Geophysical Research Abstracts
Vol. 19, EGU2017-7192, 2017
EGU General Assembly 2017

Stochastic parametrization of model errors using nested model in the context of data assimilation

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A major difficulty in data assimilation is to adequately specify the model error covariances. For ensemble assimilation schemes all uncertain aspects of the model would need to be perturbed within their range of uncertainty. While progress have been made to address the error source external to an ocean model, such as atmospheric fields, bathymetry and boundary conditions, the intrinsic model error is rarely addressed. The objective of the study is to improve our knowledge on the intrinsic model error due to the finite resolution and to propose statistical parameterization usable in ensemble simulations.

To study the impact of resolution on the model simulation, a two-way nested ROMS model is implemented. The modelling system is composed by a Ligurian Sea model at 1/60 degree nested in the CMEMS Mediterranean Model (one-way). A high-resolution NW Corsican model at 1/180 degree (about 530 m) is nested in the Ligurian Sea model (two-way). The fact that the model equations are solved twice provides an interesting opportunity to gain some insight about the model error due to resolution and to derive an empirical stochastic parametrization of subgrid-scale processes.

During the two-way nesting feedback, the difference between the coarse model grid and the averaged fine model result is computed. The statistical properties of the feedback increment is studied and related to the parameters resolved on the coarse model grid. In favorable cases, a significant part of the variance of the feedback increment can be related to fronts also resolved in the coarse model grid which allows to derive empirical statistical parameterizations of the subgrid scale processes.