6A.3 A limited-area dual-resolution hybrid variational-ensemble data assimilation system for the WRF model

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Dual-resolution (DR) hybrid variational-ensemble analysis capability was implemented within the community Weather Research and Forecasting (WRF) model data assimilation (DA) system. The DR hybrid system combines a high-resolution (HR) background, flow-dependent background error covariances (BECs) derived from a low-resolution (LR) ensemble, and observations to produce a deterministic HR analysis. As DR systems do not require a HR ensemble, they are computationally cheaper than a single-resolution (SR) hybrid configuration, where both the background and ensemble have equal resolutions.

The DR hybrid system was evaluated in a continuously cycling framework, where a new DR hybrid analysis was produced every 6-hrs over a ~3.5 week period. In our DR configuration, the deterministic backgrounds and analyses had 15-km horizontal grid spacing, but the 32-member WRF-based ensemble providing flow-dependent BECs for the hybrid had 45-km horizontal grid spacing. The DR hybrid analyses initialized 72-hr WRF model forecasts that were compared to forecasts initialized by a SR hybrid system where both the ensemble and background had 15-km horizontal grid spacing. The SR and DR hybrid systems were coupled to an ensemble adjustment Kalman filter (EAKF) that updated the ensembles each DA cycle.

On average, forecasts initialized from 15-km DR hybrid analyses performed similarly as those initialized by 15-km SR hybrid analyses. These results suggest that using LR ensemble BECs in combination with a HR background is justifiable, which permits considerable computational savings. In addition to describing these results, practical aspects of configuring DR WRFDA analysis/forecast systems will be discussed.