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EM-MHeatWaves: Eastern Mediterranean marine heatwaves - Ocean responses to atmospheric forcing and impacts on marine ecosystems

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Even before the introduction of the term “Marine Heat Wave” (MHW) and its statistical definition in global-scale studies, the scientific community had studied and recorded potentially harmful impacts of persistent conditions of warm surface layers and highly stratified water columns on the marine ecosystem. The main triggers for MHWs are yet not well understood and the current knowledge is mainly based on mass mortalities linked to temperature anomalies. EM-MHeatWaves is an interdisciplinary, collaborative, DAAD/IKYDA funded research project that investigates the atmospheric forcing, oceanic circulation and ecosystem response of MHWs in the Eastern Mediterranean Sea over the past 35 years. Two universities (Justus-Liebig-University Giessen, University of the Aegean) and one research center (Hellenic Centre for Marine Research) re-examine the definition of MHWs with emphasis on the Eastern Mediterranean by applying a holistic approach that includes reverse-engineering using model data and reanalysis covering the period 1985 to 2014. We focus on the Eastern Mediterranean because of the high sensitivity of the basin’s ecosystem to atmospheric and marine warming events, the invasion of tropical alien (Lessepsian) species, the characteristic oceanic circulation with the Eastern Mediterranean Transient events, the exchange with the Black Sea through the Turkish Strait System as well as the coastal upwelling areas. In order to study the spatiotemporal characteristics of Eastern Mediterranean MHWs we work towards a better understanding of the oceanographic processes as well as of the compounding character of the atmospheric contribution. Based on the response of marine biogeochemical cycles (depletion of subsurface oxygen levels, observed changes in the mixed layer and chlorophyll maxima depths, nutrient stoichiometries, carbon uptake and sequestration rates) and their impacts on ecosystems (i.e. shifts in planktonic and benthic community regimes, mass mortality events, disease outbreaks, etc.), triggered by the rise of ocean temperatures, we study the statistical characteristics of the oceanic temperatures and assess the corresponding ocean circulation, the synchronous and lagged contribution of the large scale atmospheric circulation. We further study the signature of these extreme Mediterranean MHW events in future projections from model runs with respect to duration, severity and spatial extent

and compare them to reanalysis.
EM-MHeatWaves aims at strengthening the partnership between the German and Greek institutions by conducting joint research at a high scientific level.