

Understanding Research Priorities in Natural Catastrophe Insurance

On the 11th of June, the Royal Meteorological Society, the Lighthill Risk Network and UCL hosted an afternoon workshop, focussed on identifying and compiling the research interests of the natural catastrophe insurance community. The event was primarily organised by Conor Lamb, in his capacity as the Science Engagement Fellow for Insurance with the Royal Meteorological Society. In this article, the authors share valuable insight into the topics, questions, and discussions from the day's sessions.

Introduction

Across natural catastrophe insurance, research is central to informing risk estimates and subsequent decisions on risk appetite, exposure management, underwriting, reinsurance requirements and capital requirements. As a result, many within the industry come from academic backgrounds with natural hazard or climate specialities. Despite the clear overlap in interests and personnel, academia and the industry often struggle to collaborate on decision relevant and applicable research. Academia struggles to understand the needs of insurance companies whilst the industry fails to communicate their requirements – a key focus on implementation and defensible, if not fully optimal, decision making. Other institutional barriers exist such as misalignment of timescales, misalignment of incentives, funding barriers and IP conflicts (Fisher et al., 2024).

However, academia is a huge resource for natural catastrophe insurance with enormous amounts of relevant information, data and expertise. The following workshop sought to identify the key research interests of the industry, with the aim of facilitating longer term research projects and more speculative thinking about the types of research that would support decision making within the industry. This follows on from, and builds upon, previous events and publications seeking to expand the interactions of academia and the insurance industry (Hillier et al., 2019) (see <https://cgfi.ac.uk/2024/06/collaborating-for-impact-insurance/>).

Approximately 40 members of the community attended with varying experience. Most attendees came from a natural catastrophe modelling or analysis background and many of these worked across their respective businesses in management, communication and decision-making roles. Attendees were split across 6 tables, each with a variety of experience levels, alongside a facilitator from academia. Tables were loosely grouped by peril of interest. The workshop was split into two sessions. The first session asked attendees to discuss and design a research

project, suitable for academia, that would support decision making within the industry. The second session looked to highlight key questions, within a variety of spaces, that are of interest to the industry. The workshop finished with a networking and canapes session, kindly put on by the Lighthill Risk Network.

During the workshop introduction, Erica Thompson gave a summary of relevant research groups and doctoral training groups, to highlight the potential for collaboration. A summary of these groups can be found in the supplementary information. Mechanisms for collaboration include involvement with Masters and Doctoral student projects, direct collaboration through research sponsorship, and acting as project partners on research proposals to other funders.

Session 1- Research proposals

The first session looked to facilitate the development of a set of research questions and projects that would support practice and decision making within the natural catastrophe insurance industry. The session was loosely broken into 3 sections - starting with a broad discussion on the context, followed by focussing on the research projects attendees would like to propose. Finally, attendees were asked to define some specifics about their research project –

- Summary of the proposed research (what, where, climate timeframe)
- Current state of the science
- Key limitations of current science/practice
- Materiality of limitation (why does this matter?)
- What methods/datasets may be suitable for addressing this limitation?
- How could you contribute to this research?
- How would this research improve decision making?

Across 27 proposals submitted, there were several key themes and research interests. Principle among them was model use - decision making in the context of model uncertainty. Of projects under this theme, two submitted practical ideas for tooling for sensitivity analysis, two suggested research into the current state of calibration and how to improve it, whilst two focussed on how models inform expectations and decision-making.

The second key theme was a focus on emerging perils, showing potential signs of regime change or model inadequacy under climate change. These included hail, wildfire and severe convective storm with proposals focused on understanding the key physical processes which drive these perils. Notably, many of the proposals within this theme focussed on near term risk, highlighting large uncertainty in current understanding and risk estimates.

The third key theme focussed on better understanding the impacts of policy terms, implementing these more effectively in models and understanding their impacts on policy

holders. The final theme, mentioned multiple times, was a focus on how to expand insurance into emerging markets. Here proposals included the application of current methods and models to new regions and more social science methods to understand the barriers to uptake. Other proposals included better understanding of natural variability, research into the limitations of reanalysis data and understanding the materiality of tipping points.

The first two themes highlight a key consideration when designing research projects for the natural catastrophe insurance industry. The focus for insurance is risk, and by extension uncertainty. The two themes highlight two complimentary approaches to uncertainty – understanding, via estimating the uncertainty or attempting to reduce the uncertainty, via better representation of physical processes. Notably, understanding uncertainty is central to making research applicable to the insurance industry.

A list of research projects can be found in the supplementary information. For contact details, where available, please contact the corresponding author.

