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An operational system for the storm surge forecast in the Adriatic Sea (Italy): results and evaluations

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A new storm surge forecasting system for the Mediterranean Sea is running operationally from 2011 at the Venice branch of the Italian Institute for Environmental Protection and Research (ISPRA). This operational forecasting system is based on a finite element hydrodynamic model, named SHYFEM, developed at the Institute of Marine Sciences (ISMAR). The model is applied in a 2D formulation computingthe barotropic transports.
The system runs once daily and it is forced using two different types of meteorological fields over the Mediterranean area: wind and mean sea-level pressure forecast fields provided by either the ECMWF Integrated Forecasting System (IFS) or the BOlogna Limited Area Model (BOLAM) operational at the Rome branch of ISPRA. Moreover, from year 2012 a data assimilation system, based on the 4D-PSAS technique, has been developed and implemented.
The SHYFEM-based system produces a first run over the Mediterranean domain and then a second run, exploiting the output of the first one, aimed at forecasting the water level in the Venice Lagoon. This area is subject to frequent and extreme storm surge events (usually referred as acqua alta events).
A statistical analysis is carried out for one year (Oct 2012-Oct 2013) comparing the predicted sea levels with the measured data at four different tide gauges: two in the Venice Lagoon (Punta della Salute and Chioggia Vigo) and two along the Northern Adriatic coast (“Acqua Alta” oceanographic tower and Grado). The analysis examines both the whole year forecast data and those data related only to the strongest events (> 80 cm).
The results show the different model performance obtained with and without data assimilation and with different meteorological forcings. Moreover, some examples of well predicted exceptional storm surge events are discussed.
This study points out the importance of adopting different meteorological models in order to calculate a sort of “multi-model ensemble” defining an uncertainty strip for the storm surge forecasts.