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Characterizing the controls on lake water isotopes for diatom biomarker paleohydrology calibrations.

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The isotopic composition of precipitation and lake water are commonly used to reconstruct past changes in paleohydrology. As part of a study evaluating the use of the hydrogen isotopic composition of diatom-derived highly branched isoprenoids as a paleohydrology proxy, characterizing the controls on lake water isotopes is needed. To accomplish this, we studied lake water isotopes from a suite of 50 lakes from the Adirondacks, New England, Midwest, and Upper Midwest regions. Lakes range in area from 0.02 km^2 to 322 km^2, elevation from 58 m to 664 m, and lake depths up to 38 m. Water chemistry lake profiles were measured including pH, conductivity, temperature, and oxidation-reduction potential (ORP). Integrated water samples were collected and measured for silica, phosphorus, dissolved inorganic carbon (DIC), and alkalinity. Surface, integrated, deep, and 0-5 cm pore waters were collected and analyzed for their water isotopes. Climate data including mean annual precipitation, temperature, and evaporation, along with modeled δ^2H and $\delta^{18}O$ values were calculated for each lake and used to construct local and regional meteoric water lines and lake evaporation lines. Results include largely consistent δ^2H ranges of -78.76 to –25.57‰ from the surface water and -78.18 to -26.12‰ from the integrated water. The lake water isotopes from the Adirondacks and New England concentrate towards the more negative end of the range, while the Midwest and Upper Midwest concentrate at the more positive end of the range. This suggests that the Adirondacks and New England are less evaporative than the Midwest and Upper Midwest regions. Deuterium excess ranges from -13.97 to 11.32‰, New England having the highest concentrations suggests oceanic evaporation as a control in the region. Lake evaporation will be characterized and compared against diatom biomarker-based evaporation estimates as a test of the proxy. Our goal is to evaluate under what conditions the proxy fails to better constrain uncertainties and potential challenges. Our aim is to use this proxy to characterize past changes in lake water evaporation thereby providing societal benefits towards understanding how future hydrological cycles will behave.