Session 2 – What’s the Question?

For the second session, participants were asked to highlight key questions of relevance in a series of spaces. For example, in relation to climate change, participants were asked, *what are the questions of relevance to the insurance industry, related to climate change?* Five spaces were selected, with participants encouraged to discuss the topic in their tables, again facilitated by an academic.

The first space was *Exposure and Vulnerability*. Here, most responses focussed on improving the precision of exposure and vulnerability models. For example, responses included improving geocoding for catastrophe models, better representing secondary modifiers, better representing property level defences, more accurate rebuild costs and expanding the representation of these attributes to less well served regions. However, some responses questioned this drive towards higher precision. These included responses questioning whether vulnerability is a physical property of buildings, questioning whether secondary modifiers should reduce uncertainty and simple statements such as, “false precision!”. Attempting to bring the groups together were broad calls for better and more available damage/loss data linked to better exposure datasets.

The second space focussed on *Alternative Risk Transfer* such as ILS (cat bonds), risk pools, and humanitarian applications. Responses in this space were very varied. Some focussed on understanding the physical peril, such as a focus on the correlation between perils and the understanding of tail risks. Others focused parametric products with responses such as, “how to design triggers?”, understanding basis risk and communicating the value of data within these products. A final set of responses focussed on the broader context of alternative risk transfer.

Responses here included, “what makes a risk pool successful and sustainable?”, understanding the impacts on the insurance gap and capacity and questions relating to market dynamics.

For the next space, participants were asked to think broadly about the key stressors to the insurance industry. This was not specifically related to natural hazards but aimed to provide an opportunity for broader *Futures Thinking*. Climate change was excluded here as this was covered in the next space. One response stood out here, with many participants highlighting artificial intelligence (AI) as a key stress for the industry moving forward. Reservations were made about the impact of AI on research and risk management. AI was also highlighted as a key risk moving forward related to cyber cover. Other responses related to “uncertainty in a changing world”. These included responses around geopolitical instability, fraud, increasing complexities, supply chain risk and political risks. Some responses included methods for addressing these challenges such as public-private partnerships and increasing complexities related to regulation.

The fourth space looked to clarify the industry's interest in *Climate Change*. Attendees were keen to refute the oft repeated line, “climate change doesn't matter because we write policies on a yearly basis”. Whilst reassuring, this may be due to the self-selecting group. The key questions attendees were keen to highlight were mostly related to near-present risk - building confidence that models represented the changes to the climate between pre-industrial and present. Some responses highlighted uncertainties related to the context. For example, “how do we determine materiality?” and “how do we facilitate productive regulation?”. There was also some apprehension about our ability to represent or understand changes in risk due to climate change – “there is a big difference in the state of the science and client expectations”.

The final space focussed on *Decision Making*. The most common responses here focussed on understanding the context of decisions across organisations. These included facilitating alignment across stakeholders and understanding decision processes. Other responses included highlighting a poor understanding of the limitations of models, escaping ingrained market views and understanding prioritisation and materiality.

Conclusion and follow-up

The described workshop, and associated follow up, is part of an ongoing attempt to bring together the expertise of academia and the objectives of the natural catastrophe insurance industry. The outputs from the workshop, including this report and a list of project proposals, can be circulated throughout academia, providing a resource to highlight the interests of the industry and, hopefully, facilitate ongoing collaboration moving forwards.

The key theme that came up repeatedly was uncertainty. From decision making uncertainty to uncertainty about the future state of the industry, across model uncertainty and uncertainty

related to emerging perils – understanding uncertainty is key to the industry moving forwards. Academia has lots to offer here, and collaboration in this space will be to managing risk in an increasingly uncertain world.

Although the themes of discussion are not new, we reflected that the identified priorities are indicative of a rapidly changing landscape for risk and insurance. The transformative potential of AI as a risk in itself as well as an opportunity for better modelling, the changing nature of climate risks and the development of innovative risk financing mechanisms all mean that the cutting edge of research in this space is a very rapidly evolving frontier. As such, there is clearly a need for further collaborative workshops to keep both communities up to date, and we will continue to facilitate discussion opportunities.

Finally, throughout the workshop attendees were enthusiastic and collaborative. They were keen to work with academia, including working around systemic barriers, and well as with each other where appropriate. We thank the Lighthill Risk Network and the Royal Meteorological Society who each act as convening organisations to improve access and collaboration across this space. Despite working within a competitive environment, there is a broad understanding that, to manage the risks present across society, we are together greater than the sum of our parts.

Acknowledgements

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References

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