

"Sharpening Up Models for a better forecast of harmful waves in the Western Mediterranean"

January 2017

Use Case Overview

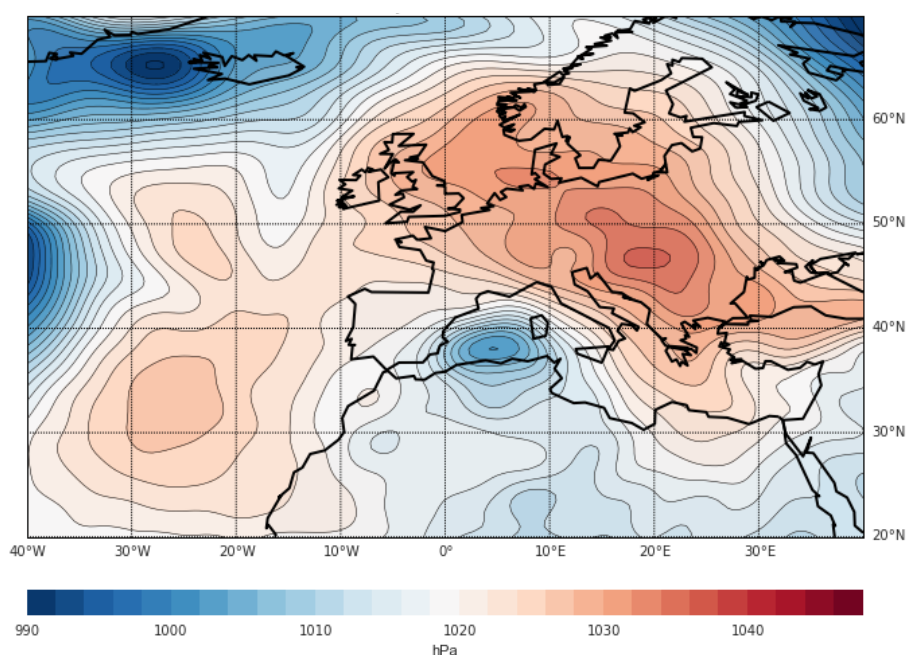


Figure 1. Mean sea level pressure (MSLP) from the NCEP Climate Forecast System (CFSv2) on 21-01-2017 at 12:00.

The western Mediterranean Sea was characterised by extreme atmosphere-ocean conditions on January 21 and 22, 2017, associated with the development of an atmospheric low-pressure system that induced strong and persistent northeasterly/easterly winds, Figure 1.

These atmospheric conditions implied a long fetch over the western Mediterranean and, as a result, waves of very high amplitude were generated and reached the Spanish coasts causing flooding of coastal areas and damaging to coastal infrastructures and beaches.

This wave event was particularly strong in Barcelona, Tarragona, Valencia (Figure 2), the Ibiza Channel and Cabo de Palos where the maximum wave significant heights recorded on January 21st, 2017 were 30-50% higher than the 2006-2016 January maxima: **significant waves heights¹ exceeding 6 m were registered; 2 m above the highest records from the last 11 years.**

¹The statistical measure for wave height corresponding to the average 1/3rd highest waves (H1/3).

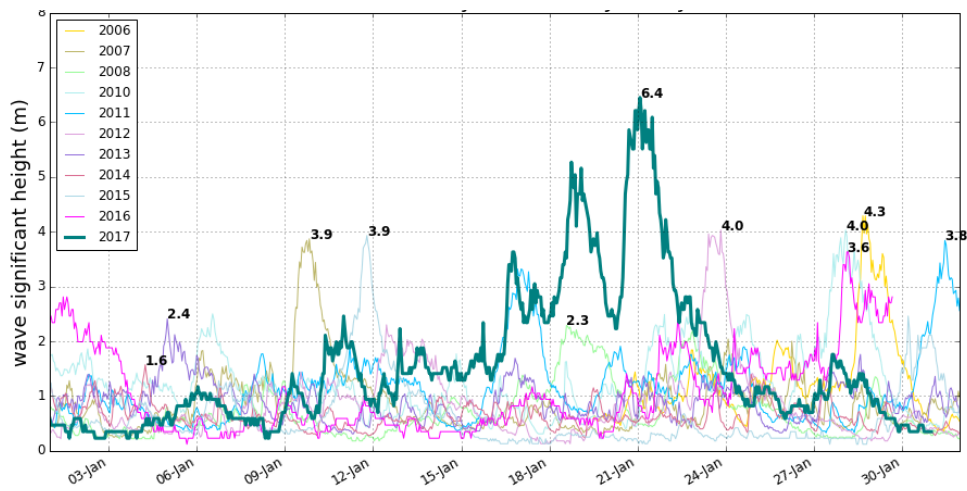


Figure 2. Hourly wave significant heights (m) recorded at the Valencia station for the last 12-year months of January. Maximum of every January is indicated.

Those abnormally high significant wave heights implied maximum wave heights of 10 m (~1.6*significant wave height) which give us a more practical glimpse of the situation. This was for example the case of the Ibiza Channel station, whose buoy recorded max wave heights of 10.1 m at 20:00 pm this same day. It is important to note that 10 m waves in the Mediterranean imply extremely steep and therefore potentially destructive waves.

