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Control of a free-surface barotropic model of the Bay of Biscay by assimilation of sea-level data in presence of atmospheric forcing errors

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A data assimilation method is set up in the barotropic, free-surface, finite element MOG2D model, implemented in the Bay of Biscay and nested in a North East Atlantic domain. The model is forced by the ARPEGE meteorological model.

In a first step, we explore the model error subspace in presence of coherent atmospheric forcing errors. This is done via an ensemble modelling approach in which the atmospheric fields are perturbed in a multivariate and coherent way : by generating an a priori ensemble of perturbed atmospheric forcing fields, and calculating the corresponding a posteriori ensemble of model simulations, one can approximate the forecast errors of the model by ensemble spread statistics, such as background error Ensemble EOFs.

These approximated model error covariances, in form of 6D-EOFs (Sea Level Anomaly, barotropic velocities, atmospheric pressure and wind-stress), are shown to be neither homogeneous over the domain, nor stationary, since they are very dependent on the meteorological forcing.

Such statistics are then used in a Reduced-Order Optimal Interpolation sequential scheme (SEQUOIA, developed at LEGOS/POC) to constrain the model forecast via sea level data assimilation. Twin experiments are conducted in the last quarter of 1999. Results show that the use of time-independent error statistics allows to control the model but that time-dependent statistics often lead to better results, advocating for a more advanced scheme in a future step.

Finally, several Observing System Experiments (OSEs) and Observing-System Sim-

ulation Experiments (OSSEs), are carried out in order to test the sensitivity of the results to the altimetric configuration, with or without tide gauges acting in a complementary manner. The impact of velocity measurements near the coast (HF radars) is also illustrated.