Article

Analysis of Sea Storm Events in the Mediterranean Sea: The Case Study of 28 December 2020 Sea Storm in the Gulf of Naples, Italy

Alberto Fortelli [1], Alessandro Fedele [2], Giuseppe De Natale [2,3], Fabio Matano [4,*], Marco Sacchi [4], Claudia Troise [2,3] and Renato Somma [2,5]

Supplementary material

S1. Explanation of the used terminology

Each measured wave record is unique and never repeats itself exactly, due to the random composition of waves propagating on the sea surface, depending on the variability of triggering wind event. But if the sea state is "stationary", the statistical properties of the distribution of periods and heights will be similar from one record to another.

The most appropriate parameters to describe the sea state from a measured wave record are therefore statistical. The following are frequently used:

1. H is the average wave height
2. Hmax is the maximum wave height occurring in a record
3. Tz is the average zero-crossing wave period; the time obtained by dividing the record length by the number of downcrossings (or upcrossings) in the record
4. H1/n is the average height of the 1/n highest waves (if all wave heights that make up the record are arranged in descending order, the one-nth part, containing the highest waves, should be taken and H1/n is then computed as the average height of this part)
5. T(H1/n) is the average period of the 1/n highest waves

A commonly used value for n is 3:

1. H1/3 is defined "significant wave height" and is indicated with Hs. Hs is well representing the sea waves state since it approximates the height of the waves that stand out and are therefore better distinguishable in the chaotic sea surface during a sea waves event
2. T (H1/3) is the significant wave period (approximately equal to the wave period associated with the spectral maximum), and is indicated as Ts

The Run up is the level reached by the wave crests as a direct consequence of the superposition of sea waves motion on lifted sea level, depending on astronomical and meteorological forcing factors. R100 is the value of Run up statistically related to T100 (Return Period T equal to 100 years).

S2. Gröen and Dorrestein nomogram comment

In 1976 Gröen and Dorrestein developed a set of curves aiming to evaluate wave height and period, given the wind speed, fetch length and wind duration, and the effects of refraction and shoaling. These graphs have been constructed to fit visually assessed wave heights and periods and are thus called "characteristic" height (Hc) and period (Tc), as distinct from significant height (H1/3) and mean period (Tz). There is uncertainty about the relationship between the visually and instrumentally derived quantities, but it appears that some bias (Hc and Tc both being slightly higher than H1/3 and Tz respectively) may need to be kept in mind when using this type of graph. However, the systematic errors are generally small compared with the random errors in individual observations.