Assimilating Conventional Observations for the Global Atmospheric Model SL-AV with Local Ensemble Transform Kalman Filter

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The presentation concerns implementation of the Local Ensemble Transform Kalman Filter scheme [1] to the global numerical weather prediction model SL-AV [2], operational in Russia. SL-AV is a semi-Lagrangian global atmospheric model that uses semi-implicit finite-difference dynamical core of own development and parameterizations from ALADIN/LACE model. The experiments are carried out with the 0.9x0.72 degrees, 28 vertical sigma-levels model version.

The localization is done in the observation space, using different localization distances for different variables and different vertical levels. We use multiplicative and additive inflation to account for model error and the finite ensemble size. For additive inflation, a random noise is added at every analysis step to every ensemble member. Additive inflation fields are isotropic for every variable, use different predefined length-scales and amplitudes for different variables (the implementation also allows them to differ in vertical).

We present the results of assimilation of conventional observations (ground stations, radiosondes, aircraft reports and atmospheric motion vectors subset), comparing different configurations of the assimilation system. Overall, the ensemble filter has shown stable behavior during 3 months experiment. The implemented analysis efficiently reduces first guess root mean square errors and removes first guess biases. The root mean square error values for temperature and wind are close to that for the LETKF assimilation system for the NCEP global model using conventional observations, presented in [3]. The ensemble distribution is close to Gaussian (based on the third and fourth central distribution moments).

References

[1] B. R. Hunt, E. J. Kostelich and I. Szunyogh. "Efficient data assimilation for spatiotemporal chaos: A local ensemble transform Kalman Filter," *Physica D: Nonlinear Phenomena,* vol. 230, pp. 112-126, 2007.

[2] M.A. Tolstykh. "Variable resolution global semi-Lagrangian atmospheric model," *Russian J. Num. An. & Math. Mod.*, vol. 18, no. 4, pp. 347-361, 2003.

[3] I. Szunyogh, E. J. Kostelich, G. Gyarmati, E. Kalnay, B. R. Hunt, E. Ott, E. Satterfield and J. A. Yorke. "A local ensemble transform Kalman filter data assimilation system for the NCEP global model," *Tellus A*, vol. 60A, pp. 113-130, 2007.