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Understanding the risk from correlated windstorms and floods in the UK

Oliver Halliday (1), Len Shaffrey (1), Dimosthenis Tsaknias (2), Alex Siddaway (2), Hannah Cloke (3,4)

(1) National Centre for Atmospheric Science, United Kingdom (o.j.halliday@reading.ac.uk), (2) Lloyds Banking Group, General Insurance, United Kingdom., (3) University of Reading, United Kingdom., (4) Uppsala University, Sweden

Both windstorms and flooding pose a significant threat to the United Kingdom. Winter Atlantic windstorms, prevailing from the west, encounter infrastructure causing significant financial loss: the great October storm of 1987, for example, eliminated western elements of the National Grid. Such storms can associate with heavy precipitation, compounding flood risk to densely populated areas. In parallel, extensive flood events can originate from a long, relentless series of slow-moving, otherwise insignificant fronts, as in the case of the winter floods of 2013/14 in the South East. The UK Met Office and Environment Agency estimate the NPV financial loss attributable to the 1987 and 2013/14 events at £5.5bn and £1.3bn, respectively. The question of correlation between windstorm and flood events remains open, with the risk a 1987-scale event "colluding" with more routine but still economically adverse meteorology of the 2013/14 season being, currently, unquantified. If correlated, insurers are under-estimating both capital requirements and risk policy price, exposing them to substantial liabilities.

Here, we undertake a collaborative project between leading academics and insurers, designed to improve understanding of the spatial-temporal distribution of risk from extreme, compounded windstorm and flood events. Using a combination of hydro-meteorological and socio-economic data, we undertake a UK-scale study aimed at a holistic understanding of correlated windstorm and flood events and translating that knowledge into a prediction of risk and hence financial loss. A preliminary statistical analysis of $\sim$40 years of winter ERA-interim reanalysis daily maximum winds and accumulated E-OBS precipitation data has already shown modest wind-rain cross-correlation in Spearman and Pearson correlation coefficients, particularly in the western UK. We find that the degree of correlation grows when coarsening the time series to longer windows (or accumulation periods). The correlation peaks at 21 days for the coarse ERA-i and E-OBS data products. Initial studies with the higher resolution CHESS precipitation product and selected hydrological station data mirror these observations.