Wave ensemble forecast in the Western Mediterranean Sea, application to an early warning system.

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The Western Mediterranean Sea is a highly heterogeneous and variable area, as is reflected on the wind field, the current field, and the waves, mainly in the first kilometers offshore. As a result of this variability, the wave forecast in these regions is quite complicated to perform, usually with some accuracy problems during energetic storm events. Moreover, is in these areas where most of the economic activities take part, including fisheries, sailing, tourism, coastal management and offshore renewal energy platforms.

In order to introduce an indicator of the probability of occurrence of the different sea states and give more detailed information of the forecast to the end users, an ensemble wave forecast system is considered. The ensemble prediction systems have already been used in the last decades for the meteorological forecast; to deal with the uncertainties of the initial conditions and the different parametrizations used in the models, which may introduce some errors in the forecast, a bunch of different perturbed meteorological simulations are considered as possible future scenarios and compared with the deterministic forecast.

In the present work, the SWAN wave model (v41.01) has been implemented for the Western Mediterranean sea, forced with wind fields produced by the deterministic Global Forecast System (GFS) and Global Ensemble Forecast System (GEFS). The wind fields includes a deterministic forecast (also named control), between 11 and 21 ensemble members, and some intelligent member obtained from the ensemble, as the mean of all the members. Four buoys located in the study area, moored in coastal waters, have been used to validate the results.

The outputs include all the time series, with a forecast horizon of 8 days and represented in spaghetti diagrams, the spread of the system and the probability at different thresholds.

The main goal of this exercise is to be able to determine the degree of the uncertainty of the wave forecast, meaningful between the 5th and the 8th day of the prediction. The information obtained is then included in an early warning system, designed in the framework of the European project iCoast (ECHO/SUB/2013/661009) with the aim of set alarms in coastal areas depending on the wave conditions, the sea level, the flooding and the run up in the coast.