

## Assimilation of Oceanic Observations With a Reduced Order Square-Root Smoother

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In contrast with filters that are specifically designed for prediction purposes, smoothers, that make use of "future" observations to improve the estimation of the ocean state, are more appropriate for re-analyses. By the beginning of MyOcean project, the theoretical development of a smoother and its implementation with an idealised configuration of the NEMO model have been finalized [1]. This smoother is based on a reduced order Kalman filter (SEEK filter). The tuning of this data assimilation tool and its implementation with a realistic NEMO configuration has been undertaken.

The NEMO configuration that has been chosen to experiment the SEEK smoother is a regional configuration of the Tropical Atlantic Ocean at a resolution of 1/4 degree. Preliminary experiments suggest the smoother is very valuable. In particular, it seems to damp potentially growing errors that remain after the corrections due to the filter.

Error statistics are difficult to specify accurately, for many reasons: inappropriate initialisation, approximated physics, truncation of the state error space, numerical constraints, etc. Such misspecification can have dramatic effects with the smoother. In some cases, the smoother deteriorates the ocean state estimation, spoiling the work due to the filter. It is why efficient parameterisations have been developed to get more accurate error statistics [2,3]. These parameterisations are based on the classical formulation of adaptivity [4] but including the strong constraint of order reduction and the compliance to the use of analysis localisation techniques. They are currently being implemented with the Tropical Atlantic model.

[1] Cosme, et. al., *Ocean Modelling*, 33, 87-100 (2010)

[2] Brankart, et. al., *Monthly Weather Rev.*, 138(3), 932-950 (2010a)

[3] Brankart, et. al., *Monthly Weather Rev.*, in press (2010b)

[4] Dee, *Mon. Wea. Rev.*, 123, 1128-1145 (1995)