



## **Practical Experience of Discharge Measurement in Flood Conditions with ADP**

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Accurate discharge estimation is important for an efficient river basin management and especially for flood forecasting. 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. Relationship between the stage and discharge values of the rating curve for the extreme events are usually extrapolated by using different mathematical methods and are not directly measured. Our practice shows that by using the Acoustic Doppler Profiler (ADP) instrument we can record the actual relation between the water stage and the flow velocity at the occurrence of flood waves very successfully.

Measurement in flood conditions it is not easy task, because of high water surface velocity and large amounts of sediments in the water and floating objects on the surface like branches, bushes, trees, piles and others which can also easily damage ADP instrument. We made several measurements in such extreme events on the Sava River down to the nuclear power plant Krško where we have install fixed cable way. During the several measurement with traditional "moving-boat" measurement technique a mowing bed phenomenon was clearly seen. Measuring flow accurately using ADP that uses the "moving-boat" technique, the system needs a reference against which to relate water velocities to. This reference is river bed and must not move. During flood events we detected difficulty finding a static bed surface to which to relate water velocities. This is caused by motion of the surface layer of bed material or also sediments suspended in the water near bed very densely. So these traditional »moving-boat« measurement techniques that we normally use completely fail.

Using stationary measurement method to making individual velocity profile measurements, using an Acoustic Doppler Profiler (ADP), at certain time at fixed locations across the width of a stream gave us much better results. We use Stationary Measurement Software from SONTEK ADP manufacture to provide the tools to make USGS/ISO/WMO "Mid-Section Method" measurements using an ADP. We have ADP with 3.0 MHz which gave us 0,15m cell size in which is capable to gauge from 0,3m to a maximum depth of 6m. The beauty of using the Stationary Measurement Software is not only to overcome common moving-bed problems, but that gave us possibility to measure at depth beyond the range of the instrument. The water depth at certain profile can be inputted with known values of cross section and velocities are then extrapolated to the bed with use of velocity profile power-law equation. In practice the other good advantage to use this method is that we can repeat each profile of measurement if we detected some anomalies in the profile of measured velocities or in the case that we must quickly remove instrument from location because of floating destroying material.