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Synchronous detection of vegetation structures in semi-terrestrial areas of the Rhine via unmanned surface vehicles and unmanned aerial vehicles and its benefits for river management

Benjamin Eberhardt[1], Maike Heuner[1], Thomas Gattung[2], Magnus Hoffmann[3], Issa Hansen[4], Beat Lüthi[5], Julian Teege[6], Enrico Neumann[7], Ralf Becker[8], and Jörg Blankenbach[8]

[1]The Federal Institute of Hydrology (BfG), Koblenz, Germany
[2]The Federal Waterways Engineering and Research Institute (BAW), Karlsruhe, Germany
[3]The Research Institute for Water Management and Climate Future at RWTH Aachen University, Germany
[4]SEBA Hydrometrie GmbH & Co. KG, Kaufbeuren, Germany
[5]Photrack AG, Zurich, Switzerland
[6]Orthodrone GmbH, Kiel, Germany
[7]IAV GmbH Ingenieurgesellschaft Auto und Verkehr, Gifhorn, Germany
[8]Geodetic Institute and Chair for Computing in Civil Engineering & GIS, RWTH Aachen University, Aachen, Germany

Maintenance of waterways is often a challenging task with conflicting interests between different parties. They are subject to economical stresses through the industry and transportation sector on the one hand, on the other the European Water Framework Directive dictates to ensure (or lead them back to) a chemically and ecologically “good status” (which benefits the balance between regulating, supporting, providing and cultural ecosystem services).

To have a good decision base for ecological measures, local-scale high resolution temporal and spatial data is needed to make sound decisions for a sustainable river management, which extends to assess and monitor the succession of restoration areas and to document change.

The objective of the project RiverCloud is the development of a data acquisition platform which enables synchronous data collection with unmanned aerial vehicles (UAV) and unmanned surface vehicles (USV). On the base of this platform different sensors can be used for a holistic data base in semiterrestrial areas of streams: e.g. acoustic doppler current profilers, multi-parameter sensors, multibeam-echosounders and a 360° camera for the USV; Sensors on the UAV consist of a bathymetric range finder and an industrial grade camera for structure from motion application to derive high-resolution point clouds and orthomosaics.

Building upon this data base, a further objective is the detection of vegetation structures such as a canopy height, single trees and the balancing of aboveground biomass, as a regulating ecosystem service for carbon sequestration, from high-resolution point clouds by using open source software. The results from remote sensing data are tested against comparative data collected in the field. Workflow, results and benefits for river management will be presented. All data was

collected in September 2022 along the river Rhine near Karlsruhe, Germany.