Study of the combined effects of data assimilation and grid nesting in ocean models. Application to the Gulf of Lions.

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Modern operational ocean forecasting systems routinely use data assimilation techniques in order to take observations into account in the hydrodynamic model. Moreover, as end users require higher and higher resolution predictions, especially in coastal zones, it is now common to run nested models, where the coastal model gets its open-sea boundary conditions from a low-resolution global model. This configuration is used in the "Mediterranean Forecasting System: Towards environmental predictions" (MFSTEP) project. A global model covering the whole Mediterranean Sea is run weekly, performing 1 week of hindcast and a 10-day forecast. Regional models, using different codes and covering different areas, then use this forecast to implement boundary conditions. Local models in turn use the regional model forecasts for their own boundary conditions. This nested system has proven to be a viable and efficient system to achieve high-resolution weekly forecasts.
However, when observations are available in some coastal zone, it remains unclear whether it is better to assimilate them in the global or local model. We perform twin experiments and assimilate observations in the global or in the local model, or in both of them together. We show that, when interested in the local models forecast and provided the global model fields are approximately correct, the best results are obtained when assimilating observations in the local model.