

On the urgent need for standardization in isotope-based ecohydrological investigations

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Abstract

Ecohydrological investigations commonly use the stable isotopes of water (hydrogen and oxygen) as a conservative ecosystem tracer. This approach requires accessing and analyzing water constrained within plant and soil matrices. Generally, there are six steps that researchers must pass through to retrieve hydrogen and oxygen isotope values from these plant and soil matrices: (i) sampling, (ii) sample storage and transport, (iii) extraction, (iv) pre-analysis processing, (v) isotopic analysis, and (vi) post-processing and correction. At each of these steps cumulative errors can be introduced which sum to non-trivial magnitudes. These errors can impact subsequent interpretations about water cycling through the soil-plant-atmosphere continuum. But these steps in the research ‘process chain’ are just the tip of the iceberg when it comes to uncertainty in published findings. At each of these discreet steps, there are multiple possible options to select from resulting in, as we will show, tens of thousands of possible combinations used by researchers to go from plant and soil samples to isotopic data. In a newly emerging science, so many options can create interpretive confusion and major issues with data comparability. This points to the need for the development of shared standardized approaches. Here we critically examine the state of the process chain, reflecting on the issues associated with each step, and end with suggestions to move our community towards standardization. We hope that critically assessing this common approach will help us see the current problem in its entirety and facilitate community action toward agreed upon standardized approaches.

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