



High-resolution record of sea ice conditions in Fram Strait sheds new light on ice-ocean interactions and climate variability during the late glacial and Termination 1

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Abrupt shifts in the palaeoceanographic setting in the subpolar North Atlantic and a hence significant climate variability characterised the transition from last glacial to deglacial and current interglacial conditions. Knowledge about the crucial role of sea ice coverage during these rapid climate reversals, however, is still limited.

Herein we present a high-resolution reconstruction of the sea ice conditions that prevailed in eastern Fram Strait - the only deepwater passage permitting a substantial exchange of water and ice masses between the Arctic and the Atlantic Ocean - during the late glacial and deglacial period (i.e. from 29 ka to 9 ka BP). The joint analysis of the sea ice biomarker IP25 (Belt et al., 2007) and phytoplankton derived biomarkers allows to distinguish between different sea ice conditions and we further provide an even semi-quantitative assessment of the sea ice cover by means of the PIP25 index (Müller et al., 2011). Information about relative sea surface temperature changes is derived from the so-called DIP25 index (Cabedo-Sanz et al., 2013; Fahl & Stein, 2012). Importantly, the exceptional high temporal resolution of the studied sediment core permits the identification of a hitherto unknown variability in the sea ice coverage throughout the late glacial, which finally culminates in a permanent sea ice cover at the end of the Last Glacial Maximum (LGM). We suggest that the heat flow to the Nordic Seas during this critical time interval of Northern Hemisphere ice-sheet growth was rather pulse-like than continuous as is commonly assumed. This new observation of late glacial short-term fluctuations in the sea ice cover has considerable implications for palaeoceanographic proxy and model studies that focus on the LGM. Furthermore, we consider that the abrupt breakup of the perennial sea ice cover in Fram Strait at about 18 ka BP directly contributed to the weakening of the Atlantic Meridional Overturning Circulation (AMOC) during Heinrich Event 1 (HE1). We contextualise our sea ice reconstructions with published North Atlantic proxy and model data on deglacial (HE1) and Younger Dryas AMOC variability and thus delineate a direct feedback between sea ice coverage and thermohaline processes in the subpolar North Atlantic.

References

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