



A New Image Based Approach to Measure Discharge and Soil Saturation

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Discharge measurements are crucial for most hydrological studies. It is common to monitor discharge by recording water level and calculate the actual discharge using a rating curve that has been previously determined for varying flow conditions. Bubble and float gauges as well as radar based gauges are frequently used to measure water level. Recently particle image velocimetry (PIV) approaches have become more attractive due to continuous improvement of sensors and computing power. Standard cameras can be easily usable and cheap monitoring devices for discharge measurement. The combination of a camera and a staff gauge has been proved to be suitable for hydrological monitoring in several studies and is promoted as redundant backup as well as independent system. Our new image based system offers the possibility to measure water velocity and soil saturation in addition to water level. We use a commercial wildlife camera with sensors in the visible and infrared spectrum, allowing for day and night images. The system can be used for three purposes. (1) Water level measurement with a specifically built gauging plate. (2) A carbon fiber stick installed instream allows water velocity measurements. Water velocity can be derived from the bending of the carbon fiber under water pressure which is proportional to the water velocity and water level. Hence we can derive a rating curve between bending angle of the carbon fiber stick and the water velocity. Therefore we can constantly measure the water velocity and do not depend on traditional rating curves. (3) Soil water saturation is measured by perforated PVC bottles that enable water in- and outflow. Rising water level in the PVC-bottle will lift an integrated floating body that pushes up a detection marker visible for the camera above the ground. The measurement system is tested for monitoring intermittent streams in the Attert basin in Luxemburg linking the dynamics of the stream network extent to the surface connectivity of the catchment.