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Spatiotemporal tracer variability in glacier melt and its influence on hydrograph separation

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Glaciers are important seasonal water contributors in many mountainous regions. Knowledge on the timing and amount of glacier melt water is crucial for water resources management, especially in downstream regions where the water is needed (hydropower, drinking water) or where it represents a potential risk (drought, flood). This becomes even more relevant in a changing climate. Environmental tracers are a useful tool in the assessment of ice water resources, because they provide information about the sources, flow paths and traveling times of water contributing to streamflow at the catchment scale. Hydrometric and meteorological measurements combined with tracer analyses help to unravel streamflow composition and improve the understanding of hydroclimatological processes. Empirical studies on runoff composition are necessary to parameterize and validate hydrological models in a process-oriented manner, rather than comparing total measured and simulated runoff only.
In the present study three approaches of hydrograph separation are compared to decide which sampling frequency is required to capture the spatiotemporal variability of glacier melt, and to draw implications for future studies of streamflow partitioning. Therefore glacier melt contributions to a proglacial stream at the sub-daily, daily, and seasonal scale were estimated using electrical conductivity and oxygen-18 as tracers. The field work was conducted during December 2015 and September 2016 in the glaciated (34%) high-elevation catchment of the Hochjochbach, a small sub-basin (17 km^2) of the Oetztaler Ache river in the Austrian Alps, ranging from 2400 to 3500 m a.s.l. in elevation. Hydroclimatological data was provided by an automatic weather station and a streamflow gauging station equipped with a pressure transducer. Water samples of streamflow, glacier melt, and rain were collected throughout the winter period (December to March) and the ablation season (July to September). In the proposed contribution, the experimental setup and preliminary results are described and discussed for the three approaches (sub-daily, daily, seasonal) of three-component hydrograph separations (glacier melt, rain, and groundwater).