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Partitioning understory evapotranspiration in semi-arid ecosystems in Namibia using the isotopic composition of water vapour

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In dry environments with a sparse vegetation cover, understory evapotranspiration is a major component of the ecosystem water balance. Consequently, knowledge on the size of evapotranspiration fluxes and the driving factors is important for our understanding of the hydrological cycle. Understory evapotranspiration is made up of soil evaporation and plant transpiration. Soil evaporation can be measured directly from patches free of vegetation. However, when understory vegetation is present distinguishing between soil evaporation and plant transpiration is challenging. In this study, we aim to partition understory evapotranspiration based on an approach that combines the measurements of water-vapour fluxes using the closed chamber method with measurements of the isotopic composition of water vapour.

The measurements were done in the framework of SASSCAL (Southern African Science Service Centre for Climate Change and Adaptive Land Management). The study sites were located in three different semi-arid ecosystems in Namibia: thornbush savanna, Baikiaea woodland and shrubland. At each site measurements were done under tree canopies as well as at unshaded areas between the canopies. We measured evaporation from the bare soil and evapotranspiration from patches covered with herbaceous species and shrubs using a transparent chamber connected with an infrared gas analyser (LI-8100A, LICOR Inc.). The stable isotope composition of water vapour inside the chamber and depth profiles of soil water stable isotopes were determined in-situ using a tuneable off-axis integrated cavity output spectroscope (OA-ICOS, Los Gatos Research, DLT 100). Xylem samples were extracted using the cryogenic vacuum extraction method and the isotopic composition of the extracted water was measured subsequently with a cavity-ring-down spectrometer (CRDS L2120-i, Picarro Inc.).

We will present the quantified fluxes of understory evapotranspiration measured in the three different ecosystems, show the effect of tree shading on these fluxes, and discuss the applicability of isotopic data to partition understory evapotranspiration in soil evaporation and plant transpiration.