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## Anticipating the Future: The 2022 Heatwave as a Harbinger of Climate Extremes in the Mediterranean Region.

Ernesto Tejedor et al. ▶

The Mediterranean basin, home to over 510 million people and characterized by unique geography, a rich cultural landscape, and economies heavily dependent on tourism, has emerged as the critical focal point for climate change impacts. In fact, it experienced an unprecedented heatwave in the warm season of 2022. With a temperature anomaly of +3.6°C, it was the most severe event recorded in the last millennium. In this study, we analyzed the 2022 extreme warm season by placing it within three distinct frameworks: instrumental data, millennial-length historical context, and future climate projections. Our analysis reveals that climate change has significantly increased the frequency of such extreme events, historically occurring once in 10,000 years, to now potentially as often as every 7 to 75 years depending on future climate scenarios.

We also compared projections from EURO-CORDEX models, which are recognized for their superior spatial resolution and enhanced ability to accurately represent regional climate dynamics and trends, against CMIP6 outputs. A key finding is the significant discrepancy in return period projections under the SSP2-4.5 scenario: CMIP6 models forecast these extreme events to recur once every 7 years, whereas EURO-CORDEX predicts a frequency of once every 75 years. While the performance of CMIP6 models is broadly comparable to that of CMIP5 models (employed in EURO-CORDEX), indicating modest enhancements in modeling capabilities for extreme events, it is notable that the CMIP6 ensemble predicts more pronounced warming in the Mediterranean compared to the CMIP5 ensemble.

The rapid emergence and severity of these events underscore the urgent need for effective adaptation strategies and a reevaluation of projections to better prepare Western Mediterranean countries for future climate risks. This study aims to deepen understanding of these dynamics, offering insights that could help guide regional response efforts and support the development of policies to enhance climate resilience, emphasizing the critical role of refined, high-resolution models like EURO-CORDEX in capturing and responding to these trends.

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