5B.6 Comparison of 3DVAR, EnKF, and hybrid data assimilation techniques for aerosol analyses and forecasts

Liu, Zhiquan, Craig Schwartz, and Hui-chuan Lin, *National Center for Atmospheric Research*

Total 550 nm aerosol optical depth, surface fine particulate matter (PM2.5), and meteorological observations were assimilated with continuously cycling three-dimensional variational (3DVAR), ensemble square root Kalman filter (EnSRF), and hybrid variational-ensemble data assimilation systems. The hybrid system's background error covariances (BECs) were a blend of those in 3DVAR and produced by the cycling EnSRF system, and the 3DVAR, EnSRF, and hybrid systems differed almost exclusively by their BECs. New analyses were produced every 6 h between 0000 UTC 1 June and 1800 UTC 14 July 2010 over a domain encompassing the contiguous United States (CONUS) and adjacent areas. Additionally, a control experiment that only assimilated meteorological observations was performed. Each 1800 UTC analysis initialized a 48 h Weather Research and Forecasting with Chemistry model forecast. These forecasts were evaluated with a focus on air quality prediction. The ensemble aerosol spread was generally insufficient, particularly over the western CONUS. However, despite the suboptimal ensemble spread, the hybrid system performed quite well and usually produced the best aerosol forecasts. Additionally, both the 3DVAR- and EnSRF-initialized forecasts typically outperformed the control. These results are encouraging and suggest the resiliency of the hybrid method. Improved aerosol ensembles should translate into even better future hybrid forecasts.