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Modelling the tail behaviour of precipitation aggregates using conditional spatial extremes.

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Fluvial flooding is not caused by high intensity rainfall at a single location, rather it is caused by the extremes of precipitation events aggregated over spatial catchment areas. Accurate modelling of the tail behaviour of such events can help to mitigate the financial aspects associated with floods, especially if river defences are built within specification to withstand an n-year event of this kind. Within an extreme value analysis framework, univariate methods for estimating the size of these n-year events are well studied and cemented in asymptotic theory.

To complement these techniques, we develop a high-resolution spatial model for extreme precipitation by providing a fully spatial extension of the conditional approach for modelling multivariate extremes. We simulate realistic precipitation fields from this model and use univariate techniques to make inference about the extremal behaviour of aggregates over specified spatial domains. The challenge of zero precipitation data is overcome and further applications of the model are discussed. The model is fit to data from a convection permitting forecast model within the 2018 UK Climate Projections (UKCP18).