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Testing different tracers for stream flow monitoring with UAS

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In hydrological applications flow monitoring with high spatial and temporal resolution is crucial to understand the interactions between flow dynamics and infrastructures as well as to estimate streamflow discharges during extreme events. In this context, the use of Unmanned Aerial Systems (UASs) combined with particle tracking techniques provide one of the greatest potential for hydraulic monitoring allowing to measure surface 2D velocity fields based on video acquisitions.
The measurement equipment consists of an action-cam installed on a low-cost quadrocopter and floating particle tracers. Particles have been distributed manually on the water surface in order to obtain an optimal spread able to cover the entire cross-section. In the present study, several experiments in laboratory and on natural streams have been carried out using different tracers in different hydraulic configurations. Thereafter, acquired videos have been processed with Particle Tracking Velocimetry (PTV) optical technique to derive free surface velocity fields. The image processing is very sensitive to the tracer characteristics, water color, river bed material, and flow velocity. The aim of the study is to describe the optimal tracer for stream flow monitoring and parameter setting for each configuration.
The obtained results provide flow velocity fields with high resolution in time and space with relatively good accuracy in comparison with benchmark velocity values measured by conventional current meters and radar techniques. The tested methodology, allowing a non-intrusive monitoring of watercourses, have great potential applicability in monitoring any river system at large scale and also in difficult-to-access environments.