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# Tightly bound soil water introduces isotopic memory effects on mobile and extractable soil water pools

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Cryogenic vacuum extraction is the well-established method of extracting water from soil for isotopic analyses of waters moving through the soil-plant-atmosphere continuum. We investigate if soils can alter the isotopic composition of water through isotope memory effects, and determined which mechanisms are responsible for it. Soils with differing physicochemical properties were re-wetted with reference water and subsequently extracted by cryogenic water distillation. Results suggest some reference waters bind tightly to the soil and not all of this tightly bound water is removed during cryogenic vacuum extraction. Kinetic isotopic fractionation occurring when reference water binds to the soil is likely responsible for the (18)O-depletion of re-extracted reference water, suggesting an enrichment of the tightly bound soil water pool. Further re-wetting of cryogenically extracted soils indicates an isotopic memory effect of tightly bound soil water on water added to the soil. The data suggest tightly bound soil water can influence the isotopic composition of mobile soil water. Findings show that soils influence the isotope composition of soil water by (i) kinetic fractionation when water is bound to the soil and (ii) equilibrium fractionation between different soil water pools. These findings could be relevant for plant water uptake investigations and complicate ecohydrological and paleohydrological studies.
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