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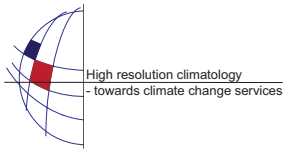


# Circulation patterns and wave climate along the coast of the Iberian Peninsula

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Evidences of an active erosion (beach retreat, falling cliffs, damaged infrastructures) are observed in many coastal areas around the Iberian Peninsula. Morphogenetic coastal processes result from individual episodes of storminess that can accelerate or mitigate the expected impacts of the global rising trend of average sea levels. Thus, a good understanding of the local forcing processes is required in order to assess the impacts of future sea levels. The spatial and temporal variability of the wave climate along the cost of the Iberian Peninsula and their relationships with regional scale circulation patterns and local-scale winds are the main objectives of this contribution.

The oceanographic data set consists of observed hourly data from 7 buoys disseminated along the Spanish coastline, and hindcasted 3-hourly analogous parameters (SIMAR 44 database), provided by Puertos del Estado. Sea level pressure, surface 10m U and V wind components gridded data were obtained from NCEP Reanalysis, while storm tracks and cyclone statistics were extracted from the CDC Map Room Climate Products Storm Track Data (http://www.cdc.noaa.gov/map/clim/st_data.html). The influence of the local conditions was highlighted comparing meteorological data from the buoys and synop reports from coastal stations.

To explore the regional atmospheric mechanisms responsible for the wave variability, a regional Eulerian approach (a synoptic typing) were combined with a larger-scale Lagrangian method, based on the analysis of storm-tracks over the area. The synoptic catalogue was obtained following a well-known procedure that combines Principal Component Analysis (PCA) for reduction purposes and clustering (Ward plus K-means) to define the circulation types.

As expected, rougher wave climate are observed along the northern and western coast of the Iberian Peninsula, open to the Atlantic storms. The Mediterranean shorelines experiences calmer conditions, although the Gulf of Lions, Catalonian coast and Balearic Islands suffer stormier episodes than Mar de Alborán. Moderate wave power conditions occurred frequently by circulation patterns predominately stable and characterized by weak (mostly sea breezes) winds. Synoptic situations dominated by extra-tropical cyclones produced the highest, but least frequent wave power conditions. Depending on the location of the shorelines, three types of storm events are defined:
1. Long winds fetch and locally strong westerly and northwesterly winds expose the northern coast of Iberia to episodes of intense storminess. Extratropical disturbances tracking between the 50-60ºN parallels are the main forcing mechanism of those episodes, many of them result of a cyclogenesis processes along the eastern coast of North America. In some cases, the systems evolves as a secondary cyclon, crossing the area southward of the 50ºN parallel; significant wave heights can be as high as the northernmost cyclones, but the wave period is slightly lower.
2.Cyclones tracking along the 40ºN parallel bring stormy conditions to the western coast and the Gulf of Cádiz area, associated to southwesterly winds.
3. Finally, the Mediterranean shoreline suffer the worst conditions during easterly and northeasterly wind events, usually dominanted by local disturbances formed along the Western Mediterranean basin.

Trends observed on the different circulation patterns can explain the temporal evolution of the wave cli-

mate along the Spanish coast, characterized by calmer conditions on the south and an increase of the wave period on the north, without discernible wave height trend.
The overall results indicated that this synoptic climatological approach provides a viable framework to establish and examine links between weather systems and wave conditions.