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On an Adaptive Ensemble based filtering for SSH Data Assimilation in Micom model

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Defining the gain is a key problem in application of filtering technique for data assimilation in meteorology and oceanography. Due to insurmountable difficulties related to very high dimensions of the system state and uncertainties in modelling model error, simple sequentiel algorithms like OI schemes are widely used in comparison with other advanced methods (Kalman filter ...) because of its less time consuming and less computer memory. The performance of the OI scheme depends essentially on specification of the forecast error covariance matrice (ECM)(or background covariance matrice). Usually the ECM is chosen a-priori as a constant matrice. Ensemble based filtering approach is aimed at modelling the forecast errors for state estimate by integrating the numerical model from an ensemble of perturbed states and use them to approximate the ECM. The question on what kind of perturbations should be selected is of first importance since it allows to extract maximally the information on forecast errors. This question will be addressed in this talk in the context of SSH data assimilation for oceanic models. The experiments will be performed in the oceanic MICOM model to illustrate the efficiency of different types of perturbations. It will be shown that the procedure of modelling forecast errors proposed in this paper is quite similar to that done in the construction of breeding modes.

The filter gain can be derived:

(i) either by using only the forecast perturbations derived from integration of the numerical model alone (without using the observations). The filter with the gain obtained in this way (it is in some sense an OI algorithm) will be applied after to assimilate the observations;

(ii) or by integrating the model from a set of pertubed analysis states and evolving the gain during the assimilation process. As illustration, the performance of the ensemble filter (and its adaptive version) will be compared with that produced by the Cooper and Haines filter (CHF) and its adaptive version developed in Hoang et al. (2005) for two situations when the SSH observations are available at all surface grid points as well as for the more delicate situation when it is required to interpolate the innovation vector into all horizontal points (modelling the real situation of collection of data along-track).

References

[1] Hoang S., R. Baraille and O. Talagrand. On an adaptive filter for altimetric data assimilation and its application to a primitive equations model MICOM. To appear in Tellus, (2005).