28*th* IUGG Conference on Mathematical Geophysics, June 7-11, 2010, Pisa, Italy
Session 8: Data assimilation and model validation

Modelling global ocean background-error covariances via ensemble simulations for use in reanalysis system

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Keywords: *3DVAR; model error*

Variational assimilation techniques for use within global ocean reanalysis systems require the estimation of background-error covariances. In order to simulate the true error evolution in the assimilation and forecast step of our global ocean analysis system, we performed ensemble variational assimilation by adding independent random Gaussian perturbations to the entire observation vector - formed of in-situ and space-borne observations - multiplied by the observational error covariance matrix. Additionally, we perturbed surface forcing as well (wind stress and sea-surface temperature) and introduced an auto-correlated multi-variate perturbation in the non-advective terms of the state parameters tendencies along with the ocean model integrations. The ensemble size consisted of 6 members and covered the period from 1993 to 2005. This strategy allowed us to depict the horizontal and vertical distribution of model error variances and horizontal correlation length-scale, for temperature and salinity apart. The background-error covariances structure showed evidence of i) the need of separately accounting for temperature and salinity error horizontal correlations, as the former primarily respond to the mesoscale dynamics while the latter to the fresh water budget (e.g. increase of error variances are found in correspondence of river mouths, etc.); ii) the need of accounting for seasonal variations within the background-errror vertical covariances; iii) the need of allowing anisotropic correlation length-scale in the Tropical belt, whereas the zonal horizontal correlation scales are found constantly longer. We used these results to further model the background-error covariances within our deterministic analysis system: vertical background-error covariances are modelled from monthly bivariate EOFs of temperature and salinity computed from the ensemble error dataset at native ensemble simulation resolution. Horizontal correlations are obtained from a four-iteration application of a recursive filter, whose coefficients allow for locally smoothed, seasonal and vertical variations of the correlation radius, further to increased zonal correlation length-scales in the Tropical region. Preliminary results prove that the analysis system is benefited by the new background-error formulation in terms of verification skill scores.