

## Discharge estimation by continuous measurement of water velocity by Doppler instrument

Andrej Vidmar, Luka Štravs, Simon Rusjan, Sašo Petan and Mitja Brilly

Chair of Hydraulics Engineering, University of Ljubljana, Jamova 2, 1000 Ljubljana, Slovenia, E-mail: avidmar@fgg.uni-lj.si

Accurate discharge estimation is crucial for an efficient river basin management and especially for flood forecasting and issuing warnings related to possible extreme flood events. The traditional way of estimating the discharge in hydrological practice is to measure the water stage and to convert the recorded water stage values into discharge by using the single-valued rating curve, which is a relationship between the stage and discharge derived from direct measurements of discharge, which are done at convenient times with measurements of flow velocities at different points over the gauging cross section, and hence the discharge values of the rating curve for the extreme events are usually extrapolated by using different mathematical methods and are not directly measured. By using the Starflow ultrasonic Doppler instrument we recorded the actual relation between the water stage and the flow velocity at the occurrence of flood waves. Unsteadiness in the water stage ? water velocity relation causes the trajectory of the flood event to appear as a loop on the stage ? velocity diagram. Results of the 3-year time measurements at different water stations on different Slovenian rivers (the Sava, Dragonja, Gradascica, Reka, etc.) show non-negligible differences in water velocities on the rising and falling limbs of the flood waves at the same water stage. Neglecting the influence of different water flow velocities on the rising and falling limbs of the flood waves can result in underestimation of peak discharges during highly dynamic floods and less accurate estimation of the time of the flood peaks. Measurements of velocity increase also accuracy of estimation of water balance significantly and make more transparent hydraulics regime in particular cross-section of the river.