

UAV based hydromorphological mapping of a river reach to improve hydrodynamic numerical models

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Unmanned Aerial Vehicles (UAVs) are increasingly used in the field of engineering surveys. In river engineering, or in general, water resources engineering, UAV based measurements have a huge potential. For instance, indirect measurements of the flow discharge using e.g. large-scale particle image velocimetry (LSPIV), particle tracking velocimetry (PTV), space-time image velocimetry (STIV) or radars became a real alternative for direct flow measurements. Besides flow detection, topographic surveys are also essential for river flow studies as the channel and floodplain geometry is the primary steering feature of the flow. UAVs can play an important role in this field, too. The widely used laser based topographic survey method (LIDAR) can be deployed on UAVs, moreover, the application of the Structure from Motion (SfM) method, which is based on images taken by UAVs, might be an even more cost-efficient alternative to reveal the geometry of distinct objects in the river or on the floodplain. The goal of this study is to demonstrate the utilization of photogrammetry and videogrammetry from airborne footage to provide geometry and flow data for a hydrodynamic numerical simulation of a 2 km long river reach in Albania. First, the geometry of the river is revealed from photogrammetry using the SfM method. Second, a more detailed view of the channel bed at low water level is taken. Using the fine resolution images, a Matlab based code, BASEGrain, developed by the ETH in Zürich, will be applied to determine the grain size characteristics of the river bed. This information will be essential to define the hydraulic roughness in the numerical model. Third, flow mapping is performed using UAV measurements and LSPIV method to quantitatively asses the flow field at the free surface and to estimate the discharge in the river. All data collection and analysis will be carried out using a simple, low-cost UAV, moreover, for all the data processing, open source, freely available software will be used leading to a cost-efficient methodology. The results of the UAV based measurements will be discussed and future research ideas will be outlined.