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Uncertainty in stream discharges mesured with the index velocity method in an alpine river with unstable bed

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The ability to provide an instantaneous and continuous time series for flow discharge in a river is a fundamental issue for flood risk or drought assessment or for ecological studies by estimating fine sediments and associated pollutant flux. Automated direct measurement of streamflow discharge is difficult at present and one or more surrogate measurements are generally used to estimate it. Moreover, alpine rivers are often characterized by a very unstable bed due to active sediment transport. As a consequence, hydrometric stations generally suffer from frequent rating curve shifts. This study deals with a hydrometric station located on the downstream part of the Arvan River in Saint-Jean-de-Maurienne, France. A Sommer RQ-24 radar was installed at the station, that continuously measures both water surface level and surface velocity. Regular stream gaugings were achieved by measuring either local velocities with a conventional current-meter during low flow periods or surface velocities using a handheld radar velocimeter during floods when the reach is not wadable. First, a classical stage-discharge relationship was developed thanks to these gaugings by applying the BaRatin software using Bayesian inference, which allows the definition of hydraulic priors and gives an estimation of the uncertainties. Since rating curve shifts frequently occur, large uncertainties can be observed in the rating curve for low flow. Second, the index velocity method (IVM) was also applied to this site and a new method for estimating the related uncertainties is suggested. It showed that the IVM significantly reduces the uncertainties in the discharge estimation for low flows. Moreover, the combined surface level and velocity measurements are useful to detect rating curve shifts and thus periods of stable hydraulic control.