WESTERN MEDITERRANEAN WAVE CLIMATE CHANGE SCENARIOS FOR THE XXIST CENTURY

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Abstract
Future wave climate in the Western Mediterranean under different emission scenarios will be presented and compared to present day climate. The results are obtained with a 1/6º wave model forced by 6-hours winds generated by a dynamical downscalling over the Mediterranean with 50km resolution. Changes in the seasonal cycle, dominant patterns and extreme events will be assessed.
Keywords: Waves, Models

The knowledge of surface wave climate is of great importance to the design of offshore structures, coastal environment protection and the planning of operations at sea, among other maritime activities. Therefore, the identification of changes in the wave climate produced by future emission scenarios is crucial for the long term management of those activities. In this contribution, we present a consistent and homogeneous dataset of past and future wave climate in the Western Mediterranean. The dataset is based on the results of a numerical model and consists on a reanalysis of past climate (1960-2000), three runs of future climate (2000-2100) under different emission scenarios (B1, A1B and A2) and a complementary control run of present climate assuming only present emissions (with no data assimilation in the atmospheric forcing). The WAM model [1] has been implemented in the Western Mediterranean with a 1/6º resolution. The wave model is forced with 6-hours winds provided by the ARPEGE climate model that provides information over a variable resolution grid (~50km resolution over the Mediterranean [2]).

The reanalysis simulation results are compared with wave buoy measurements showing a good agreement in terms of mean values and correlation (Table 1). The changes in the wave climate will be assessed through different diagnostics. First we will look at the evolution of the seasonal cycle of SWH (Significant Wave Height) and Tm (Mean Period). Preliminary results suggest a reduction of the winter mean SWH that ranges from 10% in the B1 scenario to 50 % in the A2 scenario at the end of the XXIst century. This will be accompanied by a reduction of 5-10% in Tm for the same period.

Tab. 1. Comparison of modelled and buoy measurements of wind and wave pameters. The average values at three different observing sites are presented

	Buoy Mean	Buoy STD	Model Mean	Model STD	Correlation model-obs
Wind speed	6.3 m/s	4.1 m/s	5.9 m/s	3.3 m/s	0.84
SWH	1.1 m	0.85 m	0.89 m	0.69 m	0.92
Tm	4.1 s	0.9 s	3.5 s	0.9 s	0.82

In a second step, the good agreement of the reanalysis dataset with observations supports a characterization of the present day climate in terms of dominant patterns (EOF analysis) of SWH. Then, future changes could be assessed projecting the results of future climate runs on the present day EOFs. In our presentation, we will show the main changes of wave climate relating them to changes in the wind climate.

Finally, extreme wave events will be characterized in terms of their occurrence number, duration and intensity, both for the present-day climate and for the future climate. First results (Table 2) suggest that the number of wave storms and their intensity will decrease by the end of the XXIst century due to the weakening of winds and cyclone activity over the Western Mediterranean.

Tab. 2. Changes in the extreme events characteristics in under different emission scenarios for a point located to the south-west of Mallorca Island

Variable	Scenario	1960-2000	2060-2100
SWH 99.5 Percentile	B1	4.5 m	4.2 m
SWH 99.5 Percentile	A1B	4.5 m	3.8 m
SWH 99.5 Percentile	A2	4.5 m	4.1 m
Nº days/year with SWH >4.5 m	B1	9.8	7.6
Nº days/year with SWH >4.5 m	A1B	9.8	6.0
Nº days/year with SWH >4.5 m	A2	9.8	7.3

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