EGU2020-20597
https://doi.org/10.5194/egusphere-egu2020-20597
EGU General Assembly 2020

Multi-millennial legacy of climate change in marine plankton communities

Anne Strack[1], Lukas Jonkers[1], Marina C. Rillo[2], Helmut Hillebrand[2], and Michal Kucera[1]
[1]MARUM – Center for Marine Environmental Sciences, University of Bremen, Leobener Str. 8, 28359 Bremen, Germany
[2]Institute for Chemistry and Biology of the Marine Environment, Carl-von-Ossietzky University Oldenburg, Schleusenstr. 1, 26382 Wilhelmshaven, Germany

Understanding the response of marine ecosystems to climate change requires knowledge of processes that operate over long time scales. Over the last decades, abundant data have been generated on the change in the composition of marine microplankton assemblages across the last deglaciation. These data were used to reconstruct various aspects of the ocean and climate system during this climatic upheaval; however, their potential to evaluate biotic response to climatic forcing has been rarely explored. Here, we compiled records of plankton response to the last deglaciation covering the entire North Atlantic Ocean. The records comprise assemblage composition data of marine zooplankton (planktonic foraminifera) and phytoplankton (coccolithophores, diatoms and dinoflagellates) covering the last 24 ka with a resolution of at least 1 ka. The comparability of the data is ensured by using either published age models or a combination of radiocarbon ages and correlated oxygen isotope data. We use these records to first determine the shape of the major compositional change in each record by principle components analyses and quantification of compositional turnover. The mean global response of the plankton to the deglaciation was then evaluated by an Empirical Orthogonal Function analysis of the main biotic trends across all sites. A preliminary analysis was run solely on the zooplankton data set as the phytoplankton data set is still work in progress. We find that the dominant response of the zooplankton consists of synchronous unidirectional shifts initiated between 16-17 ka BP, and progressing into the Holocene. When regressed on the global ocean temperature and CO_2 trends, we can see a proportionate response to the forcing during the last glacial maximum, the deglaciation and the early Holocene. In contrast, the late Holocene is characterised by continued compositional change, which does not appear related to environmental forcing. We speculate that this decoupling indicates the existence of a multi-millennial delay in community change following the climatic forcing, likely due to biotic interactions acting on communities that have been newly assembled or geographically displaced due to abiotic forcing. We will present a similar analysis for marine phytoplankton and discuss the consequences of the observations for the understanding of community variability on millennial time scales.