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How appropriate is catastrophe modelling in assessing and communicating climate change impacts?

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During the late 1980's and early 1990's, losses arising from a series of devastating natural disasters threatened the viability of insurance industry. For example, insured property claims from hurricane Andrew that hit Florida in 1992 totalled USD16 billion and caused 11 company insolvencies.

A quantitative revolution in risk management was triggered in 'catastrophe modelling', based on estimating financial impacts to exposure (usually portfolios of property assets) in terms of components of hazard, vulnerability and sector-specific policy conditions (such as limits and deductibles). The initial core hazards of windstorm and earthquake extended to include flood (coastal, fluvial, pluvial), hail, tornado, tsunami, wildfire and other secondary aspects.

Communication of model results is familiarly expressed as exceedance probabilities and the inverse of 'return periods of loss', which has subsequently become a benchmark solvency metric across insurance regulation. Two challenging dimensions for catastrophe modelling when addressing the global and long-term issue of climate change include:
1) spatial extent is generally at national or regional scale for simplicity, while climate change is a global, connected, and complex
2) limited historical record of extreme natural hazard events extended by statistical and physical modelling approaches to generate catalogues of many thousands of years of synthetic events in 'stochastic/probabilistic' event sets

As high quality empirical data for severe natural hazards are often of limited availability (<100 years), stochastic event sets were created which effectively implicitly contained climate change signals for that period. In recent years there has been an emerging interest in modelling physical climate risk impacts explicitly both for acute extremes and slower-onset chronic risks, such as water and heat stress.

Regulators, investors and banks require practical, analytical approaches to guide decision-making relating to physical climate risk across the financial system. The Financial Stability Board (FSB)'s 2017 Task Force on Climate-related Financial Disclosures (TCFD) recommended inclusion of physical risks disclosures in organisations' annual filings. Whilst considerable momentum has built up, there is still little clarity of how such risks should be assessed, reported and ultimately reduced.

This presentation describes initial modelling forays as well as methodological and risk communication issues into physical risk assessment using catastrophe modelling tools, to help public and private entities handle the following questions:
• Are investment/lending sector physical climate risk assessment needs congruent enough to those of re/insurance to make the catastrophe modelling framework appropriate?
• How can uncertainty from climate model parameters and natural variability best be accounted for?
o Are (GCM-based) climate projections too poorly resolved to build 'climate conditioned' event sets?
o Or can perturbed physics ensembles of transient stochastic weather generation provide robust methodologies
• How in the multiplicative uncertainty of modelling extremes and climate change best handled and communicated?
o E.g. simple modelling and transparency around assumptions

Alignment between scientific capabilities and business requirements needs to be efficiently coordinated and accelerated. Industry-led institutions such as the Oasis initiative, Willis Research Network and Insurance Development Forum aim to drive such requirements, thereby building climate resilience into global financial systems.