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Basin scale dissolved oxygen interannual variability of the Mediterranean Sea: Analysis of long-term observations

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The Mediterranean Sea is characterized by a combination of long-term trends and climatic shifts known in the literature as “transients”, that impact the biogeochemical processes. We focus on the dissolved oxygen (DO) concentration, as it is an essential oceanic parameter for the marine ecosystem functioning. Dissolved oxygen distribution in the ocean interior is controlled by air-sea interaction processes, ocean circulation patterns, and biological effects. Understanding the related mechanisms and the variability of the above processes requires systematic oceanographic measurements over long periods and at high spatial resolution. Taking advantage of the Mediterranean monitoring systems, we can examine the sensitive physical and biogeochemical processes in the Mediterranean ecosystem. In this study, we investigate and combine all available data of temperature, salinity and dissolved oxygen over the period 1960-2011 (taking into consideration the scarcity of the available DO observations during the last years). In order to receive a direct and accurate evaluation of the interannual changes in the Mediterranean Sea, we constructed a gridded dataset interpolated into $1/8^{o}$ x $1/8^{o}$ grid using Data-Interpolating Variational Analysis (DIVA). At the surface layer, the solubility-driven changes determine the dissolved oxygen concentration. In deeper layers, the interannual variability is more related to dynamical processes that may involve dense-water convection, biological consumption or mixing, rather than temperature trends. The observed changes in minimum/maximum oxygen zones are mostly related to abrupt shifts. The attribution of the observed variability involves complex physical and biogeochemical processes as well as anthropogenic activities and requires further analysis using modeling techniques and available operational tools.

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