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Application of UAS photogrammetry for assessment of flood driven fluvial dynamics of montane stream. Case study - Roklansky creek, Sumava Mts.

Jakub Langhammer (1), Jakub Miřijovský (2), Filip Hartvich (3), Jana Kaiglová (1,4)

(1) Charles University in Prague, Faculty of Science, Dept. of Physical Geography and Geoecology, Prague 2, Czech Republic (langhamr@natur.cuni.cz), (2) Palacky University in Olomouc, Department of Geoinformatics, Olomouc, Czech Republic, (3) Institute of rock structure and mechanics, Academy of Sciences of the CR, Prague, Czech Republic, (4) DHI Hydroinform, Prague, Czech Republic

Current progress in hydrology and fluvial geomorphology is largely based on new field survey and analysis techniques, employing advanced technologies for monitoring the dynamics of the runoff process, field surveying and for remote monitoring of changes in riverbeds and of fluvial dynamics.

Application of these techniques allows researchers to obtain information on a significantly higher qualitative level than using traditional methods of field survey and measurement, either in terms of spatial accuracy and resolution, frequency of sampling or qualitative characteristics of acquired data.

The contribution demonstrates the potential of Unmanned Aerial Systems (UAS) for analysis of fluvial dynamics of montane stream, driven by flood in combination with other survey techniques, namely the ground LiDAR scanning, digital granulometry and automated water level monitoring.

The UAS photogrammetry is employed in the study to acquire high precision DTMs, enabling reconstruction of riverbed and quantitative analysis of volumetric changes related to initial flood events. The hexacopter UAS platform has been used to acquire the data for photogrammetric analysis of complex stretch of stream with historically elevated fluvial dynamics. The photogrammetric reconstruction enabled to build accurate DTM of riverbed and floodplain before and after the initial event and to calculate the extent of volumetric changes.

The potential of UAS photogrammetry for fluvio morphological study is in combination with other monitoring and survey techniques, enabling complex analysis of fluvial dynamics. The magnitude, duration and hydrological properties of initial flood event were derived from automated high frequency water level monitoring. The digital granulometry enabled to analyze the structure of sedimentary material in floodplain. The terrestrial LiDAR scanning allows construction of very detailed 3D models of selected fluvial forms, enabling deeper insight into the effects of fluvial dynamics and to verify the spatial information acquired using UAS photogrammetry.

The results of above mentioned techniques are applied to build hydrodynamic model explaining threshold conditions for initiation of changes in fluvial morphology of the riverbed in relation to known and theoretical flood magnitude.

The presented study proved the UAS photogrammetry to be unique source of spatial information, allowing analysis of dynamics of fluvial systems with unprecedented precision and flexibility. This technique has full potential to bring spatial information to a new qualitative level and in experimental areas with limited availability of spatial information. The preliminary results achieved in the study enabled us to discuss the synergic potential of coupling the UAS photogrammetry, sensor networks and other hydroinformatic techniques to enhance significantly our knowledge on the dynamics of fluvial systems.

Key words: UAS photogrmmetry, DTM, fluvial processes, erosion, hydrodynamic modelling