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Simulating spatially coherent widespread flood events for risk modelling in the UK

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Within risk modelling, event 'footprints' are used to demonstrate how an extreme event impacts different locations at a similar time. Currently, estimates of future impacts from extreme events are derived by applying climate change allowances to at-site flood frequency estimates based on observations from the current period. These modified flow frequency estimates are then used to calculate flood risk and associated losses using a variety of means.

The present work brings together these two strands to develop spatially resolved projections of changes in river flow and, together with new analyses of the spatial coherence, to generate a wider collection of plausible events to improve risk modelling of the rarest events. This wide collection of extreme flood events provides the foundational input for an event-based assessment of risk.

The research extends proven methods to generate extreme, widespread flood events directly based on outputs from a 1km grid-based hydrological model driven by UKCP18 datasets. These modelled events provide coherent and highly credible descriptions of changes in flow based on spatially coherent climate change information. In addition to the small number of widespread extreme events generated directly from the gridded hydrological model, copula-based methods have been extended and applied on a regional and even national scale at a 1km resolution over the GB river network. These extensions to the Heffernan-Tawn model and Empirical Copula models are being used to generate a collection of plausible extreme based on the climate of 1980-2010 and on climate projections for 2050-2080. The collection of events is then used to compare the characteristics and variability of widespread events across different climate ensemble members and compare between present and future estimates.