Unpiloted aerial vehicles (UAVs) as a remote sensing platform to estimate the velocity of flood water

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Quantifying velocities of flood water on the floodplain is fundamental to the assessments of flood risk, hydrological responses to storm events, geomorphological processes, and physically based inundation models. The study investigates the potential of aerial surface velocity measurements based on the Lagrangian methods of large-scale particle image velocimetry (LSPIV) and Space Time Image velocimetry (STIV), as well as the Eulerian approach of particle tracking velocimetry (PTV) to estimate the velocity of flood water in the floodplain. Six experiments conducted at five sites with three different types of small unpiloted aircraft (SUA) tested the methods and workflow under varied flood and non-flood conditions. The performance was evaluated by comparison of mean velocities against that measured by a conventional Acoustic Doppler Current Profiler (ADCP). The best results were achieved using the STIV method with an off-the-shelf Phantom 3 Pro at the River Severn site, where the ADCP and STIV estimations differed by 0.63%. Very good results were also generated by both other methods, with a 2.56% difference compared to the ADCP at the Sandwell site and a 3.32% difference at the Buckland site. All the methods provided accurate estimation from at least one site, but some methods provided very poor results at others. Sites with visible distinct