Geophysical Research Abstracts
Vol. 14, EGU2012-11676, 2012
EGU General Assembly 2012

Sea ice melting increase in the eastern Barents Sea during the last ca. 500 years

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Climate conditions in the Arctic have changed considerably in the last decades. Sea ice cover is declining, temperatures are rising and the latest projections point to an ice free Arctic ocean at around 2040. To understand better climatic processes on such a sensitive and climatically significant region on the globe it is necessary to gain knowledge on the drivers of climate over time.

Here we show a reconstruction of past sea ice and sea surface temperature (SST) variations in the eastern Barents Sea from sediment core PL96-126 (73º 37.5' N, 50º 43.0' E; 270m water depth) that spans the last ca. 4.400 years (Voronina et al. 2001). To achieve this goal, we used a recently developed biomarker based on highly branched isoprenoid lipid (IP25) synthesized by sea ice diatoms (Belt et al. 2007) to infer variations in past sea ice cover, together with the concentration of alkenones - algae synthesized lipids - from which we also estimated past SST (UK37' index) and fresh water mass variation (%C37:4). At lower resolution, we also analyzed the distributions of terrigenous lipids to obtain information on the origin of the organic matter, and finally the glycerol dialkyl glycerol tetraethers (GDGTs) which give an estimate of past sea surface temperature (TEX86) and air temperature (MBT/CBT indices).

Three climatically distinct periods can be distinguished in the sediment record under study. A period from ca. 4.4 to 2.5 Kyr BP, had a generally stable sea ice cover and relatively short ice melting season, as inferred from the low IP25 and algal lipids concentrations, together with cold and freshened surface water. From ca. 2.5 to 1 Kyr BP there was a transition period with rather unstable conditions characterized by fluctuations in the biomarker indices. From ca. 1 Kyr BP until present, our data indicate a gradual increase in ice melting that accelerated during the last ca. 0.5 Kyr BP.

This is in agreement with a previous reconstruction (Vare et al. 2010) suggesting a reduced sea ice cover for the last centuries. In contrast, a reconstruction for the last 7 Kyr BP from the central Canadian Arctic Archipelago (Belt et al. 2010) interpreted an increase in IP25 flux for the last 0.8 Kyr as higher sea ice occurrence. Here we interpret our IP25 data as suggested by Müller et al. (2011). The recent increase in IP25 represents an acceleration in ice melting during the last 500 years in the Barents Sea.

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