ASSESSING THE GLOBAL RISK OF CLIMATE CHANGE TO RE/INSURERS USING CATASTROPHE MODELS AND HAZARD MAPS.

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A growing risk.

Research suggests that climate change is already impacting the financial losses associated with flood events (e.g. Kay et al., 2018), and this is translating to and increasing interest in “climate risk” in the re/insurance sector. Natural catastrophes caused overall losses of USD $150 billion during 2019, including insured losses of about USD $52 billion (Munich Re, 2020). The difference between overall economic losses and insured losses, known as the “protection gap”, was higher in 2019 than in 2018, due largely to the high share of flood losses. Climate change is expected to affect the severity and frequency of flood events in the future, so it is imperative to understand the potential impact on global flood risk and insured losses.

We show ways of integrating climate science into new and existing re/insurance industry tools, and what initial results suggest the potential impacts may be.

Tackling the challenge.

Re/insurers have a plethora of tools available to assess ‘current/baseline’ flood risk, but few extend to consider climate change. Commercial modelling companies who develop catastrophe models and hazard maps are well-positioned to bridge the gap between the financial sector and climate science research, with the opportunity to explore ways to translate climate science into understandable and operational tools and data to help the industry.

The industry is already implementing some methods to integrate climate science into maps and models. Here we outline a few of the different tools we’ve developed, some independently and others collaboratively, to show the potential impact of climate change on flood risk to support financial decision making.

UK Climate Change Flood Model

Our climate change catastrophe model is designed to provide estimates of insured losses by 2040 under a 2°C warming scenario. We developed this by applying climate projections to a stochastic flood event set and adjusting the statistical distribution of hazard severity (in relation to return period). When this is combined with information on the built environment and vulnerability of infrastructure to flood, a catastrophe model can estimate the financial loss. Results, such as those in Figure 1, help to understand the magnitude of change in flood risk associated with a realistic climate change scenario, and quantify the potential impact to inform portfolio diversification and management. The results from this model highlight substantial regional differences in financial losses in a potential future climate (Figure 1), and how difference in anticipated losses vary between different types of flooding (e.g. river flood loss decreasing in the same location as surface water losses increasing).

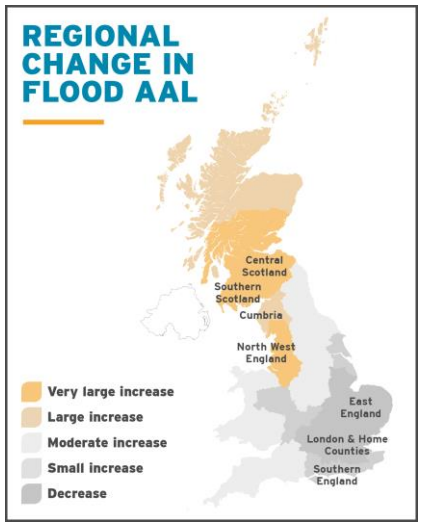

Figure 1: Map showing the regional change in Average Annual Loss across Great Britain, in comparison with a baseline (2018) output.

GB Climate Change Indicator

We derived a qualitative dataset, based on the relative difference between loss output from our UK Climate Change Flood Model and a baseline catastrophe model to quickly and easily identify areas that may be more or less susceptible to flooding under a warmer climate (Figure 2). As well as applications within the re/insurance industry, it allows asset managers and lenders to obtain an indication of areas in

their portfolio that may be at a greater risk to flooding in the future. This analysis shows differences in the projected impact of climate change at a higher resolution. Some substantial differences between neighbouring postcodes highlight the need to consider climate risk not only in terms of the changing hazard, but also it's impact on postcode-level risk, and how impacts might translate differently between river, coastal and surface water flooding.

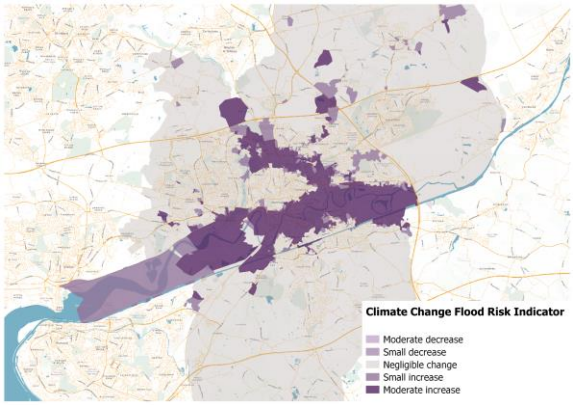

Figure 2: An example of JBA's GB Climate Change Indicator, showing the difference in impact of climate change on postcodes across a sample city.

Climate Change Maps

Hazard maps are an important analytical tool for the insurance industry. Working in collaboration with climate research groups, we've been developing ways to drive our hydrological and hydraulic models with climate data and generate Climate Change Maps. Through a US pilot study with climate-scientists at risQ (https://www.risq.io/), we have applied climate projections to hydrological model data providing climate-adjusted rainfall, temperature and river flows for use in our hydraulic model, JFlow®. Preliminary outputs from this work allow us to explore in detail the impact different climate projections have on a range of hydrological metrics and on changes in the flood extents and depths. The results also show that whilst there is a general pattern of increasing flood risk, this is not uniform, with flood risk decreasing in many places.

What does the future hold?

These are just a few examples of ways to incorporate climate science into re/insurance industry tools and data. There are plenty of other alternative methods, but all will experience a similar challenge in the face of uncertainty. We can't be sure which scenario might play out, nor by when, and there's a whole host of other factors to consider too, from land use changes to improved flood defences. However, the importance of continued research and development in this hybrid field is critical to enable an improved understanding of the potential risk to which the industry may be exposed in the coming years.

References

Kay A.L., Booth, N., Lamb, R., Raven, E., Schaller, N. and Sparrow, S. (2018). Flood event attribution and damage estimation using national-scale grid-based modelling: Winter 2013/14 in Great Britain, International Journal of Climatology, 38 (12).

Munich Re. (2020). Tropical Cyclones Causing Billions In Losses Dominate Nat Cat Picture Of 2019. [online] Munichre.com. Available at: <https://www.munichre.com/en/company/media-relations/media-information-and-corporate-news/media-information/2020/causing-billions-in-losses-dominate-nat-cat-picture-2019.html> [Accessed 30 April 2020].

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