Opposite climatic trend between the East Antarctica margin and the northern hemisphere over the last 2,000 years?

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Abstract

Recent warming impacts Antarctic seasonal sea ice cycle, thus imparting on the physical ocean atmosphere heat and gas fluxes, formation of bottom waters, nutrient distribution and the so-called 'biological carbon pump'. High-resolution investigation of past Antarctic sea ice, biological production and nutrient cycling during the late Holocene is crucial for better evaluating the response of these three major compartments to the anthropogenic-driven climate forcing at the Southern Ocean scale. However, such studies remain scarce. Here we combined new organic biomarkers with diatom census counts to reconstruct sea ice and biogeochemical cycles over the last 2,000 years at the ODP Site U1357 in the Adelie Basin, East Antarctica. The highly branched isoprenoid (HBI) di- and tri-unsaturated alkenes are useful proxies to track past changes in sea ice vs open water conditions. To circumvent issues of origin and alteration of the signal, we developed a novel approach based on the nitrogen isotopic analysis of chlorophyll *a* and derivatives to congruently document changes in nutrient (mostly nitrate) cycling. Our combined records report warmer conditions, lower productivity and weaker nitrate utilization during the Northern Hemisphere Little Ice Age and Dark Ages and colder-icier conditions, and inversely during the Roman Warm and Medieval Warm periods. Our results show the casual relationship between Antarctic climate, sea ice, nutrient supply and regional productivity in the recent past and highlight an anti-phasing climate evolution compared to the Northern Hemisphere.

Keywords: East Antarctica, last 2000 years, biomarkers