

Advances and Challenges in Ensemble Data Assimilation

Dr. Takemasa Miyoshi (University of Maryland)

Ensemble data assimilation (EnDA) is a rapidly growing field mainly due to its potential and its relative ease of implementation. EnDA with geophysical systems has inevitable imperfections: a limited ensemble size, nonlinearities, non-Gaussianities, model errors, and observation bias. These limitations could cause an unstable data assimilation cycle, eventually leading to filter divergence, a failure of data assimilation. Among many possible treatments such as model and observation bias correction, studies have shown that error covariance inflation and localization played an important role in dealing with those issues and stabilizing the filter. Advancing the inflation and localization methods is a key to improving EnDA performances. One of the foci of this presentation is the Gaussian approach to adaptive inflation, inspired by Li et al. and Anderson, which takes information from observations to estimate temporally and spatially varying covariance inflation parameters. The method has been implemented with the Local Ensemble Transform Kalman Filter (LETKF) and has shown success with broad applications ranging from a toy model to real-world NWP models, and even with a Martian atmospheric model. Another key to improving EnDA is to seek more effective use of observations. Liu and Kalnay proposed a sensitivity analysis method to quantify how helpful or harmful each observation is within an EnDA framework. This ensemble sensitivity method has been applied for the first time to real observations using the LETKF system with the WRF model. The impact of T-PARC/TCS-08 dropsonde observations for Typhoon Sinlaku (2008) was investigated.