Aquatic leaf wax δ^2H in lakes with contrasting residence times reflects Arctic precipitation seasonality

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Arctic precipitation is predicted to increase in the coming century, due to greater northward atmospheric moisture transport and evaporation from ice-free Arctic seas. These two mechanisms have differing seasonal expressions: northward moisture transport dominates during the summer, whereas local evaporation occurs mainly during fall and winter. Quantifying precipitation seasonality during previous warm periods would aid development of a mechanistic understanding of the dynamics controlling Arctic precipitation. We present a method to reconstruct Arctic precipitation seasonality using stable hydrogen isotopes (δ^2H) of aquatic plant waxes in proximal lakes with contrasting water residence times. We apply this method near Disko Bugt, western Greenland. Catchment hydrology suggests that growing season lake water δ^2H in one of our study lakes reflects summer precipitation δ^2H and the other reflects winter-biased precipitation δ^2H. Aquatic plant leaf wax δ^2H in the "summer lake" declines steadily throughout the Holocene, from –205‰ at 9 ka to –230‰ at 2 ka. In contrast, aquatic plant leaf wax δ^2H in the "winter lake" is 100‰ ^2H-depleted from 6 to 4 ka compared to the early and late Holocene. We interpret these records to reflect an increase in winter precipitation amount during the middle Holocene. Increased winter precipitation is coincident with minimum sea ice extent in and maximum oceanic heat transport to Baffin Bay, both of which would have caused greater winter ocean evaporation and a concomitant increase in terrestrial precipitation. This method may be applied to other sites with strong seasonal precipitation isotope variability and minimal lake water evaporative enrichment.