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Interactions between phytoplankton organisms and key carbonate system properties in the southern Adriatic Sea: seasonal variability within an annual cycle

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Although the impact of CO_2 uptake on ocean chemistry has been recognizing for the last decades, ocean acidification has emerged as a key issue of global concern in less than a decade. Studies of the impacts on marine organisms, ecosystems and biogeochemical processes are only at the beginning and the results are still contrasting. In open sea, the pool of particulate organic carbon is mainly determined by phytoplankton production (controlled by light and nutrient availabilities). However pH and key carbonate system properties (AT, DIC, calcium carbonate saturation states), influencing phytoplankton population and communities can play a fundamental role in determining the autothrophic production and its cycle. In the perspective of lighting possible impacts of climatic changes on natural phytoplankton communities of the Southern Adriatic open sea region, this contribute describes the relationships between pH/carbonate system and the phytoplankton during almost one year (Sept 2007-June 2008), with particular regard to calcareous phytoplankton. A few seasonal campaigns were conducted within the frame of the Italian VECTOR project, on a repeated section from Bari to Dubrovnik.
The dynamics of phytoplankton community have been analyzed considering the export of particulate organic matter from the photic layer (collected in sediment traps at 150 m).
The phytoplankton cycle from September 07 to late June 08 was determined analysing samples collected from CTD bottles. It appears to be characterized by short time blooms of different groups: in autumn the main component (62%) was represented by siliceous plankton (diatoms), in late winter calcareous plankton (coccolithophores) reached 31% of total biomass, whereas flagellates appeared the dominant group (84%) during summer. Downward fluxes of organic carbon (at 150 m), strictly depending on the upper layer autotrophic activity, were well correlated with carbonate fluxes. A succession of different dominant productive groups was observed through the year (confirming the very dynamic seasonal pattern of species composition). Blooms were relatively short time events (less than 15 days): diatoms showed peaks in late winter-spring, while coccolithophores showed an evident bloom in February. Biogeochemical conditions (nutrients, dissolved oxygen, AT, DIC, pH) fitted well to the described phytoplankton biomass abundances and species composition; in particular the decrease of both AT and DIC between February and June suggest the occurrence of calcification process, in good agreement with calcareous plankton bloom observed as a peak in the sediment traps.
The relevance of calcareous community in Southern Adriatic Sea is evidenced by the BSi /$CaCO_3$ ratio in sediment trap samples. Regarding the export of particles, the southern Adriatic can be considered a carbonate system with short-time, silica-dominated events (mainly occurring in the period March-April).