Geophysical Research Abstracts
Vol. 19, EGU2017-17681, 2017
EGU General Assembly 2017

Observations and modelling of sea level variability in the Bay of Biscay in the framework of the ENIGME project.

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In a climate change context, understanding the variability of physical properties along the coasts and its link to large scale processes is of paramount importance in order to project how global warming will affect the coastal environments. In this framework, the ENIGME project aims to implement and validate a suite of high resolution numerical models in the Bay of Biscay (NE Atlantic) in order to better represent the interannual variations of physical properties. In this presentation we will focus on sea level variations at the coast characterized from observations (tide gauges and altimetry) and models (barotropic and baroclinic in different configurations).
In a first step we characterize the mechanisms behind sea level variations at time scales from hours to decades. Most of the variability is associated with tides while atmospherically induced variations (meteorological tides) dominate the residuals at all frequencies (<30 days, monthly and interannual). However, non-atmospherically induced interannual variations are non-negligible and must be included in the modelling systems.
In a second step we compare the skills of different numerical simulations using 2D and 3D models at spatial resolutions ranging from 1 km to 30 km. Our results suggest that using 3D baroclinic models slightly increase the quality of the tidal representation. Concerning the residuals at frequencies higher than 30 days all models perform similarly. At those frequencies the atmospheric pressure and tide-surge interactions are the most relevant mechanisms driving the variability. Also, we have found that high resolution wind forcing does not improve the results when looking at overall skill indices although for particular extreme events it does. Concerning the interannual and multidecadal variability, the modelling is improved when large scale variability is included. This is especially true for narrow shelf areas where the open sea dynamics have non-negligible influence on the coastal sea level variability. In those cases, the treatment of the open boundaries in regional circulation models and the quality of the information there (i.e. from the OGCM) is crucial for a good representation of variations in coastal areas. Finally we have also noticed that none of the models is able to correctly reproduce the long-term trends, which are dominated by large scale processes.