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A spatially distributed isotope sampling network in a snow-dominated catchment for the quantification of snow meltwater

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In mountainous catchments with seasonal snowpacks, river discharge in downstream valleys is largely sustained by snowmelt in spring and summer. Future climate warming will likely reduce snow volumes and lead to earlier and faster snowmelt in such catchments. This, in turn, may increase the risk of summer low flows and hydrological droughts. Improved runoff predictions are thus required in order to adapt water management to future climatic conditions and to assure the availability of fresh water throughout the year. However, a detailed understanding of the hydrological processes is crucial to obtain robust predictions of river streamflow. This in turn requires fingerprinting source areas of streamflow, tracing water flow pathways, and measuring timescales of catchment storage, using tracers such as stable water isotopes (^{18}O, ^{2}H).

For this reason, we have established an isotope sampling network in the Alptal, a snowmelt-dominated catchment (46.4 km^2) in Central-Switzerland, as part of the SREP-Drought project (Snow Resources and the Early Prediction of hydrological DROUGHT in mountainous streams). Precipitation and snow cores are analyzed for their isotopic signature at daily or weekly intervals. Three-week bulk samples of precipitation are also collected on a transect along the Alptal valley bottom, and along an elevational transect perpendicular to the Alptal valley axis. Streamwater samples are taken at the catchment outlet as well as in two small nested sub-catchments (< 2 km^2). In order to catch the isotopic signature of naturally-occurring snowmelt, a fully automatic snow lysimeter system was developed, which also facilitates real-time monitoring of snowmelt events, system status and environmental conditions (air and soil temperature). Three lysimeter systems were installed within the catchment, in one forested site and two open field sites at different elevations, and have been operational since November 2016.

We will present the isotope time series from our regular sampling network, as well as initial results from our snowmelt lysimeter sites. Our data set will allow for detailed hydrograph separation based on stable water isotopes and geochemical components, which we use to identify source areas and to quantify snowmelt contributions to streamflow.