Geophysical Research Abstracts
Vol. 20, EGU2018-8352, 2018
EGU General Assembly 2018

Appraisal of quantitative biomarker palaeoproductivity proxies using satellite color data

Maria Raja (1), Eric Galbraith (1,2), Antoni Rosell-Mele (1,2)

(1) Autonomous University of Barcelona, Institute of Environmental Science and Technology, Spain (maria.raja@uab.cat), (2) ICREA, Barcelona, Catalonia, Spain

Ocean primary productivity is a key element of the marine carbon cycle. However, its quantitative reconstruction in the past relies on the use of biogeochemical models as the available proxy approaches are qualitative at best. Here, we use satellite ocean color data to evaluate the uncertainties and constraints in the use of phytoplanktonic biomarkers (i.e. chlorins and alkenones) as quantitative proxies to reconstruct past changes in marine productivity. We compare biomarkers contents in a global suite of core-top sediments to sea-surface chlorophyll-a abundance estimated by the SeaWIFS, MERIS, MODIS and VIIRS satellite missions over the last 20 years. We assess sources of uncertainty related to the organic proxies, but also to the satellite data. In that sense, we exclude from our analysis satellite observations from regions where the sea-surface estimates do not reflect in situ chlorophyll-a measurements. Our findings show that both sedimentary chlorins and alkenones can be used to quantitatively track total sea-surface chlorophyll-a abundance, and thus to infer past primary productivity. Estimates from chlorins records have lower uncertainty than from alkenones. However, diagenetic processes are likely to preclude the application of the chlorin proxy to oligotrophic areas, while alkenones concentrations in sediments correlate linearly with sea-surface chlorophyll-a throughout the whole range of biogeochemical regions investigated. These results allow us to place new constraints in the interpretation of biomarker-productivity records, and identify those stratigraphic intervals where the signal is representative of degradation rather than productivity. Conversely, the different diagenetic behavior between biomarker proxies can be used to infer water column properties related to organic matter preservation. In addition, we also show that the use of sediment total organic carbon (TOC) contents is less accurate than chlorins and alkenones as a proxy for sea-surface chlorophyll-a. This is likely due to the occurrence of terrigenous organic matter inputs, and the chemical complexity of TOC. In conclusion, as long as specific constraints are taken into account, our study shows that the sedimentary contents of chlorins and alkenones can be used as quantitative proxies of past primary productivity.