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An integrated statistical and hydraulic modelling approach for collective flood risk assessment

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This paper presents a methodology for assessing collective flood risk based on a combination of two innovative models. The first is a multivariate statistical model for extremes of river flow or sea level, based on the conditional exceedance approach of Heffernan and Tawn (2004) and Keef et al (2009). This model is analogous to a generalised form of copula function in that it separates the joint distribution of a variable into its marginal characteristics and its dependence structure. The dependence structure is flexible in its description of the joint extremes, which has advantages for representing spatial dependence in data such as river flows. The second part of the methodology is a two-dimensional (2D) hydraulic floodplain inundation model that is applied using parallel processing technology to provide high resolution gridded flood depth data over large regions (Lamb et al., 2009). These depth grids can then be combined with a model for economic losses.

We present an overview of the methodology and demonstrate through simulation studies how it can be applied to estimate the distribution function of the spatially aggregated economic losses from flooding over regions up to the scale of England and Wales, or greater. The results are also placed in the context of hydrological assessment of the probability and severity of notable historical flood events experiences in the British Isles.

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