3) Model Miss will never be defeated

4) The 1 in 200 year loss is not an event

5) Whole Of Portfolio modelling focuses on probability, not loss



1) Cat models weren't developed for reinsurance

- Cat models started in the US as underwriting/pricing tools in the early 1980's
- Their use for capital decision making followed
- RI brokers exploited this idea and globalised the practice (propagating the misconception, sorry!)
- Most AU/NZ companies were introduced to Cat Models via RI

Why is this important

- The use of models in underwriting is often overlooked
- The impetus for change (eg data improvements etc) has often been misplaced
- Consistence or otherwise of logic creates opportunities



2) Not every cat model adds value

- A model which does not represent the hazard does not add value
- Is the model in question “Fit For Purpose”
- Don’t assume all models are scientifically correct
- Model change doesn’t automatically represent progress in science
- Model blending doesn’t always improve accuracy

Why is this important

- “Beware of geeks bearing formulas!” (Warren Buffett)
- Most often, little additional value is gained from over complication
- Don’t feel the need to follow the pack



3) Model Miss will never be defeated

- It is highly unlikely a probabilistic catalogue will model reality
- Input data is a big driver of model miss
- The focus should be on systemic errors
- Fallacious confidence leads to disaster

Why is this important

- Models are the start of decision making, not the end
- This is "Owning a View of Risk"
- Recognises that even a crude model is better than no model



4) The 1 in 200 year loss is not an event

- The 1 in 200 year value represents an economic loss with an exceedance probability
- This value could be a large event in a sparsely populated area or a small event in a highly populated area
- The probability of a geophysical event is materially different
- The higher the return period being considered, the fewer the events

Why is this important

- It makes equating historic events difficult
- Simply taking one event as the 1 in 200 year loss can mask risk
- If you understand this you understand Whole of Portfolio modelling



5) Whole Of Portfolio modelling focuses on probability, not loss

- Whole of Portfolio modelling combines Geographies and Perils
- An EP curve shows the probability of exceeding the economic loss, irrespective of cause
- When combining curves, the mathematics revolves around the probabilities, not the quantum of loss

Why is this important

- WOP modelling confuses many
- It explains why diversification doesn't always work
- It helps **me** sleep better (this is one of the most common conversations we have)

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In Conclusion...

- Building a catastrophe model is (moderately) formulaic
 - However the devil is in the detail
- Producing answers from a catastrophe model is easy
 - Making them trustworthy is not
- Applying the results of a cat model is expedient
 - Making them applicable for decision making takes consideration

“If you can't explain it simply, you don't understand it well enough” Albert Einstein

- Overcomplicating an analysis does not make it more robust