A novel sampling system of in-canopy precipitation for isotopic analysis

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Research gap

- Tracking water stable isotopes ($\delta^{18}O$, $\delta^{2}H$) leads to deeper understanding of hydrological processes.
- The isotope ratio of precipitation passing through tree canopy is altered. Due to a lack of detailed in-canopy measurements, the exact processes and their impacts are unknown.

Approach:

- Design a low-cost collection system for in-canopy precipitation fit for isotopic analysis

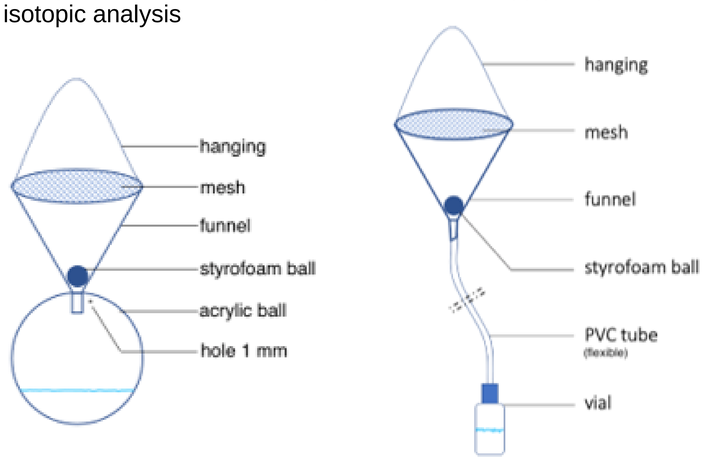


Figure 1. Variant A (left), consisting of an acrylic ball, a funnel with a protective mesh, a Styrofoam ball, and a wire for hanging in the tree, and variant B (right), using a PVC tube and vial instead of an acrylic ball.

Objectives

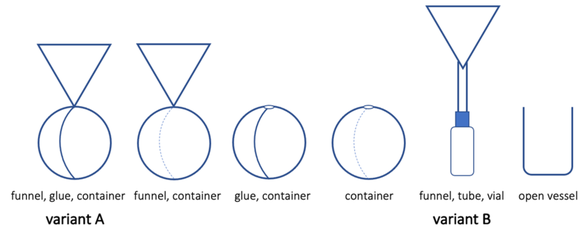
a) Test two different sampling systems in terms of preventing evaporation (isotopic fractionation), storage time, and ease-of-handling

b) Test the system on real and artificial trees

c) Assess potential isotopic difference of sampled precipitation within the canopy

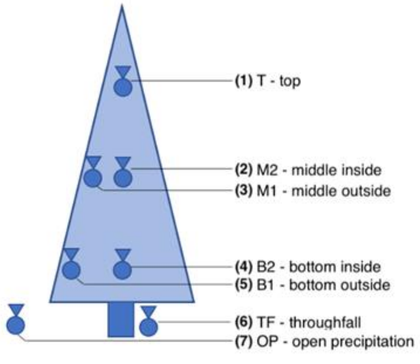
Method

Laboratory test to evaluate evaporative loss and fractionation.



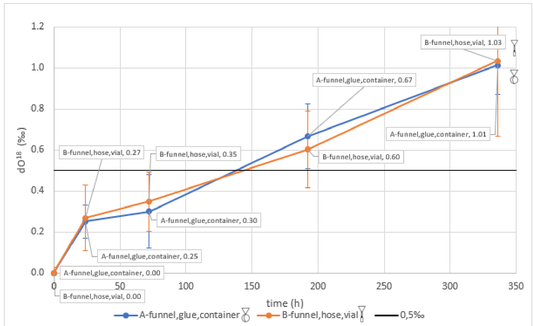
Field test to evaluate practicability of the system (rainfall simulator, natural rainfall) with a real and an artificial tree.

Sampling locations within the canopy



Results

Variant A was better suited:



- No difference in isotope deviations
- Storage time up to 72 hours
- Variant A chosen (better handling, no residual water in tubing)

Mean canopy isotope ratio was similar to collected throughfall:

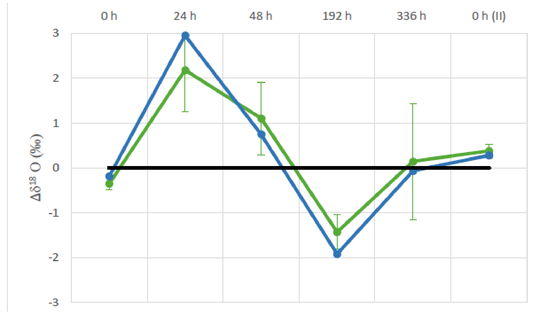


Figure 2. The mean of in-canopy sampled precipitation isotope ratios (green) compared with throughfall collected with a standard rainfall collector (blue) for different sample storage times.

Conclusions

- **Variant A** using an acrylic ball was easier to handle and showed similar isotopic deviations as variant B, with storage time up to 72h
- **Mean of canopy isotope ratios** reflected throughfall, showing viability of the sampling method
- No strong trends or patterns of within-canopy stable isotope ratios detected, possibly due to low sample amount