Geophysical Research Abstracts
Vol. 21, EGU2019-5829, 2019
EGU General Assembly 2019

Comparison of skill between high and medium resolution ocean models in the North Indian Ocean

Xavier Francis (1), Georgy Shapiro (1), Jose M. Gonzalez-Ondina (1), Fred Wobus (1), Jan Maksymczuk (2), Isabella A. Kenov (2), James While (2), and Muhammad Asif (1)

(1) University of Plymouth, School of Bilogical and Marine Sciences, Plymouth Ocean Forecasting Centre, Plymouth, Devon, United Kingdom, (2) Met Office, Fitzroy Road, Exeter, Devon, EX1 3PB, United Kingdom

The use of high-resolution grids in ocean modelling provides a greater granularity of the spatial structure but incurs a significant increase in computational cost compared to lower resolution models. The purpose of this presentation is to investigate how much improvement (if any) is achieved in the quality of simulation defined as an area-averaged difference between the model and observations, in a high-resolution model when compared to its medium-resolution counterpart.

In order to do so, we employed two NEMO (version 3.6_stable) based ocean models with the same meteorological forcing and initial conditions. The medium-resolution model covers the Arabian Gulf, Gulf of Oman, and the northern part of Arabian Sea at 1/20˚ (approximately 5km) resolution. The high-resolution model covers the Arabian Gulf and the western part of the Gulf of Oman at 1/60˚ (approximately 1.8km) resolution. The high resolution model is nested into the medium resolution model via boundary conditions. The models were run both in free mode (no data assimilation) and with assimilation of Sea Surface Temperature (for both models); T/S profiles and Sea Surface Height (for medium resolution model only). The comparisons were made over the overlapping domain of the two models.

The model simulations were carried out in free mode for six years from 1^{st} January 2011 to 31^{st} December 2016 and in an assimilating mode from 2^{nd} to 31^{st} January 2014. The meteorological forcing was taken from ECMWF ERA-Interim dataset. To assess the skill of each model in terms of temperature difference between observations and the models, we used observations from Argo floats for T/S profiles, and SST analysis from OSTIA (Operational Sea Surface Temperature and Sea Ice Analysis).

The results show that even in free mode, both medium and high-resolution models reproduce observations reasonably well. During winter season, the area-averaged bias in SST for high-resolution and medium-resolution are -0.18˚C and -0.19˚C respectively; and for summer season are 0.08˚C and 0.02˚C respectively. The Root Mean Square Errors (RMSE) are 0.62˚C and 0.59˚C for winter and 0.66˚C and 0.64˚C for summer respectively. Similar differences were obtained for data-assimilating runs. Note that in both seasons the medium resolution model performs as well as or better than the high resolution model.

The analysis shows that while the high resolution model gives more detail of the spatial structure, the difference in water temperature between the high-resolution and medium-resolution models is marginal. This might suggest that there is a resolution threshold above which no improvement is achieved in the model simulation of water temperature without change in the model physics and/or numerical implementation and/or resolution of the meteorological forcing.