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Response/feedback of the Arctic Ocean in the Northern Hemisphere climate system: the sea-level joker

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The Arctic Ocean is a major player in the climate system of the Northern Hemisphere due to its role vs albedo, atmospheric pressure regimes, and thermohaline circulation. It shows large amplitude variability from millennial, to decadal and seasonal time scales. At millennial time scales, two drastically distinct regimes prevail primarily in relation with ocean volume and sea level (SL) changes: A modern like system, with a high SL when the Arctic Ocean shelves are submerged and Bering Strait is opened vs a glacial one, with a low SL, when shelves are emerged and partly glaciated and Bering Strait is closed. In the modern system, large submerged shelves result in high productivity, high sea-ice production rates and sea ice-rafting deposition in the Central Arctic. Moreover, a fully open Bering Strait, with SL at the present elevation, contributes about 40% of the freshwater budget of the Arctic Ocean (Woodgate & Aagaard, 2005, doi:10.1029/2004GL021747), and supports Si fluxes of about 20 kmol.s^{-1} towards the Western Arctic (Torres-Valdés et al., 2013, doi:10.1002/jgrc.20063), thus impacting primary productivity. Under low SL conditions, the Arctic Ocean is linked exclusively to the North Atlantic, through practically a single gateway, that of Fram Strait. Sedimentation in the Central Arctic is then dominated ice-rafting deposition from icebergs, thus controlled by streaming and calving processes along surrounding ice sheets. Due to its shallowness (< 50 m), the Bering Strait gateway becomes effective at a very late stage of glacial to interglacial transitions but closes early during reverse climate trends. Sedimentary records from shelves North of Strait may provide information on the status of the gateway, so far, for the present interglacial. Clay minerals in cores from the northern Alaskan shelf (Ortiz et al., 2009, doi:10.1016/j.gloplacha.2009.03.020) and micropaleontological tracers from the Chukchi Sea southern shelf (present study) can be used to document the status of the gateway. Here, North Pacific microfossils transported by currents through the gateway demonstrate its full effectiveness at ca 6 ka BP, well after the insolation maximum of the early Holocene but when SL had reached its maximum postglacial elevation, with significant impacts on Arctic Ocean salinity, sea-ice cover and productivity.. This out-of-phase behavior of the Arctic Ocean may have impacted the North Atlantic and Northern Hemisphere climate system, as the openings and closings of Bering Strait constitute critical tipping points on this system, off out of phase with other parameters controlling more globally the climate of the Northern Hemisphere.

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