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Extreme oceanic events in the Lagoon of Venice simulated by an atmospheric/oceanic model

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The hydrodynamics induced, in an oceanic region including the Adriatic sea as well as the lagoon of Venice, by tidal, wind and atmospheric pressure forcing was investigated using an oceanic and an atmospheric numerical model. Through the atmospheric BOLAM model, which is a hydrostatic regional model, simulations were performed with two different discretizations, namely 20 km and 5 km grid step. In particular, the simulations performed with the higher resolution permit an accurate description of topographically induced wind intensifications. The oceanic model is based on curvilinear, boundary fitted coordinates and allows one to simulate the coastal flooding and dry up with great accuracy. The curvilinear grid is designed to fit the coastal morphology and the variable mesh focuses on the northern area of the basin (maximum grid resolution O(50)m), in correspondence of the Lagoon of Venice. Different numerical experiments were carried out in order to test the sensitivity of the hydrodynamic model to the input provided by the atmospheric one. The oceanic-atmospheric model was then applied to the simulation of a series of exceptionally high tides observed between November 25, 2005, and December 10, 2005 in the lagoon of Venice. Observed phenomena induced by Bora winds inside the lagoon and in the outer coastal area were captured. Moreover, the model correctly reproduced the current intensification and the evolution of the sea surface level along the coast of the north Adriatic sea induced by the Bora. Based on the above findings, the modeling approach was used for investigating the consequences of larger scale climatic changes on sea level variation.