Scientists warn about decoupling warming trend when detecting marine heat waves

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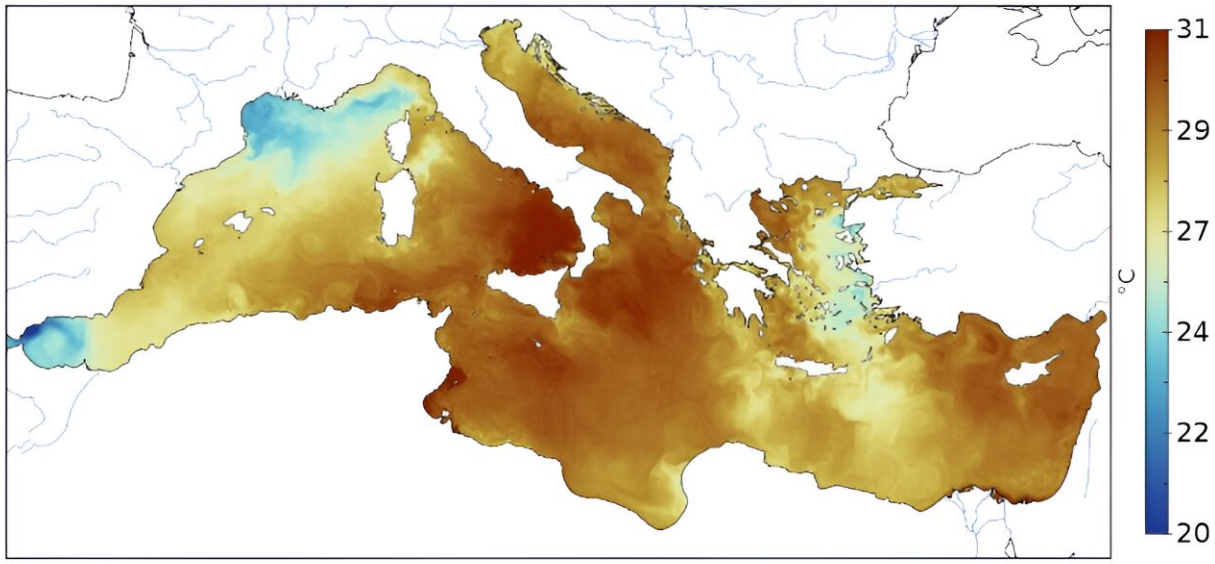

Map of the surface temperature of the Mediterranean Sea corresponding to July 24, 2023 from Copernicus / ICM-CSIC. Credit: Copernicus / ICM-CSIC

The climate crisis is severely affecting marine ecosystems around the world and the Mediterranean is not an exception. Marine heat waves associated with this crisis are causing massive mortality events throughout the basin. Given this scenario, their correct definition and characterization become a key element in defining possible future

scenarios.

Now, a new study by the Institut de Ciències del Mar (ICM-CSIC) and the Institute of Marine Sciences of the National Research Council (CNR-ISMAR) has revealed how decoupling global warming trends affects the definition of marine heat waves characteristics. According to the authors, this would be the cause of an apparent magnification of the frequency and intensity of this type of extreme events.

To prepare the work, recently published in the journal *Frontiers in Marine Science*, the authors analyzed a data set corresponding to the surface temperature of the Mediterranean Sea collected during the last 41 years (1982–2022) by the Copernicus Marine Monitoring Service (CMEMS).

"Our results show that when temperature data are analyzed without trend correction during the study period, marine heat waves are not properly detected and their characteristics, such as frequency, intensity or duration, are biased," explains J. Martínez, researcher at the ICM-CSIC and first author of the study.

Thus, analyzing surface temperature anomalies without correcting the trend produces an increase in the frequency and intensity of marine heat waves in the last years of any time series studied, which results in the underestimation of marine heat waves that occurred longer ago. According to the authors, this would be linked to a warming trend in the region and not to the actual change in heat wave characteristics.

"Correcting the series by removing the trend from the data allows us to distinguish and separate between long-term warming and transient and abrupt changes in surface temperature (heat waves), obtaining a more accurate description of the properties of marine heat waves," adds J. Martínez in this regard.

Main heat waves in the Mediterranean

The study also publishes a catalog of the main heat waves occurred in the Mediterranean since 1982. In total, during the period analyzed, 15 marine heat waves classified as severe and five as extreme (1989, 1993, 1999, 2001 and 2007) were detected.

These include the events of 1999, with the greatest surface area affected in the entire series, and the 2003 event, which affected all the Mediterranean sub-basins with high average and maximum intensity values (up to 7 ºC higher than usual) for 94 days. This event also coincided with an atmospheric heat wave throughout the European continent.

Finally, the study authors highlight an event occurred last year that lasted from May to December (131 days), although in this case the intensities were lower than in the 2003 event.

All in all, the work evidences the influence of climate change on the Mediterranean warming, which makes marine heat waves have greater effects.

"This is a significant challenge for the management and conservation of marine ecosystems in the region, although it is very valuable information for future studies on the impact of the climate crisis on the ocean at a time of particularly alarming sustained warming," conclude the authors, who maintain a daily monitoring system of marine heat waves in the Mediterranean that can be accessed at this link.

More information: Justino Martínez et al, Evolution of marine heatwaves in warming seas: the Mediterranean Sea case study, *Frontiers in Marine Science* (2023). DOI: 10.3389/fmars.2023.1193164

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