



## Overview and recent improvements of the global Mercator Ocean operational systems

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In the framework of the European project GMES/MyOcean, Mercator Ocean has designed a hierarchy of ocean analysis and forecasting systems based on numerical models of the ocean/sea-ice and data assimilation methods. Since December 2010, Mercator Ocean runs new versions of the global system at  $\frac{1}{4}^\circ$  and the Atlantic and Mediterranean system at  $1/12^\circ$  between  $20^\circ\text{S}$  and  $80^\circ\text{N}$ . Both new systems deliver weekly and daily services and are operated in real time. The Atlantic and Mediterranean one is nested in the global  $\frac{1}{4}^\circ$  at the south and north open boundaries.

Many improvements concern the ocean/sea-ice model and the assimilation scheme. The ocean and sea-ice models are based on the NEMO code. The data assimilation algorithm is a reduced order Kalman filter using 3D multivariate modal decomposition of the forecast error covariance. The systems assimilate conjointly altimeter data, SST and in situ observations (temperature and salinity profiles, including ARGO data) in order to provide the initial conditions required for numerical ocean prediction.

The main improvements of the systems are (i) the use of high frequency (3h) atmospheric forcings including the diurnal cycle, (ii) the use of the CORE bulk formulation, (iii) the use of a new TKE scheme, (iv) the use of the LIM2-EVP ice model, (v) the insertion of the zonal and meridional velocity components into the control vector, (vi) the use of the IAU procedure, (vii) the insertion of new observational operators, (viii) the use of a new MSSH, (ix) the introduction of pseudo-observations (innovations equal to zero) to overcome the deficiencies of the background errors, in particular for extrapolated variables and (x) the use of a method of bias correction based on a variational approach which takes into account cumulative innovations on recent period (typically 3 months) in order to estimate a large scale bias.

After a description of the updated systems, we will present recent validation results. It demonstrates the high level of performance and the stability of the new systems for all variables, and their superiority to the previous ones in most aspects.

In addition, since July 2010, a global  $1/12^\circ$  ocean forecasting system delivers weekly services in a quasi-real time mode. This system does not benefit from all the recent improvements mentioned above but offers a new perspective on the global ocean mesoscale predicting. In this context a special focus on the mesoscale activity in the south hemisphere will be done.