Application of the time-lagged ensemble approach to the NCEP FV3GFS based new generation global weather prediction system at CWB

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Abstract

The Gridpoint Statistical Interpolation (GSI) data assimilation package developed by the National Center for Environmental Forecasting (NCEP) was introduced to the Central Weather Bureau (CWB) for its operational global weather prediction with the CWB Global Forecast System (CWBGFS) in 2010. The data assimilation of CWBGFS is configured using the hybrid 3DEnVar with only 36 EnKF members. This relatively small ensemble size may cause significant sampling errors typically characterized by the remote spurious covariances. Instead of direct increase of the ensemble size in the EnKF system that requires a substantial increase in computational cost, the time-lagged ensemble is a computationally cheaper approach to achieve a larger ensemble: it combines the ensemble forecasts of different lengths, valid at the same analysis time, to provide the flow-dependent background error covariance for the hybrid EnVar data assimilation.

In the current operational CWBGFS, the time-lagged ensemble approach has been employed, combining the 6-h forecasts from the previous cycle and the 12-h forecasts from the second previous cycle to effectively double the ensemble size from 36 to 72 members. A previous study has shown that this implementation improves the quality of the ensemble error covariances and practically leads to an improved forecast performance of the hybrid 3DEnVar. Since CWB has worked on developing a new global weather prediction system based on the NCEP's new finite-volume cubed-sphere model, FV3GFS, it is desirable to investigate whether our experience on the time-lagged ensemble approach can be transferred to the FV3GFS-based system. For this purpose, the same technique is implemented to the FV3GFS system, and a test experiment applying the time-lagged ensemble to increase the ensemble size from 32 to 64 members is conducted. Preliminary results show similar effects by the time-lagged ensemble approach to improve the ensemble error covariances, while the impact to the forecast performance of the hybrid data assimilation has been mixed; therefore, a more detailed examination is needed to determine whether this approach will be used in the operational run of the FV3GFS system at CWB.