Ensemble-based Atmospheric Reanalysis using a Global Coupled Atmosphere-Ocean GCM

*Nobumasa Komori[1], Takeshi Enomoto[1,2], Takemasa Miyoshi[1,3], Akira Yamazaki[1], Akira Kuwano-Yoshida[1,2], Bunmei Taguchi[1,4]

1. Japan Agency for Marine-Earth Science and Technology, 2. Disaster Prevention Research Institute, Kyoto University, 3. RIKEN Advanced Institute for Computational Science, 4. Research Center for Advanced Science and Technology, The University of Tokyo

Ensemble-based atmospheric data assimilation systems are sometimes afflicted with an underestimation of the ensemble spread near the surface caused by the use of identical boundary condition for all ensemble members and the lack of atmosphere-ocean interaction. To enhance the capability of the local ensemble transform Kalman filter (LETKF) with the Atmospheric GCM for the Earth Simulator (AFES), a new system has been developed by replacing AFES with the Coupled atmosphere-ocean GCM for the Earth Simulator (CFES). Two months of a retrospective analysis-forecast cycle with the coupled system (CLERA-A) from 1 August 2008 has been completed successfully, assimilating atmospheric observational data (the NCEP PREPBUFR archived at the UCAR) every 6 hours to update the atmospheric variables, whereas the oceanic variables are subject to no direct data assimilation. Although SST in CLERA-A suffers from the common biases among many coupled GCMs, the ensemble spreads of air temperature and specific humidity in the lower troposphere are larger in CLERA-A than in ALERA2. Therefore, the replacement of AFES with CFES successfully contributes to mitigate an underestimation of the ensemble spread near the surface. In addition, the basin-scale structure of surface atmospheric variables over the tropical Pacific is reconstructed from the ensemble-based correlation in CLERA-A but not in ALERA2. This suggests the importance of using a coupled GCM rather than an atmospheric GCM even for atmospheric reanalysis with an ensemble-based data assimilation system.

Keywords: ensemble-based data assimilation, atmospheric reanalysis, coupled atmosphere-ocean GCM

©2018. Japan Geoscience Union. All Right Reserved.