A regional GSI-based EnKF system for the Rapid Refresh configuration: Tests for Satellite Radiance Observation

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A regional ensemble Kalman filter data assimilation (EnKF) system based on the NCEP operational Grid-point Statistical Interpolation (GSI) system has been established for the target Rapid Refresh (RAP) applications. The EnKF system borrows the data processing and observation operators from the GSI system, and pre-calculates observation priors using the GSI. The filter is based on the serial ensemble square-root Kalman filter (EnSRF) and updates both the state vector and observation priors and its distributed memory parallelization is carried out at the state vector level.

In this study, the impact of satellite radiance including AMSU, AIRS, MHS and HIRS within the established EnKF-RAP framework was examined. Testing is performed at the ∼40 km grid spacing, and its performance is compared to the GSI system which uses three dimensional variation method. The performance is evaluated in terms of short-range (up to 18 hours) forecast errors verified again soundings. The assimilation of AMSU-A data improved the forecast accuracy for all the verified variables especially for the wind components; the assimilation of AIRS data greatly improved the forecast accuracy of relative humidity; when all the radiance data were assimilated, the forecast is the best. The forecast started from EnKF analysis is consistently better than from GSI analysis though the relative improvement is smaller than GSI. In additional, the configurations like bias correction and thinning for radiance assimilation within ENKF-RAP will be presented and discussed.