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Use of a grid-based hydrological model with a snowmelt component to estimate spatial variation in changing flood risk across the UK

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A grid-based flow routing and runoff-production model, the Grid-to-Grid or G2G, configured to employ as input either observed or Regional Climate Model (RCM) estimates of precipitation and potential evaporation (PE), has previously been used to assess how climate change may impact river flows on a 1km grid across the UK (Bell et al., 2009, JoH). A high degree of spatial variability was seen in the estimated change in river flows, reflecting both projected climate change and the influence of landscape and climate variability. Most of the areas of high projected increases in peak flows were located in Northern Britain where the lack of an explicit snowmelt model in the original G2G model may have led to some underestimation of flow peaks in the current period (1960-1990). This may have exaggerated the potential change in future flows as snowmelt events are expected to be less influential in a future warmer climate.

To assess the impact of snowmelt-related flood events on estimated changes in peak flows under a projected warmer future climate, the model has been enhanced to employ a temperature-dependent snowmelt component shown to be effective under UK conditions where changes in temperature exert an important control on snowmelt. Here we present a historical assessment of the performance of the snowmelt-enhanced G2G model using observation-based estimates of precipitation and PE. The influence of snowmelt-induced high flow events on projected changes in peak flows across the UK is assessed using an ensemble of UKCP09 RCMs.