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# Estimating background-error covariances for variational ocean data assimilation using an ensemble method

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Ensemble methods provide an attractive way to estimate the background error covariances of the control variables in a statistical data assimilation system. In this presentation we describe an ensemble method that has been developed for a variational data assimilation system for a global ocean version of the OPA model. Ensembles of ocean analyses and forecasts are generated by perturbing the surface forcing fields (windstress, fresh water fluxes, sea surface temperature) and the observations (temperature and salinity profiles) used in the assimilation process. The perturbations for the surface forcing fields are constructed from differences between different forcing products, while the perturbations for the observations are specified to have statistical properties consistent with the observation error covariance matrix used in the assimilation system.

The ocean forecast ensembles are used to verify existing assumptions in the background error covariance model such as those underlying the multivariate formulation of the model in which analytical balance relationships are used to decorrelate the model state variables. The ensembles also provide an objective means to calibrate geographically-dependent parameters of the covariance model, such as the background error variances and directional length scales of the background error correlation model. Both static and adaptive (flow-dependent) calibration procedures are being considered and will be discussed. Cycled 3D-Var experiments are currently being performed to test the impact of using the ensemble to update the background eror variances on each cycle. Initial results from these experiments show an overall reduction in forecast error compared to experiments using a conventional, parameterized form for the variances. Results from these experiments will be discussed.