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Assessment of ocean models in Mediterranean Sea against altimetry and gravimetry measurements

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This work aims at assessing in a regional study in the Mediterranean Sea the agreement between ocean model outputs and satellite altimetry and satellite gravity observations. Satellite sea level change are from altimeter data made available by the Sea Level Climate Change Initiative (SLCCI) and from satellite gravity data made available by GRACE.

We consider two ocean simulations not assimilating satellite altimeter data and one ocean model reanalysis assimilating satellite altimetry.
Ocean model simulations can provide some insight on the ocean variability, but they are affected by biases due to errors in model formulation, specification of initial states and forcing, and are not directly constrained by observations. Their trend can be quite different from the altimetric observations due to surface radiation biases, however they are physically consistent.
Ocean reanalyses are the combination of ocean models, atmospheric forcing fluxes and ocean observations via data assimilation methods and have the potential to provide more accurate information than observation-only or model-only based ocean estimations. They will be closer to altimetry at long and short timescales, but assimilation may destroy mass consistency.

We use two ocean simulations which are part of the Med-CORDEX initiative (https://www.medcordex.eu). The first is the CNRM-RCM4 fully-coupled Regional Climate System Model (RCMS) simulation developed at METEOFRANCE for 1980-2012. The second is the PROTHEUS standalone hindcast simulation developed at ENEA and covers the interval 1960-2012. The third model is the regional model MEDSEA_REANALYSIS_PHIS_006_004 assimilating satellite altimeter data (http://marine.copernicus.eu/) and available over 1987-2014.

Comparison at basin and regional scale are made. First the steric, thermo-steric, halosteric and dynamic components output of the models are compared. Then the total sea level given by the models is compared to the altimeter observations. Finally the mass component derived from GRACE is compared to the difference between the total sea level and the steric component.

We observe large differences between the ocean models and discuss the model which best agrees with the CCI sea level product at short and at longer timescales. We consider departure in sea level trends, inter-annual variability and seasonal cycle. The work is part of the Sea Level Climate Change Initiative project.