Monitoring surface flow velocity using natural tracers and noncontact techniques

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In the last years, non-intrusive technologies have been increasingly used for environmental monitoring overcoming numerous limitations of traditional systems, which require qualified operators, significant economic investments and a careful management of specialized equipment. These new methodologies allow to collect the surface streamflow velocity along different river cross sections with high spatial and temporal resolution. However, the quality of the surface streamflow velocity measurements can be influenced by local environmental factors or site depending circumstances. Therefore, additional efforts are needed to improve the performance of these methodologies especially under high flow conditions and in difficult-to-access sites or ungauged sites.

In the present study, laboratory experiments and field measurements on natural streams have been carried out to derive surface velocity measurements using the PTV technique applied on videos of an action camera installed on Unmanned Aerial Systems (UAS). Videos of the free water surface with floating particles have been processed with the Particle Tracking Velocimetry (PTV) techniques obtaining free surface velocity fields. Experiments have been carried out testing several different natural and artificial tracers under different conditions. For comparison, additional flow velocity measurements have been obtained using both a portable Surface Velocity Radar (SVR) and current meters. Experiments demonstrate the great potential of UAS in river systems monitoring that may provide flow velocity fields with a good accuracy and resolution. Moreover, results also demonstrate the critical role of tracer material selection that should be made according to the local characteristics such as: water turbidity, river bed material and flow velocity.