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Correlating regional natural hazards for global reinsurance risk assessment

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Concurrent natural hazards represent an uncertainty in assessing exposure for the insurance industry. The recently implemented Solvency II Directive requires EU insurance companies to fully understand and justify their capital reserving and portfolio decisions. Lloyd's, the London insurance and reinsurance market, commissioned the Met Office to investigate the dependencies between different global extreme weather events (known to the industry as perils), and the mechanisms for these dependencies, with the aim of helping them assess their compound risk to the exposure of multiple simultaneous hazards.

In this work, we base the analysis of hazard-to-hazard dependency on the interaction of different modes of global and regional climate variability. Lloyd's defined 16 key hazard regions, including Australian wildfires, flooding in China and EU windstorms, and we investigate the impact of 10 key climate modes on these areas. We develop a statistical model that facilitates rapid risk assessment whilst allowing for both temporal auto-correlation and, crucially, interdependencies between drivers. The simulator itself is built conditionally using autoregressive regression models for each driver conditional on the others.

Whilst the baseline assumption within the (re)insurance industry is that different natural hazards are independent of each other, the assumption of independence of meteorological risks requires greater justification. Although our results suggest that most of the 120 hazard-hazard connections considered are likely to be independent of each other, 13 have significant dependence arising from one or more global modes of climate variability. This allows us to create a matrix of linkages describing the hazard dependency structure that Lloyd's can use to inform their understanding of risk.