
A new global ocean ensemble system at the Met Office: Assessing the impact of hybrid data assimilation and inflation settings

Daniel Lea^{*1}, James While², Matthew Martin¹, Anthony Weaver³, Andrea Storto⁴, and Marcin Chrust⁵

¹United Kingdom Met Office [Exeter] – FitzRoy Road, Exeter, Devon, EX1 3PB, UK, United Kingdom

²United Kingdom Met Office [Exeter] – FitzRoy Road, Exeter, Devon, EX1 3PB, UK, United Kingdom

³CERFACS [Toulouse] – Institut National des Sciences de l’Univers – 42 Avenue Gaspard Coriolis
31057 TOULOUSE CEDEX 1, France

⁴ISMAR – via del Fosso Cavaliere 100, Rome, Italy

⁵European Centre for Medium-Range Weather Forecasts (ECMWF) – Shinfield Park, Reading, RG1
9AX, United Kingdom

Abstract

We have developed a global ocean and sea-ice ensemble forecasting system based on the operational FOAM (Forecasting Ocean Assimilation Model) system run at the Met Office. The ocean model NEMO and the CICE sea-ice model are run at 1/4 degree resolution and the system assimilates data using NEMOVAR. This is primarily a variational data assimilation (DA) system, but it can now also perform hybrid ensemble/variational assimilation. A 36 member ensemble of hybrid-3DEnVars with perturbed observations (values and locations) has been set-up, with each member forced at the surface by a separate member of the Met Office Global-Regional Ensemble Prediction System (MOGREPS-G). The system includes stochastic model perturbations and a Relaxation to Prior Spread (RTPS) inflation scheme. The system has an additional unperturbed or deterministic member with higher resolution Met Office Numerical Weather Prediction (NWP) atmospheric forcing.

A control run of the system using an ensemble of 3DVars is shown to be generally reliable for sea level anomaly (SLA), temperature and salinity (the ensemble spread being a good representation of the uncertainty in the ensemble mean), although the ensemble is under spread in eddying regions.

In this system the optimal results, in terms of short-range forecast error and ensemble reliability statistics, are obtained with hybrid-3DEnVar - pure 3DVar and pure 3DEnVar do not perform as well. The inflation scheme is beneficial in producing an appropriate ensemble spread in response to hybrid DA. Work has started to include the ocean ensemble system in a coupled NWP system.

Keywords: ensemble, ocean, assimilation, hybrid

*Speaker