Publication

Leaf water deuterium enrichment shapes leaf wax n-alkane δD values of angiosperm plants II: Observational evidence and global implications

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Leaf wax n -alkanes are long-chain hydrocarbons that can persist in sedimentary records over geological timescales. Since their hydrogen isotopic composition (expressed as a δD value) can be correlated to the δD values of precipitation, leaf wax n -alkane δD values have been advocated as new and powerful proxies for paleohydrological research. The exact type of hydrological information that is recorded in the δD values of leaf wax n -alkanes remains, however, unclear. In a companion paper we provide experimental evidence showing that the δD values of leaf wax n -alkanes of angiosperm plants grown under controlled environmental conditions not only reflect δD values of precipitation – as has often been assumed – but that evaporative deuterium (D)-enrichment of leaf water has an additional critical effect on their δD values. Here we present a detailed observational study that illustrates that evaporative D-enrichment of leaf water also affects the δD values of leaf wax n -alkanes in plants from natural ecosystems along a 1500ăkm climate gradient in Northern Australia. Based on global simulations of leaf water D-enrichment we show that the effects of evaporative D-enrichment of leaf water on leaf wax n -alkane δD values is relevant in all biomes but that it is particularly important in arid environments. Given the combined influence of precipitation δD values and leaf water D-enrichment we argue that leaf wax n -alkane δD values contain an integrated signal that can provide general hydrological information, e.g. on the aridity of a catchment area. We also suggest that more specific hydrological information and even plant physiological information can be obtained from leaf wax n -alkanes if additional indicators are available to constrain the plant- and precipitation-derived influences on their δD values. As such, our findings have important implications for the interpretation of leaf wax n -alkane δD values from paleohydrological records. In addition, our investigations open the door to employ δD values of leaf wax n -alkanes as new ecohydrological proxies in contemporary plant and ecosystem sciences.

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