國立中央大學大氣物理研究所書報討論

Date : 2023/11/04
Location : S1-713
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Reduced non-Gaussianity by 30s rapid update in convective-scale numerical weather prediction

ABSTRACT

Non-Gaussian forecast error is a challenge for ensemble-based data assimilation, especially for those nonlinear convective dynamics, such as mesoscale or small-scale weather systems. That is because a lot of assumptions used to derive the formula are based on Gaussian distribution. If the observation or background what we use is not like Gaussian distribution, then it will produce some problems. As a result, the author used a 1000-member ensemble Kalman filter with the 1 km resolution to investigate the degree of the non-Gaussianity of forecast error distribution. Using different DA frequencies and the observation number to examine how non-Gaussianity is affected.

In this study, the author used SCALE (Scalable Computing for Advanced Library and Environment) model to do regional numerical weather forecasting and used the LETKF (Local Ensemble Transform Kalman Filter) to assimilate phased array radar observation data with different DA frequencies. This study shows some results. Firstly, that experiments with longer windows show more KLD growth during the forecast step and a large reduction at the analysis step. Another is that non-Gaussianity will rapidly grow up in the convective clouds and shallow convective. Least but not least, as the assimilation frequency increased, non-Gaussianity can be reduced by up to 40%.

Keyword

Kullback-Leibler divergence (KLD)
Local Ensemble Transform Kalman Filter (LETKF)

Reference

Ruiz, J., Lien, G. Y., Kondo, K., Otsuka, S., & Miyoshi, T. (2021). Reduced non-Gaussianity by 30 s rapid update in convective-scale numerical weather prediction. *Nonlinear Processes in Geophysics, 28*(4), 615-626.