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Exploring the probabilistic performance of an operational, distributed hydrological model driven by high-resolution rainfall forecast ensembles

R. J. Moore (1), C. Pierce (2), S.J. Cole (1), M. Mittermaier (2), and A. Wynn (3)

(1) Centre for Ecology & Hydrology, Wallingford, OX10 8BB, UK (rm@ceh.ac.uk), (2) Met Office, FitzRoy Road, Exeter, EX1 3PB, UK (clive.pierce@metoffice.gov.uk), (3) Flood Forecasting Centre, Met Office, FitzRoy Road, Exeter, EX1 3PB, UK (adrian.wynn@environment-agency.gov.uk)

Significant advances in operational precipitation and hydrological forecasting capabilities have been made in the UK over the past few years. From 2010, 1 km configurations of a physical-conceptual distributed hydrological model - known as G2G (or Grid-to-Grid) and developed by the Centre for Ecology & Hydrology - were introduced into operational centres responsible for flood forecasting and warning across England, Wales and Scotland. G2G is formulated to represent the spatial variability in river flow response to rainfall and to make full use of gridded rainfall data as input. These data derive from both weather radar and raingauge observation networks and from deterministic and ensemble nowcasts and Numerical Weather Prediction forecasts produced by the Met Office.

In 2012, an ∼2km, convection-permitting, short-range, ensemble configuration of the Met Office Global and Regional Ensemble Prediction System, known as MOGREPS-UK, was implemented. Nested within an ∼33 km global configuration of MOGREPS, MOGREPS-UK is currently run four times daily out to 36 hours as a downscale ensemble of 12 members. Through its superior representation of the processes governing the evolution of heavy rainfall and the quantification of associated forecast uncertainties, this system offers the prospect of a step change in short-range, operational flood forecasting and warning capabilities.

This paper explores the performance of both rainfall and river flow ensembles using a selection of case study storm events involving heavy convective rainfall over catchments with rapid response flood characteristics. The potential benefits to operational flood forecasting and warning of propagating uncertainties in high-resolution precipitation forecasts through a distributed hydrological model are demonstrated.