



Quantification of short-term geomorphological effects of glacial lake outburst flood, Zackenberg Valley, West Greenland: Implementation of repeatable UAV surveys.

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Zackenberg River is located in the Western Greenland and drains local ice cap situated approximately 30 km from the seashore. River floods related to the outburst of ice-dammed lake occur on cyclic basis. This study presents results of geomorphological investigations of the results of flood which happened on 6th of August 2017. We studied 2 km long section of the river, located near the river mouth and Zackenberg Research Station to quantify short-term riverscape response to the flood. Three survey sessions utilizing small quadcopter were performed on: 5th August 2017 (a day before the flood started), 6th August 2017 (during the high-water conditions) and 8th August 2017 (after the river returned to the normal water level). From each survey session detailed orthomosaic (2 cm cell size) and digital elevation model (DEM, 8 cm cell size) has been produced. Volumetric changes were quantified using geomorphic change detection approach by subtraction of DEMs from subsequent periods. Planar changes were investigated using time-series of orthomosaics.

Results indicate an important role of thermo-erosion in modification of riverbanks. Waterflow seriously undercut steep riverbanks leading to development of overhanging sections or collapsing of large blocks of sediments. The maximal lateral erosion recorded as an effect of this single flood event was up to 9 meters. River channel also changed course, width and depth. In addition, collected data are useful from logistics point of view allowing to assess potential hazards to the buildings of Zackenberg Research Station (due to the lateral riverbanks erosion) and to the steel bridge, which foundations were also affected by erosion. Results indicated suitability of small, budget UAVs, for monitoring of rapid changes, even in relatively harsh Arctic environment.

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