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Spatio-temporal variability of phytoplankton dimensional classes in the Mediterranean Sea from satellite data

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Phytoplankton contributes to fix half of the carbon dioxide released on Earth, becoming a key component not only in the carbon cycle, but also in several biogeochemical cycles. It is involved in the control of greenhouse gases and, consequently, in the effect of climate change on marine system. Therefore, phytoplankton is often considered one of the most common bio-indicator for any environmental changes, which, in turn, can affect the algal community composition and structure. The alteration of the biological, physical and chemical conditions in the ocean can be reflected in the algal assemblage structure, in terms of variation of dominant size class and taxonomic composition.
In this work, the seasonal and year-to-year variability of the phytoplankton size class (PSC) spatial distribution has been examined in the Mediterranean Sea using ten year of satellite observations.
The estimation of PSCs from space is based on relationship between chlorophyll a (Chl a) and diagnostic pigments that should be verified at regional scales. Our analysis shows that the Mediterranean pigments ratios differs from the global ones; therefore, we regionalized the mathematical relation existing between the Chl a and the diagnostic pigments, used in the in situ PSC identification.
This regionally tuned relation allowed to improve the estimation of PSCs from space by reducing the observed bias between modelled and measured PSCs.
The analysis of PSC satellite time series allowed, for the first time, to have a quantitative description of the seasonal and inter-annual variability of the spatial distribution of the algal community in the Mediterranean Sea. The results demonstrated that the pico-phytoplankton contributes with high values to the total Chl a, especially in summer and in ultra-oligotrophic environments, such as the Levantine basin. Micro-phytoplankton contribution results high during spring bloom period in offshore areas, characterized by a strong water mixing; while, in coastal areas, such as the North Adriatic Sea, micro-phytoplankton fraction on Chl a is constant, all over the year. On contrary, the contribution of nano-phytoplankton seems to be quite constant (30-40%) over the basin, with higher values in the western basin. At sub-basin scale, the largest interannual variability occurs in specific areas, e.g. Northwestern Mediterranean Sea, influenced by physical processes, which strongly control the nutrients availability.
In absence of sufficient in situ data of community composition, our analysis underlines the potential use of ocean colour data for monitoring the phytoplankton assemblage in the Mediterranean Sea.