Geophysical Research Abstracts,
Vol. 11, EGU2009-4644, 2009
EGU General Assembly 2009

Application of a 3-D Super Ensemble to ocean forecast

F. Lenartz (1,2), A. Barth (2), J.-M. Beckers (2), L. Vandenbulcke (2), and M. Rixen (1)
(1) NATO Undersea Research Centre, La Spezia, Italy, (2) University of Liège, Liège, Belgium (f.lenartz@ulg.ac.be)

Super Ensemble (SE) techniques have recently allowed improving the forecast of various important oceanographic parameters, such as the significant wave height, the speed of sound or the surface drift, by correcting the prediction at a single or multiple locations, where data were available during the whole training period. However, nowadays common observation systems, such as satellite imagery or drifters, do not always provide information at the exact same locations, hence it is necessary to generalize the approach in order to take benefit of every image or track available. In this study, we try and apply a SE, fed with remote sensing and gliders data, to 3-D hydrodynamic models.

The basic idea on which rely the SE methods is that a certain combination of several model runs and possibly data could yield better results than just one single model, even if it has a higher temporal or spatial resolution. As the most efficient techniques are the ones using observations, they rapidly developed and increased in complexity by copying what had been done in the data assimilation community; getting from the simple ensemble mean of the model outputs to their linear combination based on a particle filter. In our present study, we have decided to use the Kalman filter (KF) as it alleviates the need of an a priori determination of the training period length, and does not require the run of a very large ensemble of members. In addition, we apply it in a 3-D framework in order to take benefit of the spatial information contained by each source of measurements. For example, satellite images of sea surface temperature (SST) are very useful to correct the value of this parameter, but depending on the structure of the water column, it can also give a precious guess of how warm or cold is the ocean at 20 m deep.

In our experiment the domain of interest is the Ligurian Sea during the last week of September, when part of the set-up for the CalVal08 campaign (SiC Charles Trees) had already taken place. The data assimilated during the training of the filter are SST images from AVHRR, as well as temperature and salinity profiles from two Rutgers University gliders. The models used for the study are three nested models of NCOM, run without data assimilation. The two considered variables are the temperature and the salinity. As our method is designed to work in a multivariate way, salinity forecast can possibly be improved by observing temperature profiles. Statistics are computed for both the training and the testing periods with an independent set of data.

In four test cases, we review the impact of both the nature of the assimilated data, and the formulation of the model covariance matrix. At the end, we show that, on the basis of previous model outputs from which we've drawn an estimate of the model covariance, RMS error of the forecast in the whole 3-D domain can be reduced by 30%, thanks to the only assimilation of satellite SST images.