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Limits and potentials determining stable water isotopes using in-situ measurements and soil water extractions.

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Dual isotope approaches can be used to study soil water root uptake, transit time and evaporation patterns. However, the comparability of unsaturated zone studies and isotope ratios derived from different soil types might be debatable considering interactions of oxygen with cations on clay minerals (Oerter et al., 2014) and different behaviour of deuterium (Steward 1967). In addition to interactions and fractionation that can occur between water and substrate the compareability of different methods needs further investigation. Even the application of one method can lead to very different results depending on soil type and applied sequence. In this study we explored the cryogenic vacuum extraction method and in-situ measurements in more detail.

Therefore, the present study presents results from spike test and will discuss limits and potentials regarding the recovery of water from different soil types using the cryogenic vacuum extraction method. Soils within a catchment in the Cuvelai-Etosha-Basin (CEB), Namibia are different in terms of cation exchange capacity and mineral composition. Soil water extractions using temperatures up to 200°C halved the analytical error for sandy soils. The bias between spike water and extracted water can be reduced for clay rich soils. Further, a relationship between clay content and the offset between spiked and recovered water could be found. However, full recovery could not be achieved for fine textured soils and values of the extracted water fall on a evaporation line. It is strongly recommended that studies using the cryogenic vacuum extraction method for soil water studies conduct spike tests with their particular soils and their specific technical setup prior to sample treatment. In addition in-situ measurements at different locations in the CEB are compared to isotope depth profiles detructively sampled and subsequently extracted. It can be shown that soil type specific calibration needs consideration.

Oerter, Erik; Finstad, Kari; Schaefer, Justin; Goldsmith, Gregory R.; Dawson, Todd; Amundson, Ronald (2014): Oxygen isotope fractionation effects in soil water via interaction with cations (Mg, Ca, K, Na) adsorbed to phyllosilicate clay minerals. In: *Journal of Hydrology* 515, S. 1–9. DOI: 10.1016/j.jhydrol.2014.04.029.

Stewart, G. L. (1967) Fractionation of Tritium and Deuterium in Soil Water, in Isotope Techniques in the Hydrologic Cycle (ed G. E. Stout), American Geophysical Union, Washington, D. C.. doi: 10.1029/GM011p0159