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# Quantifying the Effect of Dew and Fog Water on Swiss Grasslands with Stable Water Isotopes

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Dew and fog water are essential moisture sources for plants in arid and semi-arid areas where available rain water is limited (Beysens, 2016). However, research so far has rarely focused on the dew or fog water used by plants in temperate ecosystems, although summer drought conditions may impose water stress on plants like in semi-arid regions. Moreover, a very tiny dew yield will have a stronger impact on smaller grasses than trees for which dew contribution is tiny compared to tree's internal water in the respective root crown, stem and leaf canopy.

Even temperate ecosystems can experience relatively dry seasons (e.g., summer 2018 in Europe) with water limited conditions (MeteoSwiss, 2018), and this makes dew or fog droplets a potentially essential water source for grassland plants.

Our research aims at quantifying how fog and dew affect the performance of representative species at three Swiss grasslands at different elevations and how the relevance of fog and dew may increase under anticpiated future climate change.

Three Swiss grasslands along an elevational gradient, where long-term half-hourly $H_2O$ flux measurements and meteorological data are available, are visited to conduct the measurements of gaseous and liquid water isotopes ($\delta^2$H and $\delta^{18}$O) during intensive observation periods. The hydrogen and oxygen isotopic ratio ($\delta^2$H and $\delta^{18}$O) of water vapor in the atmospheric air is continuously measured with a cavity ring-down spectrometer (e.g. Picarro L2130-i) with a sampling frequency of 1$\sim$2Hz. While the liquid samples are extracted from leaf, root crown, soil, and dew/fog water droplets on the leaf surface through destructive sampling during at least three expected dew or fog nights at each site, and then analyzed with isotope ratio mass spectrometry (IRMS) to obtain the $\delta^2$H and $\delta^{18}$O values. The deuterium excess of water samples are calculated as $d\text{-}excess = \delta^2H - 8 * \delta^{18}O$ to help analyze the $H_2O$ variability and exchange in the Soil-Plant-Atmosphere Continuum (SPAC). Further more, a substantially depleted water tracer with known stable isotope ratio is manually sprayed on the leaf surface of selected plants to quantify the share of fog or dew water taken up by typical grassland plants. Ecophysiological measurements including leaf water potential, relative water content, and stomatal conductivity are carried out to quantify the effect of fog and dew on grassland plant performance.

In this contribution, we phrase the following working hypotheses: during summer fair weather and drought periods, nocturnal dew formation and/or fog droplet deposition has a measurable and nonnegligible quantitative effect on the plant water status of representative Swiss grassland species.

**REFERENCES**:

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