Pierre-Antoine
Bouttier
OSUG-LGGE/CNRS
Jacques Verron, LGGE/CNRS
Eric Blayo, LJK/Université Joseph Fourier-INRIA
Pierre Brasseur, LGGE/CNRS
Arthur Vidard, LJK/INRIA
Poster
A long-term challenge for data assimilation (DA) in oceanography is the adequate representation of meso- and smaller-scale dynamics into numerical models used to simulate the ocean general circulation, variability and energy budget. However this small-scale activity, which is typically seen from altimetric satellites, is strongly linked to the nonlinear character of the flow whereas DA methods are generally less efficient in such contexts than in (almost) linear ones.

The purpose of this presentation is to address this problem specifically, by exploring the behavior of an incremental 4D-VAR DA method in a non-linear ocean model, based on NEMO and NEMOVAR modeling frameworks. More specifically, we investigate the impact of different altimeter observational networks based on JASON 1-2-3 and SARAL/AltiKA missions, by looking at the performances of variationnal DA system at eddy-permitting resolution. A simplified double-gyre ocean circulation model is implemented using the NEMO SEABASS configuration at 1/4° and 1/12° resolution. This idealized configuration is a common benchmark further used in the frame of the SANGOMA (Stochastic Assimilation for the Next Generation Ocean Model Applications) EU project dedicated more specifically to stochastic assimilation methods.

We have performed three twin experiments, without model error, with different simulated observation sets: one based on JASON-1 satellite tracks, one based on SARAL/Altika tracks and one taking in account both simulated satellites. Among others, we will present results characterizing scales and structures of the analysis error along the assimilation process, as well as potential connections with small scale activity. In order to study qualitatively and quantitatively the convergence of the algorithm and the structure of analysis and forecast errors, a broad spectrum of diagnostics have been considered: classical spatial and temporal RMSE, cost function characteristics and energy spectrum.

In our experiments, it appears that the incremental 4DVAR algorithm gives the best results in reducing analysis and forecast errors for one-month assimilation windows. This variational DA system also appears to be very sensitive to the observational sampling.The difficulty of convergence for the incremental 4DVAR algorithm at this spatial resolution is tackled with an observational network based on multiple altimeter satellite. In this case, this variational DA system is more efficient to reduce analysis error. Moreover, our results indicate that higher spatial resolution of the observational network (SARAL/Altika) is more efficient to achieve this goal than a higher temporal resolution (JASON-1).
OSTS session
Science Results from Satellite Altimetry
Meeting name
Ocean Surface Topography Science Team (OSTST) Meeting
Download to PDF