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Investigating microbial parameters for the characterization of biogeochemical variability in the Mediterranean sea

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In the oceans, the biological pump of carbon modulates the CO_2 exchanges with atmosphere and regulates the functioning of the marine ecosystems by means of the equilibrium between microbial production and respiration. Moreover, biological pump can mitigate the green house effect by increasing the CO_2sequestration in the marine depths. Nevertheless, up to date the interdependence between climate, carbon cycle and microorganisms has not been well defined. Moreover, study on production in euphotic layers has been emphasized in spite of remineralization, which occurs along the entire water column.

In the context of global climate changes, the Mediterranean Sea proved to be an ideal basin for mesoscale studies of oceanic processes. It is a semienclosed basin where several ocean dynamics take place and its small size, the lateral transport of organic matter from its shelf and the brief residence time of its deep waters have allowed to study the climatic event called Eastern Mediterranean Transient (EMT) here occurred in nineties.

In this paper, we refer on microbial processes involved in the C biogeochemistry in the Mediterranean sea as indicators for assessing climate changes. A synoptic picture of the studies performed on microbial biogeochemical activities in the frame of several multidisciplinary oceanic surveys (SESAME, VECTOR-Carpel, PRISMA2, CIESM,

POEM-Liwex) is reported, with the aim of estimating the significance of microbial metabolism in relation to climate variability.

From a microbiological point of view, the Mediterranean Sea results a very sensitive ecosystem to climate variability and unstable in its trophic equilibrium.

At depth, the microbial metabolism highlights the tight coupling between biological processes and circulation patterns and undergoes some important modifications as a consequence of the EMT impact on “young” labile organic matter.

In the photic layers, the temporal proximity of heterotrophic and autotrophic events on seasonal scale suggests that the Mediterranean Sea is an unstable system reacting to changing environmental conditions. The occurrence of seasonal trophic imbalances in this oligotrophic ecosystem confirms its vulnerability to climate changes, suggesting that climatic phases of cooling and heating could conversely stimulate microbial community to make the Mediterranean Sea a source or sink of CO_2, respectively.