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FlowVeloTool: Measuring flow velocities in terrestrial and UAV image sequences automatically with PIV and PTV

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We introduce a Python based software tool to measure surface flow velocities and to estimate discharge eventually. Minimum needed input are image sequences, some camera parameters and object space information to scale the image measurements. Reference information can be provided either indirectly via ground control point measurements or directly providing camera pose parameters. To improve the reliability and density of velocity measurements the area of interest has to be masked for image velocimetry. This can either be performed with a binary mask file or considering a 3D point cloud, for instance retrieved with Structure from Motion (SfM) photogrammetry, describing the region of interest. The tracking task can be done with particle image velocimetry (PIV) considering small interrogation regions or using particle tracking velocimetry (PTV) and thus detecting and tracking features at the water surface. To improve the robustness of the tracking results, filtering can be applied that implements statistical information about the flow direction, flow steadiness and average velocities.

The FlowVeloTool has been tested with two different datasets; one at a gauging station and one at a natural river reach. Thereby, UAV and terrestrial data were acquired and processed. Velocities can be estimated with an accuracy of 0.01 m/s. If information about the river topography and bathymetry are available, as in our demonstration, discharge can be estimated with an error ranging from 5 to 31 % (Eltner et al. 2019). Besides these results we demonstrate further developments of the FlowVeloTool regarding filtering of tracking results, discharge estimation, and processing of time series. Furthermore, we illustrate that thermal data can be used, as well, with our tool to retrieve river surface velocities.

Eltner, A., Sardemann, H., and Grundmann, J.: Flow velocity and discharge measurement in rivers using terrestrial and UAV imagery, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-289, 2019.