EGU21-15201
https://doi.org/10.5194/egusphere-egu21-15201
EGU General Assembly 2021
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Biogeochemical and ecological features of sinking particulate matter in the deep Ionian Sea (E. Mediterranean) during a 10-year time series study: impacts of atmospheric and oceanographic variabilities on carbon production and sequestration

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Biotic and abiotic processes that form, alter, transport, and remineralize particulate organic carbon, silicon, calcium carbonate, and other minor and trace chemical species in the water column are central to the ocean's ecological and biogeochemical functioning and of fundamental importance to the ocean carbon cycle. Sinking particulate matter is the major vehicle for exporting carbon from the sea surface to the deep sea. During its transit towards the sea floor, most particulate organic carbon (POC) is returned to inorganic form and redistributed in the water column. This redistribution determines the surface concentration of dissolved CO_2, and hence the rate at which the ocean can absorb CO_2 from the atmosphere. The ability to predict quantitatively the depth profile of remineralization is therefore critical to deciphering the response of the global carbon cycle to natural and human-induced changes.

Aiming to investigate the significant biogeochemical and ecological features and provide new insights on the sources and cycles of sinking particulate matter, a mooring line of five sediment traps was deployed from 2006 to 2015 (with some gap periods) at 5 successive water column depths (700, 1200, 2000, 3200 and 4300 m) in the SE Ionian Sea, northeastern Mediterranean ('NESTOR' site). We have examined the long-term records of downward fluxes for Corg, N_{tot},

δ^{13}Corg and $\delta^{15}N_{tot}$, along with the associated ballast minerals (opal, lithogenics and $CaCO_3$), lipid biomarkers, Chl-a and PP rates, phytoplankton composition, nutrient dynamics and atmospheric deposition.

The satellite-derived seasonal and interannual variability of phytoplankton metrics (biomass and phenology) and atmospheric deposition (meteorology and air masses origin) was examined for the period of the sediment trap experiment. Regarding the atmospheric deposition, synergistic opportunities using Earth Observation satellite lidar and radiometer systems are proposed (e.g. Cloud-Aerosol Lidar with Orthogonal Polarization - CALIOP, Moderate Resolution Imaging Spectroradiometer - MODIS), aiming towards a four-dimensional exploitation of atmospheric aerosol loading (e.g. Dust Optical Depth) in the study area.

Our main goals are to: i) develop a comprehensive knowledge of carbon fluxes and associated mineral ballast fluxes from the epipelagic to the mesopelagic and bathypelagic layers, ii) elucidate the mechanisms governing marine productivity and carbon export and sequestration to depth and iii) shed light on the impact of atmospheric forcing and deposition in respect to regional and large scale circulation patterns and climate variability and the prevailing oceanographic processes (internal variability).

Acknowledgments

We acknowledge support of this work by the Action ‘National Network on Climate Change and its Impacts – **CLIMPACT**’, funded by the Public Investment Program of Greece (GSRT, Ministry of Development and Investments).