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Study on initial perturbation construction method for regional ensemble forecast based on dynamical downscaling

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Using Global Ensemble Forecasts(GEFS) data, a regional ensemble forecast system based on WRF model is constructed, two initialization strategy are tested, one is direct dynamical downscaling of GEFS initial states(namely DOWN ensemble), the other is overlaying the downscaled initial perturbations of GEFS onto the analysis of high resolution regional numerical weather prediction (NWP) system, which is called Beijing Rapid Update Cycle(BJ-RUC) system, to form the initial states of regional ensemble(namely D-RUC ensemble). Using the two methods, a series of ensemble forecast tests are conducted, and the results shows that: the small scale components of D-RUC perturbations grow more rapid than those of DOWN perturbations. For short term forecast, the DOWN perturbations tend to underestimate the forecast error while the D-RUC perturbation tend to identify where the forecast error is large from where the forecast error is small. Ensemble forecast verification shows that the D-RUC ensemble has larger spread and smaller root mean square error than DOWN ensemble at short forecast lead time, while the probabilistic scores of D-RUC are also better for short term forecast. Typical precipitation case study shows that D-RUC ensemble can provide better probabilistic precipitation forecast than DOWN ensemble.