A Fast Flow Adaptive Error Covariance Estimation Scheme and Application

Christian L. Keppenne
NASA GMAO

Guillaume Vernieres, Robin M. Kovach and Michele M. Rienecker
NASA GMAO

A method to estimate background error covariances for data assimilation from the spatial distribution of variables in a single model state vector is introduced. The algorithm, henceforth referred to as system-state adaptive flow estimation (SAFE), shares flow adaptive properties with ensemble Kalman filters (EnKFs), but it is faster and less demanding because it estimates all the necessary covariance information from a single state vector rather than from an ensemble of model trajectories.

The methodology is demonstrated by applying it to assimilate ocean temperature profiles from Argo floats and validating the analysis against independent in situ temperature and salt data from Argo, TAO, XBT, CTD, PIRATA and RAMA. The results show that SAFE explains a larger fraction of the observation-minus-forecast error variance of non-assimilated data than a conventional optimal interpolation algorithm. SAFE also compares favorably with the ensemble optimal interpolation (EnOI) used to produce the NASA Global Modeling and Assimilation Office (GMAO) ocean analysis, while being considerably faster than EnOI.

Corresponding Author:

Name: Christian Keppenne
Affiliation: NASA Global Modeling and Assimilation Office
Address: Mail Code 610.1
NASA Goddard Space Flight Center
Greenbelt, MD, 20771
USA