On using scatterometer and altimeter data to improve storm surge forecasting in the Adriatic Sea

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Satellite data are seldom used in storm surge forecasting. Among the most important issues related to the storm surge forecasting are the quality of the model wind forcing and the initial condition of the sea surface elevation. In this work, focused on storm surge forecasting in the Adriatic Sea, satellite scatterometer wind data are used to correct the wind speed and direction biases of the ECMWF global atmospheric model by tuning the spatial fields, as an alternative to data assimilation. The capability of such an unbiased wind is tested against that of a high resolution wind, produced by a regional non-hydrostatic model. On the other hand, altimeter Total Water Level Envelope (TWLE) data, which provide the sea level elevation, are used to improve the accuracy of the initial state of the model simulations. This is done by assimilating into a storm surge model the TWLE obtained by the altimeter observations along ground tracks, after subtraction of the tidal components. In order to test the methodology, eleven storm surge events recorded in Venice, from 2008 to 2012, have been simulated using different configurations of forcing wind and altimeter data assimilation. Results show that the relative error on the estimation of the maximum surge peak, averaged over the cases considered, decreases from 13% to 7% using both the unbiased wind and the altimeter data assimilation, while forcing the hydrodynamic model with the high resolution wind (no tuning), the altimeter data assimilation reduces the error from 9% to 6%.