Storm thresholds for the Spanish Gulf of Cádiz coast

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In this study critical thresholds are defined for storm impacts along the Spanish coast of the Gulf of Cádiz. The thresholds correspond to the minimum wave-tidal conditions necessary to produce significant morphological changes on beaches and dunes and/or damage on coastal infrastructure or human occupation.

Threshold definition was performed by computing theoretical sea level variations during storms and comparing them with the topography of the study area and the location of infrastructures at a local level. Specifically, the elevations of the berm, the dune foot and the entrance of existing washovers were selected as threshold parameters. The total sea level variation generated by a storm event was estimated as the sum of the tidal level, the wind-induced setup, the barometric setup and the wave-associated sea level variation (wave setup and runup), assuming a minimum interaction between the different processes. These components were calculated on the basis of parameterisations that were adapted to the specific oceanographic and environmental conditions of the Gulf of Cadiz. Validation of the obtained results was performed for a range of coastal settings over the study area. The obtained thresholds for beach morphological changes in spring tide conditions range between a significant wave height of 2.4 and 3.7 m, while for dune foot erosion are around 4.8 m and for damage to infrastructure around 6.3 m. In case of neap tide conditions these values are increased on average by 50% over the areas with large tidal range.

The calculated thresholds constitute snapshots of risk conditions within a certain time framework. Beach and nearshore zones are extremely dynamic, and also the characteristics of occupation on the coast change over time, so critical storm thresholds will change accordingly and therefore will need to be updated.