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Explaining the temporal clustering of UK flooding: large-scale atmospheric influences

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Natural catastrophes are particularly threatening for the insurance industry when they occur in temporal clusters, that is groups of events within a short time period. We present work combining knowledge and techniques from two distinct disciplines, hydrology and meteorology, to explore the role of large-scale atmospheric flow patterns in the temporal clustering of floods in the UK.

The UK floods that occurred in the summer of 2007 provide the context for this research. These floods were due to three distinct high-intensity rainfall events in June and July 2007, during a wet summer that affected much of the country. Together, the North of England floods in June and the Central England floods in July resulted in the largest flood-related insured losses in the UK (est. £3 billion). The summer floods were deemed unusual due to their wide spatial extent and rapid succession. However, devastating flooding in the UK has been common in recent years (e.g. autumn 2000 in Northern England; July 2002 in Glasgow, January 2005 in Carlisle; and recently, during the 2008 summer in the North East of England). Examination of the longest historical flow records in the UK, dating back to the 1800s, reveals that this flood-rich period follows a relatively dry, flood-poor period from the 1960s until the late 1990s.

To understand and predict the probability of flood clustering and flood-rich periods, we study the effect of low-frequency atmospheric and climatic factors in driving high river flows and flood events. Previous work shows that temporal variations in large-scale atmospheric patterns explain winter storm clustering through changes in the tracks of North Atlantic extratropical cyclones towards and over Europe. We use the following teleconnection indices as predictors in a Poisson regression model for threshold exceedances: the North Atlantic Oscillation and the East Atlantic Pattern (obtained by Principal Component Analysis of the geopotential field) and the Atlantic Multidecadal Oscillation. The long-term goal of this research is to achieve improved understanding of flood clustering, for use in CAT models for more comprehensive, multi-hazard hydro-meteorological risk assessment. Here, we present results from the initial stages of this project.