The CMEMS INSTAC moorings network was instrumental in characterizing the atmosphere-ocean conditions. In particular, fixed moorings deployed by Puertos del Estado along the Iberian shelf, from Barcelona to Cabo de Palos since 2005, and also in the offshore area of the Ibiza channel at 800 m depth by SOCIB since 2013 (Figure 3) provided high resolution *in situ* met-ocean data such as for example hourly significant wave heights.

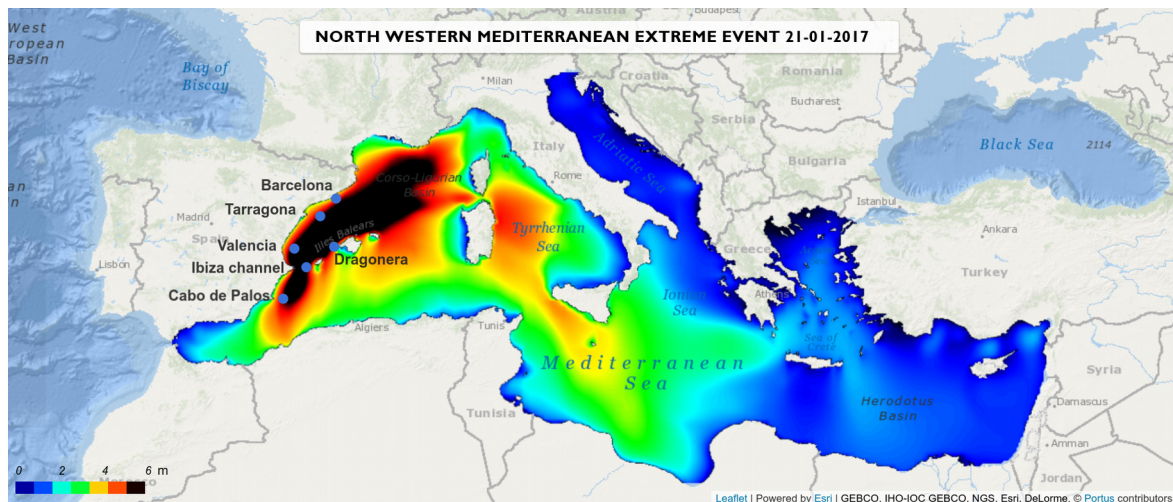


Figure 3. CMEMS *in situ* buoys network and Puertos de Estado wave forecasting system in the North-western Mediterranean on 21-01-2017.

The strong wave event from January 2017 was well reproduced and predicted by the Puertos del Estado wave forecasting system (Figures 2 & 4). Figure 2 shows the model forecast area of significant waves above 6 m that is in good agreement with observations and Figure 4 presents the model forecast comparisons with the Valencia mooring *in situ* data showing the **capability and reliability of the model forecasts**, as well as small discrepancies in the amplitude.

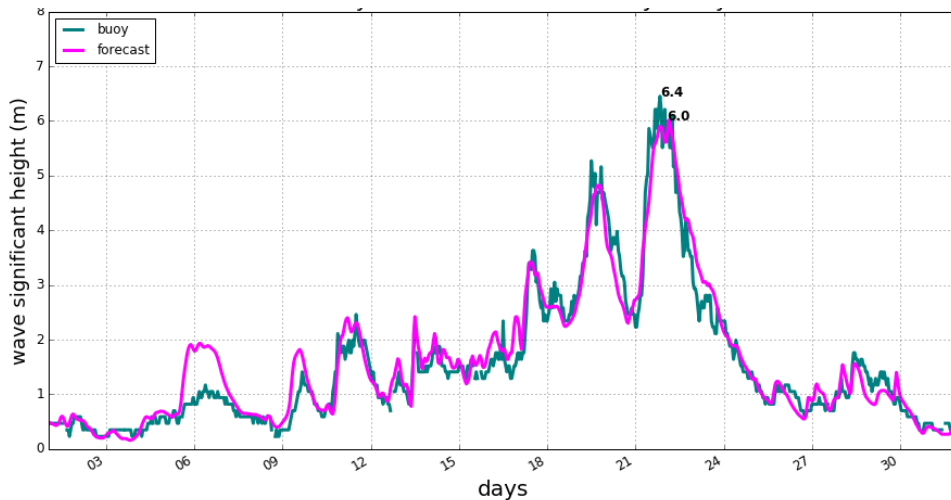


Figure 4. Daily wave significant heights (m) during January 2017 from CMEMS *in situ* data and Puertos del Estado wave forecasting system at the Valencia station.

***In situ* data are key to assess model results and enhance our forecasting skills in order to adequately respond to society needs.**

BENEFITS FOR USER

1. Model Forecast Systems need met-ocean info from insitu measurements along all their life phases (design, construction & exploitation). Puertos del Estado is covering these needs, with strong use of CMEMS NRT measured data (PdE complements its networks with data from in-situ TAC) among others CMEMS products (i.e Multi-Year Reanalysis products).

FACTS AND KEY NUMBERS

Puertos del Estado Portus Observatory: 25 Buoys, 39 tide gauges, 20 met stations, 8 HF radars. **Now, additional data obtained via CMEMS in-situ TAC**

CMEMS PRODUCT IN USE

INSITU NRT PRODUCTS IN THE WESTERN MEDITERRANEAN AREA:

http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_IBI_NRT_OBSERVATIONS_013_033

http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=INSITU_MED_NRT_OBSERVATIONS_013_035