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The Generation of Downwind Rainbands by Mountains

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In this study we investigate rainbands that form downwind of mountainous terrain using both observational data and output from an operational forecast model. Although relatively small in scale (a few tens of km across by up to ∼100 km in length), these often poorly forecast bands can cause localised flooding as they can be associated with intense precipitation over several hours due to the anchoring effect of orography.

A case study is performed of a rainband that was observed over Scotland on the 29 December 2012. This case study was chosen due to the occurrence of heavy continuous precipitation near orography. Radar images during the event showed a clear band along The Great Glen Fault, a deep valley between the Northern Highlands and the Grampian Mountains. The deterministic convection-permitting high-resolution Met Office model forecast, using the United Kingdom Variable resolution (UKV) model (1.5 km horizontal grid spacing), failed to represent this band. However, some members of the ensemble convection-permitting (MOGREPS-UK) Met Office forecast produced a similar band to that observed. Localised convergence and weak convective available potential energy (CAPE) along the fault supported the formation of the valley band.

To determine the effect of model resolution on the model's representation of the rainband, a forecast was performed with the horizontal grid spacing decreased to 500 m. In this forecast a rainband formed in the correct location which generated precipitation accumulations close to those observed, but with a time displacement. Work is in progress to assess the robustness of this forecast skill improvement by embedding simulations at the same resolution within the operational global (MOGREPS-G) ensemble members. Results to date suggest that accurate representation of mesoscale rainbands requires model resolutions higher than those used operationally by national weather centres.