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Reconstructing climatic conditions in the Skagerrak during the last 2000 years using an organic biomarker approach

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The Skagerrak, between Norway and Denmark, is a major sink for fine grained sediment from the North Sea. Sediments are transported by the North Atlantic current, which brings warm water and air to northern Europe, being a key factor for modulating continental climate in this region. The relative sediment accumulation rate in the central and north-eastern Skagerrak can be higher than 1 cm/year, being a unique site for studying the paleoceanographic development of the eastern North Sea and paleoclimatic history of northwestern Europe at high resolution during the Holocene.

Here we show a paleoclimatic reconstruction for the last 2000 years at a decadal scale, obtained from core MD99-2286 located in north-eastern Skagerrak. To obtain past sea surface temperature (SST) estimates, we analyzed organic biomarkers such as the commonly used UK37' ratio based on the relative abundance of alkenones, lipids synthesized by algae, and the more recently proposed TEX86 proxy, based on the relative abundance and distribution of isoprenoid glycerol dialkyl glycerol tetraethers (GDGTs), lipids synthesized by archaea thriving in the water column. To estimate past continental air temperatures we used the MBT/CBT proxy based on branched GDGTs, postulated to be synthesized by soil bacteria. We analyzed chlorins, degradation products of chlorophyll present in the marine sediments to obtain information on past primary productivity variations over time. Our data can be compared to other recent studies conducted in this area analyzing microfossil and sedimentologic proxies, completing the paleoclimatic development history of this region for the last 2000 years. Our results suggest that the North Atlantic thermohaline circulation variability influenced climatic multidecadal variability in northern Europe for the last 2000 years, in agreement with previous studies.