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Extreme sea level events in the western Mediterranean: analysis of the main contributions based on high frequency tide gauge records

J. Ramos1, M. Agulles2, D. Gomis3 and G. Jordà4

1, 3 Institut Mediterrani d'Estudis Avançats (IMEDEA, Universitat de les Illes Balears - CSIC). Esporles (Mallorca), SPAIN.
jorge.ramos@uib.es, damia.gomis@uib.cat
2,4 Instituto Español de Oceanografía, Centro Oceanográfico de Baleares. Palma, SPAIN.
miguel.agulles@ieo.es, gabriel.jorda@ieo.es

Abstract

Sea level extremes cause significant environmental damage and affect the well-being of populations living in coastal regions. As a consequence of climate change, sea level rise is progressively adding to positive sea level extremes, increasing coastal damages. Furthermore, the variability of sea level extremes is also associated with different climate drivers that influence the intensity and occurrence of these events (Marcos et al., 2015; Torres & Tsimplis, 2014). Therefore, understanding the mechanisms behind those events is important to ensure robust projections (Vilibić & Šepić, 2017).

Most observational analysis of sea level extremes in the Western Mediterranean have based on hourly data from tide gauges. In this work, we aim to produce a detailed characterisation and to achieve a deeper understanding of extreme sea level events in that region through the analysis of high temporal resolution (1 min) tide gauge series from the Puertos del Estado, SOCIB and VENOM networks. Key parameters such as the magnitude and duration of the events or the return periods will be first determined. Next, we will quantify the relative contribution of the different mechanisms affecting extreme sea levels. For this purpose, the sea level series will be decomposed into different physical components such as storm surge, seasonal cycle, or astronomical tides, paying special attention to the remaining high frequency residuals. The weight of each of these processes in the extreme event statistics will be analysed. The spatio-temporal variability of the extreme events will also be analysed and related to the variability of the different components. Finally, the role of wind waves on extreme events will also be discussed based on the outputs of coastal wave models.