

Ocean Monitoring Indicators for the Mediterranean Sea biogeochemistry derived from a high-resolution reanalysis

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In recent years the interest in multi-decadal reanalyses of the status of the Mediterranean marine ecosystem has been rising constantly, also in light of the need of information for a proper implementation of European directives (e.g. MSFD). State-of-art reanalyses of the Mediterranean Sea biogeochemistry - being an optimal integration of multi-platforms data and numerical models - constitute an extremely relevant source of information in evaluating the ecosystem status at basin and sub-basin scale. Furthermore, they provide highly valuable data to be used as boundary conditions for local studies.

The objective of this work is to produce sensible environmental indicators useful to characterize the environmental status of the Mediterranean starting from an upgraded high-resolution reanalysis of Mediterranean Sea biogeochemistry delivered in the frame of the Copernicus Marine Environment Monitoring Services (CMEMS). The reanalysis was qualified by a comparison against several available data sets, in terms of the main surface and sub-surface biogeochemical essential climate variables (chlorophyll, carbon dioxide partial pressure, ocean acidity, nutrients, oxygen). The reanalysis outputs reproduced spatial patterns, seasonal cycle and inter-annual variability of the assessed variables, allowing for a proper description of recent trends and present status of the Mediterranean Sea biogeochemistry. Our results confirm the vision of the Mediterranean as a mainly oligotrophic ecosystem with the presence of significant biogeochemical gradients from the eastern to the western sub-basins (e.g. in chlorophyll, nutrients, primary production).

Our reanalysis can be used to contribute estimating eutrophication MFSM descriptors, atmospheric carbon sequestration fluxes, first assessment of potential resources available for the higher trophic levels and more. Indeed, the reanalysis data set provides a suitable basis for the estimation of the so-called Ocean Monitoring Indicators (OMIs) and Essential Biogeochemical Variables (EBVs), developed within CMEMS for the Ocean State Report. Some of the OMIs that have been proposed so far for the Mediterranean biogeochemistry include indicators describing: the influence of physical forcing on ecosystem (e.g. mixed layer depth); the basic ecosystem status, functioning and changes (e.g. nutrient concentration, oxygen content, chlorophyll and their variability at monthly/seasonal/annual/decadal scale); the ecosystem health (e.g. anoxia indicators, N/P ratio); the relation of ocean ecosystem with fisheries (e.g. integrated primary production, phyto/zooplankton biomasses) and climate change (e.g. acidification, CO₂ fluxes).

Recent results in the Mediterranean Sea OMIs investigation will be widely discussed in our contribution.