Reduced non-Gaussianity by 30-second rapid update in convective-scale numerical weather prediction

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Abstract

Non-Gaussian forecast error is a challenge for ensemble-based data assimilation (DA), particularly for more nonlinear convective dynamics. This study investigates the degree of non-Gaussianity of forecast error distributions at 1-km resolution using a 1000-member ensemble Kalman filter, and how it is affected by the DA update frequency and observation number. Regional numerical weather prediction experiments are performed with the SCALE (Scalable Computing for Advanced Library and Environment) model and the LETKF (Local Ensemble Transform Kalman Filter) assimilating every-30-second phased array radar observations. The results show that non-Gaussianity develops rapidly within convective clouds and is sensitive to the DA frequency and the number of assimilated observations. The non-Gaussianity is reduced by up to 40% when the assimilation window is shortened from 5 minutes to 30 seconds, particularly for vertical velocity and radar reflectivity. Also, short-range forecasts confirm the beneficial impact of reducing the length of the assimilation window to assimilate phased-array radar observations.

Keywords: non, gaussianity, rapid, update, mesoscale data assimilation

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