Abstract

Weather radars offer hydro-meteorological observations at a high spatial and temporal resolution. Despite research over the past 70 years these observations still suffer from uncertainty which hinders their use for hydrological modelling, where rain gauge observations are preferred (Villarini and Krajewski 2010). Two recent developments in weather radar are the upgrade of observational radar networks to dual polarisation and the use of uncertainty ensembles. This work applies the REAL ensemble technique developed by Germann et al. (2009) to a small urban catchment (Blackburn Brook, 4 km²), located on the periphery of Sheffield, as a precursor to research into combining the two techniques. This initial research enables the methodology to be shaped to the data available in the UK prior to the use of dual polarisation data from the CONvective Precipitation Experiment (COPE), measurements from the Burn mobile radar site and UKMO/EA radar network.

METHODOLOGY

The ensembles were developed using the REAL technique of Germann et al. (2009), with the following modifications to improve the applicability to the study area.

1. Applying a low pass filter to transform the error distribution to an ideal Gaussian distribution, set using objective skill scores. (Figure 1)
2. Bootstrapping a sample of ensembles to determine the optimum number required for representativeness. (Figure 2)

The ensemble deltas were then interpolated across the study area using a radial basis function, and used as input to a PDM rainfall-runoff model of the catchment.

HYDROLOGICAL MODELLING

The PDM developed by Moore (2007), is a lumped catchment model with a limited parameter set, operationally used by the EA for flood forecasting. Our model was calibrated using 6 months of river level data supplied by the EA, using rain gauge input from Harley and Cannon Hall rain gauges. Radar data will be used alongside rain gauge data for future calibrations, to determine the influence of data choice on calibration parameters.

CONCLUSION

Application of statistical ensembles to radar QPE provides a clear indication of the uncertainty they contain, but only by representation of the statistically normal deviation from rain gauge observations.

This data will be used to model the contrasting Inny Catchment in Cornwall, which drains 105 km² of upland agricultural land. Further data will be obtained from the Burn site, to model the Blackburn Brook using dual polarisation data.

Previously seasonal parameter sets have been used for ensembles, with some success, but we believe dual polarisation provides observational data on which to build a robust set of parameters for ensembles in different synoptic conditions.

References