Geophysical Research Abstracts
Vol. 20, EGU2018-7764-1, 2018
EGU General Assembly 2018

Community respiration and ETS activity responses under variable CO_2 and nutrient fertilization during a mesocosm study in the subtropical North Atlantic

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In this study we explore the evolution of oxygen consumption (R) and the enzymatic respiratory activity (ETS) in natural communities (<200μm) enclosed inside mesocosms, treated with different CO_2 concentrations. The experiment lasted 30 days, during which the ecosystem underwent abrupt changes in community structure and biomass through a sharp transition from oligotrophy to highly eutrophic conditions after nutrient-induced fertilization (day 18th). R and ETS did not show any response to CO_2 under oligotrophic conditions, but R increased significantly more at the two mesocosms with higher CO_2 concentrations after fertilization, coinciding with a sharp rise in heterotrophic bacteria and large diatoms. Total organic carbon (TOC) started accumulating from the first days of the experiment, with an increasing proportion of high molecular weight in the chromophoric dissolved organic matter (CDOM), suggesting that either carbon respiration by microorganisms was limited by nutrient availability or that the rate of organic matter production was higher than the rate of uptake and transformation by prokaryotes. The R/ETS ratio was highly variable, ranging more than 3 fold in magnitude during the experiment. Average R/ETS were always significantly higher under oligotrophic conditions (before nutrient fertilization), being R and ETS only significantly correlated during the eutrophic phase. We did not find any significant relationship between the ratio and community structure or biomass. Our results suggest that R/ETS may be too variable in the ocean as to apply constant values to different microplanktonic communities living under contrasting environmental conditions. Thus, until we understand the factors driving the R/ETS changes and are able to constrain the range of variability of the ratio, we should be cautious when deriving actual respiration from ETS, unless we measure the two variables at the same time during fieldwork experiments and cruises.