



## Modelling extreme precipitation fields for large scale flood insurance

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Assessment of both localised and widespread flooding is vital for flood insurance to ensure adequate financial protection for businesses and property owners alike. But modelling precipitation and catchment response on very large spatial scales remains a challenge because of the availability of data and the high dimensionality of the problem. Modelling flood risk for insurance requires spatially coherent estimation of extremes which go beyond the historical record. At the national and continental scale, it can be difficult to apply models which maintain both the dependence structure of the precipitation field and the marginal distributions which determine local impacts. Recent research into spatiotemporal random fields modelling is highly promising. Numerical weather prediction is also an attractive prospect because correlations are implicitly captured in physical processes, but the computational demand and the uncertainty of perturbed physics ensembles can limit its usefulness.

We introduce a data driven approach for widescale flood risk assessment based on modelling extreme precipitation fields. Using gridded reanalysis precipitation data, we identify extreme precipitation events in space and time using a measure of correlation in the tails of the marginal distributions. The simulation of extreme precipitation follows two main processes. First, the timing and extent of events are modelled using a Poisson distribution for event triggers, and a spatial Poisson process perturbs event footprints for observed events in the neighbourhood of the trigger location. The second stage is to model the extreme precipitation field within the event footprint. A Copula process is used to estimate extreme precipitation quantiles for all simulation points within the event ensuring internal spatial coherence. Our method has the flexibility to model extreme precipitation with any underlying physical conditions using computationally efficient models which facilitate widescale risk assessment.