The effect of including boundary perturbations in ensembles of the North-West European Shelf-Seas

Tom Louden-Cooke & Matthew Martin

Met Office

Abstract

The Met Office AMM7 model is a 7 km resolution operational system which can be run as an ensemble to assimilate temperature, salinity and sea level anomaly observations to produce forecasts for the North-West European Shelf (NWS) seas. The model is nested into the Met Office global ocean forecasting system at the Atlantic boundaries and the Copernicus Baltic system at the Kattegat-Skagerrak area. At present, the lateral boundary values are identical between the ensemble members. Not including uncertainty in the boundary region can lead to an underestimation of the overall ensemble spread, contributing to a general underestimation of forecast errors.

Ideally, a regional model would use a global ensemble to set the boundary values for each ensemble member. However, compatible global ensembles may not always be available, or practical for use in an operational context. Instead, we have implemented a simple method for generating an ensemble of regional boundaries by smoothly perturbing deterministic boundary values both laterally and in time.

We will present our findings on how these lateral and temporal perturbations impact the ensemble mean and spread, and the root mean square errors in an entire season of data for the Met Office AMM7 regional ensemble. We will highlight how the perturbations propagate, with particular attention to their interaction with the shelf break. We will demonstrate that our method provides reasonable, well-behaved perturbations, improves the ensemble spread, and is overall an appropriate method for setting regional boundary conditions when a nesting ensemble is not available.