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Biogeochemistry and plankton variabilities in the Mediterranean Sea: a long-term 3D coupled modelling approach

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The Mediterranean Sea is a semi-enclosed basin between Europe, Asia and North Africa. Around half a billion people (7% of the world population) live in this region, in 22 countries. The Mediterranean Sea is crossed by about one third of the world's total merchant shipping each year, representing a strong anthropogenic pressure on its ecosystems. Additionally, important climatic differences between Africa and Europe make the Mediterranean Sea a high gradients area, and thus can explain why it is very sensitive to climate change. Indeed, changes in temperature and salinity have already been observed in its deep waters. The semi-enclosed sea displays hydrodynamical processes which can be observed on a global scale, such as a thermohaline circulation or dense water formations, and a wide variety of trophic regimes. Studying environmental changes in the Mediterranean Sea can therefore bring insights for the global ocean. In this context, we propose to investigate the impact of climate and anthropogenic changes on the Mediterranean Sea pelagic planktonic ecosystems. A long-term historical simulation (hindcast) is performed in order to evaluate these changes. The regional ocean model NEMO-MED12, computing the circulation at a 1/12° resolution, is used to force offline the biogeochemical model ECO_3M-S. After a validation of the simulation with existing data, a focus is made on the interannual variability of our key variables for the studied period: biogeochemical cycles are discussed, and nutrients budgets are computed on a basin scale. Finally, estimations of subsequent primary production and the structure of projected planktonic ecosystems are analysed.