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Ensemble predictability of stationary convective orographic rainbands in the UK

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Stationary convective bands are associated with high rain rates and can cause significant damage if they form over a region prone to flash flooding. Mountainous regions can initiate such stationary bands and are also particularly prone to flash flooding due to the terrain (e.g. steep sided valleys). The impact of the terrain could make these events more predictable than non-orographically forced convection. To understand the mechanisms involved and the predictability of the bands, a convection-permitting ensemble of the UK Met Office Unified Model is used to study a number of real cases.

The 1.5km grid-length ensemble is used to determine the required ingredients that lead to the heavy, persistent rain. This allows us to establish the importance of both synoptic scale flow and mesoscale features in each case. In our first case study, we find that the precise details of the large-scale pressure pattern are important in controlling the wind upstream of the band and its flow around the terrain. Additionally the local temperature and humidity are important in governing where the convection is and is not initiated. Despite the predictable changes to the flow as it encounters terrain, the band itself is relatively unpredictable. The location and stationarity of the band are critically dependent on the upstream flow conditions such that subtle changes in either the synoptic or mesoscale pattern disrupt the stationary band.

In addition to the first case study, generalized results from analysis of numerous cases over the UK will be presented, identifying the differing mechanisms of each case. The flow regimes that produce bands most predictably will be identified and methods for forecasting when intense rainfall will be tied to orography will be discussed.