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Improving the robustness of flood catastrophe models in insurance through academia-industry collaboration

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To quantify risk from natural hazards and ensure a robust decision-making process in the insurance industry, uncertainties in the mathematical models that underpin decisions need to be efficiently and robustly captured. The complexity and sheer scale of the mathematical modelling often makes a comprehensive, transparent and easily communicable understanding of the uncertainties very difficult. Models predicting flood hazard and risk have shown high levels of uncertainty in their predictions due to data limitations and model structural uncertainty. Moreover, uncertainties are estimated to increase with climate change, especially for higher warming levels.

Global Sensitivity Analysis (GSA) provides a structured approach to quantify and compare the relative importance of parameter, data and structural uncertainty. GSA has been implemented successfully in tools such as the Sensitivity Analysis For Everybody (SAFE) toolbox, which is currently used by more than 2000 researchers worldwide. However, tailored tools, workflows and case studies are needed to demonstrate GSA benefits to practitioners and accelerate its uptake by the insurance industry.

One such case study has been the collaboration between the University of Bristol and JBA Risk Management on JBA's new Global Flood Model, whose technology and flexibility has allowed to test a catastrophe model in ways not possible in the past. JBA has gained great insight into the sensitivity of modelled losses to uncertainties in the model datasets and analysis options. This has helped to explore the key sensitivities of the results to the assumptions made, for example to visualise how the distribution of modelled losses varies by return period and explore which parameters have the biggest impact on loss for the part of the Exceedance-Probability curve of interest. This information is essential for insurance companies to form their view of risk and to empower model users to adequately communicate uncertainties to decision-makers.