

A Hybrid Variational-Ensemble data assimilation scheme with systematic error correction for limited area ocean models

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A hybrid variational-ensemble data assimilation scheme to estimate the vertical and horizontal components of the background-error covariance matrix for an ocean variational data assimilation system is presented and tested in a limited area ocean model. The high resolution limited area model is implemented in the western Mediterranean Sea where an extensive dataset has been collected during the Recognized Environmental Picture Experiments (REP14-MED) conducted in June 2014 by the Centre for Maritime Research and Experimentation with several partners. Observational data is used for assimilation and validation purposes. The hybrid scheme is used both to correct the systematic error introduced in the system from the external forcing (initialization, lateral and surface open boundary conditions) and model parameterization and to improve the representation of small scale errors in the background error covariance matrix. A 14-members ensemble system generated through perturbation of assimilated observations is run off-line for further use in the hybrid scheme. Results of four different experiments are compared. The reference experiment uses the classical stationary formulation of the background error covariance matrix and has no systematic error correction. The other three experiments account, or not, for systematic error correction and hybrid background error covariance matrix combining the static and the ensemble derived errors of the day. Results show that the hybrid scheme when used in conjunction with the systematic error correction reduces the mean absolute error of temperature and salinity misfit by 55% and 42% respectively versus statistics arising from standard climatological covariances without systematic error correction.