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Predicting precipitation growth and decay with weather radar rainfall measurements

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Recently, weather radar has been increasingly used to estimate precipitation for a variety of hydrological and meteorological applications, including real-time flood forecasting, severe weather monitoring and warning, and short-term precipitation forecasting. In very short range (0–6 h), many critical decisions are taken to ensure people's safety. For example, the damage of a localized hazard of flood is high so that the warning of these severe weather is important. Forecasting precipitation in this time range the commonly relies on extrapolation-based nowcasting tools that exploit the persistence of the most recent weather radar observations. To obtain the best possible prediction skill in the 0–6-h range, one cannot solely rely on numerical weather prediction (NWP) but must also use the available observations in a more direct way. Weather radars are instruments capable to provide rainfall measurements with suitable spatial and temporal resolutions. The potential benefit of using radar rainfall in hydrology is huge, but practical hydrological applications of radar have been limited by the inherent uncertainties and errors in radar rainfall estimates. As radar nowcasts are essentially based on extrapolation from a series of consecutive radar scans, they are characterized by a high skill at the start of the forecast, but this decreases with lead time very rapidly, as extrapolation techniques generally do not account for growth and decay processes in the atmosphere (Golding 1998).

Machine learning algorithms can be trained with weather radar data to identify regions of precipitation growth and decay based on historical observations. Artificial neural networks (ANN) can be employed to learn the complex nonlinear dependence relating the growth and decay to the predictors, which are geographical location, motion vectors, temperature, precipitation and time (Foresti et al.2019). The precipitation motion field can be calculated by using the optical flow driven by weather radar data. Around 15-year of weather radar precipitation observations from Great Britain (GB) are used to derive precipitation growth and decay mainly due to orography. This paper will present the preliminary findings of predicting precipitation growth and decay in different regions in the UK.