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A high resolution grid-based river flow model for use with Regional Climate Model output

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A spatially-distributed hydrological runoff-production and routing scheme has been developed for use with gridded Regional Climate Model (RCM) precipitation and atmospheric data. The new model is configured spatially using river networks and terrain information derived from a digital terrain model (DTM). The scheme provides a simple modelling framework which can translate climate model estimates of current or future scenarios of rainfall (and potential evaporation) into estimated river flow at a daily or sub-daily time-step.

The new model, called the "Grid-to-Grid Model" or G2G, can be configured to, and provides estimates of river flow for, grids of different resolution and coverage. A 1 km grid over the UK is used here. The model can simulate flow on both a catchment and areawide (regional) basis, as well as providing estimates of fluvial discharges for input to shelf-sea and ocean models.

Configuration of the model on a relatively high resolution 1 km grid allows simulated river flows to be compared to gauged observations for a variety of catchments across the UK. Modelled flows have also been compared to those obtained from a catchment-based model: a parameter-generalised form of the Probability-Distributed Model (PDM) developed for assessing flood frequency. G2G model performance has been assessed for 25 catchments across the UK using two sources of rainfall data: (i) RCM output and (ii) gridded raingauge observations. Results indicate that it performs well in comparison with measured flows at a daily time-step, particularly for high relief catchments. Performance is worst for low-relief and groundwater-dominated regions where control on runoff production is less dominated by topography.