

Height of large waves changes according to month

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A team of researchers from the University of Cantabria, Spain, has developed a statistical model that makes it possible to study the variability of extreme waves throughout the year, according to the journal *Coastal Engineering*. The study has shown that there are seasonal variations in the height of waves reaching Spain's coasts, and stresses the importance of this data in planning and constructing marine infrastructures.

"Anybody who observes waves can see that they are not the same height in winter and summer, but rather that their height varies over time, and we have applied a 'non- seasonal' [statistical model](#) in order to measure extreme events such as these", Fernando J. Méndez, an engineer at the Institute of Environmental Hydraulics at the University of Cantabria and co-author of a study published recently in the journal *Coastal Engineering*, tells SINC.

The new model can chart the pattern of extreme waves "with a greater degree of reliability", by studying 'significant wave height' (H_s) in relation to a specific return period. The H_s is the representative average height of the sea, provided by buoys (it is calculated by measuring one in three of the highest waves), and the return period is the average time needed for the event to happen.

For example, if a wave height of 15 metres is established at a certain point on the coast with a return period of 100 years, this means that, on average, a wave of 15 metres could reach this point once every 100

years. "This can be very useful when it comes to building an oil platform in the sea or a particular piece of coastal infrastructure", explains Méndez.

The researchers have used data recorded between 1984 and 2003 by five coastal buoys located near the cities of Bilbao, in Vizcaya; Gijón, in Asturias; La Coruña, Cádiz and Valencia in order to demonstrate the validity of their model. The results show that extreme Hs values vary according to location and the month of the year.

The meteorological component of extreme waves

The results showed a similar seasonal variation between waves in Bilbao and Gijón, with waves being less than four metres high between May and September, but increasing after this to reach an average height of seven metres between December and January. The period of large waves in La Coruña extends from October to April, because of the city's westerly position and resulting exposure to more prolonged winter storms.

The Atlantic coast of Cádiz, meanwhile, reflects the characteristic calm of this area of sea between July and September, with Hs values below two metres. The figures for December and January, however, can vary a great deal from one year to another, reaching wave heights in excess of six metres.

Waves on the Mediterranean coast at Valencia measure between 3 and 3.5 metres from September until April, although the graphics reveal two peaks during this period, one of which coincides with the start of spring and the other with the autumn months, during which the phenomenon of the gota fría occurs. (Gota fría events are atmospheric cold air pools that cause rapid, torrential and very localised downpours and high winds).

"All these data are of vital importance in terms of coastal management, since they can establish the risk of flooding and are indispensable for the carrying out of marine construction work, for example infrastructure built close to the coast", Melisa Menéndez, another of the study's authors, tells SINC. "In addition, they make it possible to calculate the likelihood of a maritime storm occurring".

The researcher also stresses that this information could be very useful in helping to better understand some biological processes, such as how the distribution of marine animals is affected by wave swell, and seaweed growth rates, as well as geological processes, such as how particulates and sediments are transported along the [coast](#).

Extreme value theory

The model developed by the Spanish scientists is based on 'extreme value theory', a recently-developed statistical discipline that aims to quantify the random behaviour of extreme events. The latest advances in this field have made it possible to better study climatic variability at various scales - over a year (seasonality), over consecutive years or decades (which allows climatic patterns to be derived), and over the long term (providing trends).

The study into extreme waves is on the seasonal scale, but the team has also studied extreme sea level values over almost a 100-year period, thanks to data gathered during the 20th Century by a mareograph located in Newlyn, in the United Kingdom. The scientists have already started to obtain information about extreme swell and sea level values at global level as part of a United Nations project to study the sea's impacts on coasts all over the planet, and how these affect climate change.

Source: FECYT - Spanish Foundation for Science and Technology

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