EGU22-732
https://doi.org/10.5194/egusphere-egu22-732
EGU General Assembly 2022

Sea-level modelling in the Mediterranean Sea using data assimilation

Christian Ferrarin, Marco Bajo, and Georg Umgiesser
CNR-ISMAR, Venice, Italy (c.ferrarin@ismar.cnr.it)

The correct reproduction of sea-level dynamics is crucial for forecasting floods and managing the associated risk. On the other hand, sea-level monitoring through observations can provide a description only of past events and it is challenging and costly, both of time and money. In this context, oceanographic models are increasingly used to describe the sea dynamics, providing a spatial/temporal extension to the observations. The best solution, which merges the observation accuracy and the model spatial/temporal resolution, is the data assimilation analysis, which is particularly important in coastal regions with scarce monitoring resources. In this study, we investigate the benefits of assimilating sparse observations from tide gauges in an unstructured hydrodynamic model for simulating the sea level in the Mediterranean Sea. We use the Ensemble Kalman filter, both to obtain an analysis of the past and to produce accurate forecasts. In the analysis we tested the assimilation in storm-surge simulations, only-tide simulations, and total-level simulations, using the observations in the stations. The results of storm-surge simulations were compared with those of total-level simulations, by adding the tide obtained from harmonic analysis of the observations. RMSE and correlation show improvements for all the components of the sea level and all the stations considered (not assimilated). The averaged-over-station RMSE reduces from 9.1 to 3.4 cm for the total level. The greatest improvements happen when the model without assimilation, due to an error of the wind-pressure forcing, did not reproduce some barotropic free modes of oscillation triggered by an initial surge. The preliminary forecast simulations of storm surge show improvements due to the data assimilation extending up to 5 days of forecasting. Even in this case, the longer improvements seem to happen when a free mode of oscillation is triggered. The results of this study will be used to improve the sea level forecasting system in the Adriatic Sea, developed within the framework of the Interreg Italy-Croatia STREAM project (Strategic development of flood management, project ID 10249186).