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Improvements in the spread-skill relationship of precipitation in a convective-scale ensemble through blending

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Convective-scale ensembles are routinely used in operational centres around the world to produce probabilistic precipitation forecasts, but a lack of spread between members is providing forecasts that are frequently overconfident. This deficiency can be corrected by increasing spread, increasing forecast accuracy or both. A recent development in the Met Office forecasting system is the inclusion of Large-Scale Blending (LSB) in the convective-scale data assimilation scheme. This method aims to reduce the synoptic-scale forecast error in the analysis by reducing the influence of the convective-scale data assimilation at scales that are too large to be constrained by the limited domain. These scales are instead initialised using output from the global data assimilation scheme, which we expect to reduce the forecast error and, thus, improve the spread-skill relationship. In this study, we have quantified the impact of LSB on the spread-skill relationship of hourly precipitation accumulations by comparing forecast ensembles with and without LSB over a 17-day summer trial period. This trial found modest but significant improvements to the spread-skill relationship as calculated using metrics based on the Fractions Skill Score. Skill is improved for a lower precipitation centile by an average of 0.56% at the largest scales, but a corresponding degradation of spread limits the overall correction. The spread-skill disparity is reduced the most in the higher centiles due to a more muted spread response, with significant reductions of up to 0.40% obtained at larger scales. Case study analysis using a novel extension of the Localised Fractions Skill Score demonstrates how spread-skill improvements transfer to smaller-scale features, not just the scales that have been blended. There are promising signs that further spread-skill improvements can be made by implementing LSB more fully within the ensemble.