Geophysical Research Abstracts, Vol. 7, 02081, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02081

A reduced order Kalman filter to assimilate along track altimetric observations and sea surface temperature with the HYCOM model

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The main objective of this work is to implement the SEEK filter, an advanced statistical assimilation scheme, and to compare results with the current ocean nowcast/forecast system running in real time at the Naval Oceanographic Office (NAVO).

At the center of the system is the HYbrid Coordinate Ocean Model (HYCOM). This model is designed to use an efficient vertical system coordinate which evolves in time and space. Isopycnal coordinates are used in the deep stratified ocean, geopotential near the surface and terrain-following in shallow coastal regions. The 1/12 North Atlantic configuration is used to estimate performances of this new assimilation scheme. This region covers 28S to 70N including the Mediterranean sea. In the vertical, there are 28 levels and the mixed layer model is a K-Profile Parameterization (KPP). Simulations are produced throughout 1998-2004 with the use of FNMOC (Fleet Numerical Meteorology and Oceanography Center) fluxes.

The assimilation method used is a reduced-order Kalman filter derived from the SEEK, in which the error covariance matrix is determinated through a three-dimensional multivariate analysis of the model variability. It allows a reduced cost of the assimilation scheme, a strong requirement of any operational ocean system. The analysis algorithm has been further developed to strenghten the local impact of the data and a physical adjustment has been incorporated to take care of the vertical coordinate of the model. The assimilated SST data come from the MODAS system (an operational product from NAVO) and the altimetric data come from the Topex/Poseidon,

ERS2, Jason1, GFO and ENVISAT satellites.

Hindcast experiment will be presented and interpreted (throughout 1998-1999). Validation with independant in-situ measurements (XBT) demonstrated the skill of the system to represent the Atlantic ocean circulation in surface or mid-depth, as the Gulf Stream. Later, in-situ data (XBT, GDEM3 climatology) will be assimilated to improve the control of the deep ocean.