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Providing future UK heavy precipitation guidance for water management stakeholders using a convection-permitting climate model ensemble and a spatial extreme statistical model

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The UK Climate Projections (UKCP) provide the latest information on future climate change expected in the UK. The latest UKCP products include the first UK national climate scenarios at a resolution consistent with weather forecasting. In particular, they include projections from a 12-member 2.2km convection permitting climate model (CPM) ensemble, called UKCP Local (2.2km), released by the UK Met Office in September 2019. A key added value of CPMs is their improved representation of precipitation extremes, and as such the UKCP Local ensemble is particularly useful for water management stakeholders (water utilities and flood risk management professionals) for future adaptation in waste water and flood risk management. A key metric of interest is future increases (“uplifts”) of precipitation return levels. However, diagnosing precipitation return levels for such high-resolution model simulations is difficult due to their spatial-temporal variability and correlation. Here, we adapt an Exeter University-developed spatial extreme statistical model which incorporates the spatial-temporal variability and correlation of precipitation extreme, and apply it to daily and hourly precipitation data from the UKCP Local Ensemble for both the present-day and future RCP8.5 simulations. This allows us to provide robust estimates of uplifts for high return levels across all of the UK for months and seasons of interest.