STORM SURGE VARIATIONS IN THE MEDITERRANEAN SEA UNDER CLIMATE CHANGE SCENARIOS

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Abstract

A 2D ocean numerical model covering the Mediterranean Sea and the NE Atlantic sector has been forced by atmospheric pressure and wind fields generated by dynamical downscaling over the European region that follow three climate change scenarios (A2, A1B and B1). The variability of the obtained atmospherically-induced sea level has been compared among scenarios and with a re-analysis of the period 1960-2000 carried out with the same numerical model. The analysis presented here focuses on the changes in the decadal variability of mean sea level and in sea level extremes projected for the 21st century

Keywords: Air-Sea Interactions, Sea Level

Sea level is an important parameter for coastal habitats and infrastructures and has been recognized as a key indicator of global climate change. During the last years there has been a growing interest among the scientific community in understanding sea level changes, given the impact that sea level rise may have in coastal and highly populated areas. Global sea level rise during the 20th century has been estimated in 1.8 mm/yr [1], while in the Mediterranean coastal sea level derived from the longest tide gauges indicates a rate of sea level rise of 1.1–1.3 mm/yr [2]. In a world with a higher mean sea level, high waters caused by storm surges will have increasing hazardous impacts on coastal areas. However, while projections of climate models mostly agree and predict a continuous increase in mean sea level in many parts of the globe during the 21st century, no consensus has been reached in respect to the changes in storminess [1]. This work aims at obtaining regional projections of storm surges in the Mediterranean Sea and the adjacent NE Atlantic area for the 21st century under different climate change scenarios on the basis of regional atmospheric and oceanic numerical models. Extreme sea level events are commonly driven by the combination of tidal elevation and storm surges. However, the non-linear interaction between tides and surges in the Mediterranean is negligible and can thus be ignored [3] Therefore we will concern ourselves only with the storm surges component. High frequency (6h) atmospheric pressure and wind fields are obtained as the output of a global atmospheric model with variable-resolution (50 km over the Mediterranean [4]). The atmospheric model is run for the period 2000-2100 forced by greenhouse gases (GHG) and aerosols concentrations following the A2, A1B and B1 SRES scenarios. Two more runs have been carried out for the period 1960-2000. One was forced by observed GHG and aerosols concentrations (the control run). The second is a dynamical downscaling of ERA-40 re-analysis fields. The atmospheric fields are used to force the oceanic barotropic model HAMSOM over the area 30ºN to 47ºN and 12ºW to 35ºE, which covers the Mediterranean Sea and the NE Atlantic adjacent sector with a spatial resolution of 1/4ºx1/6º. Mean values and decadal variability of atmospherically-induced sea level will be examined and compared between the different runs for the 21st century and with the results obtained for the 20th century. The hourly outputs will be used to explore the changes in the magnitude and frequency of extreme sea level events under climate change scenarios.

References

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