

Automated streamflow measurements in high-elevation Alpine catchments

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Abstract

Salt dilution is a well-established streamflow measurement method in creeks, which works particularly well downstream of turbulent flow sections as mixing of the salt tracer is enhanced. Usually salt dilution measurements are performed manually, which considerably limits the observations of rare peak flow events. However, these events are particularly important for constructing robust rating curves and avoiding large uncertainties in the extrapolation of river discharge values. An additional challenge is the variability of the river cross-section, especially after larger discharge events, leading to non-stationary rating curves. Therefore, discharge measurements well distributed over time are needed to both construct a reliable streamflow-water level relationship and to detect changes caused by erosion and deposition processes. To overcome these two issues, we used an automated streamflow measuring systems at three different sites in the Alps for event-based discharge measurements. This system allowed us to measure close to the highest peak flows at all three sites in the observation period (2020-2021) and to detect abrupt changes in the rating curve. Based on a very large data set of almost 300 measurements, we were able to evaluate the reliability of the system and to identify the main sources of uncertainty in the experimental setup. One key aspect was the site selection for the downstream electrical conductivity sensors as measurement location strongly controls the signal-to-noise ratio (SNR) in the recorded breakthrough curves.

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