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The mid- to late-Holocene δD signal of n-alkanoic acids in lake sediments from the Southern Alps

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The hydrogen isotopic composition δD of plant leaf waxes has been increasingly applied in paleoclimate studies over the recent years. Yet, Holocene data from the mid-latitudes still seems relatively sparse, with one limiting factor certainly being the expected complex climatic forcings of the water isotopic composition at this latitude.

In this context, we present a new δD record of n-alkanoic acids from lake sediments in the Southern Alps (Lake Ghirla, Italy) covering the past 5600 years. The goals of this study are twofold: i) a general evaluation of the amplitude and quality of the δD signal in the Alpine region, and ii) identifying the relative importance of different climatic parameters such as temperature, precipitation, and moisture-source changes on the water isotopic composition of this region.

First analyses show a variation in δD values of the n-alkanoic acids (C_{14-28}) that spans 25-50 ‰ over the past 5600 years, clearly larger than typical analytical uncertainties. In addition, the observed pattern is remarkably coherent across all chain lengths, even if the absolute variation in shorter chain acids (C_{14-20}) is higher than in the longer chain acids (C_{22-28}). This coherence supports the assumption that the record primarily reflects the isotopic composition of regional precipitation. Regarding the temporal evolution of the δD values, we observe two long-term features: a period of only moderate δD variation (C_{24-28} within 10-15 ‰) from 5.6-3 cal kyr BP, and a gradual decrease in isotopic composition (-15-25 ‰) from ~2 cal kyr BP to the onset of the Little Ice Age. In addition, distinct excursions towards lighter (-8-15 ‰) and heavier (+15-30 ‰) δD values occur at 2.8-2.3 cal kyr BP and during the Little Ice Age, respectively. Since both periods have been attributed to wetter and cooler climate conditions, this inverse signal seems to underscore the complex climatic forcing of the water-isotopic composition in this region.

In order to better understand this δD record, further work will require close comparison with additional proxy data from the same sediment record as well as with independent reconstructions of climate and vegetation from the Alps and the Mediterranean area. With this in hand past changes in the water cycle could be better constrained.