Reconstructing lake evaporation extent from simultaneous measurement of D/H ratios on aquatic and terrestrial lipids: a proof of concept

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Abstract. The isotopic composition of lake water is a widely used tool to reconstruct past changes in climate. Evaporation increases the $\delta^{18}O$ and δD of lake water, providing a sensitive indicator for regional aridity. However, the lake water $\delta^{18}O$ and δD values also depend upon the isotopic composition of the water flowing into the lake – a value that is usually not known. Hydrogen isotope analysis of lipid biomarkers from lake sediments has the potential to circumvent this issue, providing a record for the isotopic composition of lake water **and** precipitation δD. Lake water is the ultimate source of hydrogen in lipids from algae and littoral macrophytes growing in the lake. Thus the δD value of these lipids should reflect lakewater δD. Likewise, precipitation is the ultimate source of hydrogen in lipids from watershed vegetation (trees, shrubs and grasses) and these lipids should reflect precipitation δD. Lipid molecules unique to each of these sources are present in lake sediments, providing the potential for determining two useful climate values: the isotopic composition of precipitation and the evaporative enrichment of lake water over precipitation. This proposal will investigate the controls on aquatic and terrestrial lipid δD values from a suite of surface lake sediments. The goal is to evaluate i) which molecules best track water δD values and ii) how well the isotopic difference between aquatic and terrestrial lipids tracks lakewater evaporative enrichment. The results from these surface sediments will be applied to a Holocene lake sediment record from the Venezuelan Andes to provide a proof-of-concept dataset.