Altimetric networks and 4DVAR incremental: 1/4˚ case

The present work takes place in the context of applying the 4DVAR DA technique to oceanic flows, in order to make an optimal use of altimeter data from various missions. The present work aims at investigating:

- The capability of the Incremental 4DVAR to cope with nonlinear ocean models
- The impact of the model horizontal resolution on the 4DVAR performances
- To explore the impact of various altimetric sampling (Jason-1 vs. SARAL/AltiKa) on incremental 4DVAR performances.

Model and configuration NEMO ocean code, rectangular box of 3000 km by 2000 km, Two horizontal resolutions: 1/4˚ and 1/12˚

Data Our data are simulated from the model (twin experiments), with a 3 cm white noise error, and following SARAL/AltiKa and Jason-1 satellite orbits, illustrated by Figures below. SARAL/AltiKa orbits has a longer repetitivity period and higher spatial resolution (35 days and 70 km inter-track spacing at the equator) than Jason-1 (10 days and 300 km inter-track spacing at the equator).

According to these two kinds of tracks, we have studied three different scenarios: simulated SARAL/AltiKa data only, simulated Jason-1 data only, and both kind together.

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- For longer DA windows, SARAL/AltiKa simulated tracks give a lower error level.
- For the longest DA window, taking both satellites into account degrades cost function conditioning, and gives stronger error than considering only SARAL/AltiKa.

Conclusions

This assimilation system proved to be quite robust under different contexts for long DA windows. However, increasing horizontal model resolution slows the convergence of the minimisation algorithm.

For eddy-permitting model resolution, SARAL/AltiKa simulated tracks give best results in terms of reduction of the analysis error. At higher resolution, combination of different altimetric networks, which have different sampling characteristics, is needed to control a larger spectrum of the scales contained in the analysis error.

Further works will explore similarly the impact of the SWOT-like observational sampling on this variational DA system, for a 1/12˚ model.

References

