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Coupled impacts of sea ice variability and North Pacific atmospheric circulation on Holocene hydroclimate in Arctic Alaska

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Arctic Alaska lies at a climatological crossroads between the Arctic and North Pacific Oceans. The modern hydroclimate of the region is responding to rapidly diminishing sea ice driven in part by changes in heat flux from the North Pacific. Paleoclimate reconstructions have improved our knowledge of Alaska's hydroclimate, but no studies have examined Holocene sea ice, moisture, and ocean-atmosphere circulation in Arctic Alaska, limiting our understanding of the relationship between these phenomena in the past. We present a sedimentary diatom assemblage and diatom isotope dataset from Schrader Pond, located ~80 km from the Arctic Ocean. We interpret these new datasets alongside synthesized regional records of Holocene hydroclimate, and sea ice reduction scenarios modeled by HadCM3. The paleo data synthesis and model simulations suggest the early and middle Holocene in Arctic Alaska were characterized by less sea ice, a greater contribution of isotopically-heavy Arctic-derived moisture, and wetter climate. In the late Holocene, sea ice expanded and regional climate became drier. This climatic transition is coincident with a documented shift in North Pacific circulation involving the Aleutian Low (AL) at ~4 ka, suggesting a Holocene teleconnection between the North Pacific and Arctic. The HadCM3 simulations reveal that reduced sea ice leads to a strengthened AL shifted west, potentially increasing transport of warm North Pacific water to the Arctic through the Bering Strait. Our findings demonstrate the interconnectedness of the Arctic and North Pacific on multi-millennial timescales and are consistent with future projections of less sea ice and more precipitation in Arctic Alaska.