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Improvements in early flood forecasting using a 1-hour gridded precipitation dataset to drive a hydrological model. A case study of the summer floods in the Upper Severn, UK

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Early flood warning systems usually consist of rainfall-runoff models that are run operationally on a 6-hour timestep, which is the typical resolution of the forecast. However, the hydrological forecast model is often calibrated using daily data, since this is the most abundant data source. There is potential for substantial improvements in model performance and initial conditions if the hydrological model is run by hourly rather than daily precipitation input in the set-up and initialisation of the model. In this study, gridded hourly 1-km gridded precipitation datasets for a meso-scale catchment (4,062 km2) of the Upper Severn River, UK were constructed using different methods. The methods included precipitation created entirely from rainfall radar data, using rainfall radar data to disaggregate a daily precipitation dataset from rain gauge readings, redistributing daily rainfall data using information from hourly station, and temporal redistribution of daily data. When assessed against gauge readings and as input to a hydrological model, the rain gauge/radar disaggregated dataset performed the best suggesting that using information from rainfall radar data can improve hydrological forecast and therefore also improve early flood warning systems.