Experiments with a continuously cycling 3-km ensemble Kalman filter over the entire conterminous United States for convection-allowing ensemble initialization

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Abstract

Using the Weather Research and Forecasting model, 80-member ensemble Kalman filter (EnKF) analyses with 3-km horizontal grid spacing were produced over the entire conterminous United States (CONUS) for 4 weeks using 1-h continuous cycling. For comparison, similarly-configured 15-km EnKF analyses were also produced. The EnKF analyses initialized 36-h, 3-km, 10-member convection-allowing ensemble forecasts. Additionally, forecasts were initialized from operational Global Ensemble Forecast System (GEFS) initial conditions (ICs) and experimental "blended" ICs produced by combining large scales from GEFS ICs with small scales from EnKF analyses using a low-pass filter.

Precipitation forecasts initialized from 3-km EnKF analyses were better than those initialized from downscaled GEFS and 15-km EnKF ICs through 12–18 and 6–12 h, respectively. Conversely, after 18 h, GEFS-initialized precipitation forecasts were better than EnKF-initialized precipitation forecasts. Blended 3-km ICs reflected the respective strengths of both GEFS and high-resolution EnKF ICs and yielded the best overall performance: blended 3-km ICs led to short-term forecasts with similar or better skill and reliability than those initialized from unblended 3-km EnKF analyses and 18–36-h forecasts possessing comparable quality as GEFS-initialized forecasts.

In addition to describing these results, this presentation will discuss challenges that were overcome to produce the 3-km EnKF analyses; this work likely represents the first time a convection-allowing EnKF has been continuously cycled over a region as large as the entire CONUS. Furthermore, sensitivity studies regarding assimilation of radar observations will be briefly described.

Keywords: high, resolution, EnKF, convection, allowing data assimilation

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