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Unmanned aerial monitoring of fluvial changes in the vicinity of selected gauges of the Local System for Flood Monitoring in Kłodzko County, SW Poland

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Only high resolution spatial data enable precise measurements of various morphometric characteristics of river channels and ensure meaningful effects of research into fluvial changes. Using ground-based measurement tools is time-consuming and expensive. Traditional photogrammetry often does not reach a desired resolution, and the technology is cost effective only for the large-area coverage. The present research introduces potentials of UAV (Unmanned Aerial Vehicle) for monitoring fluvial changes.

Observations were carried out with the ultralight UAV swinglet CAM produced by senseFly. This lightweight (0,5 kg), small (wingspan: 80 cm) aircraft allowed frequent (with approximately monthly sampling resolution) and low-cost missions. Three hydrologic gauges, the surroundings of which were the target of series of photos taken by camera placed in airplane frame, belong to the Local System for Flood Monitoring in Kłodzko County (SW Poland).

The only way of obtaining reliable results is an appropriate image rectification, in order to measure morphometric characteristics of terrain, free of geometrical deformations induced by the topographical relief, the tilt of the camera axis and the distortion of the optics. Commercially available software for the production of digital orthophotos and digital surface models (DSMs) from a range of uncalibrated oblique and vertical aerial images was successfully used to achieve this aim.

As a result of completing the above procedure 9 orthophotos were generated (one for each of 3 study areas during 3 missions). For extraction of terrain parameters, a DSM was produced as a result of bundle block adjustment. Both products reached ultra-high resolution of 4cm/px. Various fluvial forms were classified and recognized, and a few time series of maps from each study area were compared in order to detect potential changes within the fluvial system. We inferred on the origins of the short-term responses of fluvial systems, and such an inference was feasible due to the analysis of metrological and hydrological data recorded by the Local System for Flood Monitoring in Kłodzko County.

Orthophotos and DSMs, generated from imagery obtained by UAV, show high accuracy of results and are suitable for measuring fluvial changes. This approach moves beyond current restrictions of traditional data collecting, due to its unprecedented spatial and temporal resolution and low cost of application.