UAV based 3D digital surface model to estimate paleolandscape in high mountainous environment

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Our method to present current state of a peat bog was focused on the possible use of a UAV-system and later Structure-from-motion algorithms as processing technique.

The peat bog site is located on the Vinderel Plateau, Farcău Massif, Maramureș Mountains (Romania). The peat bog (1530 m a.s.l., N47°54'11", E24°26'37") lies below Rugașu ridge (c. 1820 m a.s.l.) and the locality serves as a conservation area for fallen down coniferous trees. Peat deposits were formed in a landslide concavity on the western slope of Farcău Massif. Nowadays the site is surrounded by a completely deforested landscape, and Farcău Massif lies above the depressed treeline. The peat bog has an extraordinary geomorphological situation, because a gully reached the bog and drained the water. In the recent past sedimentological and dendrochronological researches have been initiated. However, an accurate 3D digital surface model also needed for a complex paleoenvironmental research.

Last autumn the bog and its surroundings were finally surveyed by a multirotor UAV developed in-house based on an open-source flight management unit and its firmware. During this survey a lightweight action camera (mainly to decrease payload weight) was used to take aerial photographs. While our quadcopter is capable to fly automatically on a predefined flight route, several over- and sidelapping flight lines were generated prior to the actual survey on the ground using a control software running on a notebook. Despite those precautions, limited number of batteries and severe weather affected our final flights, resulting a reduced surveyed area around peat bog.

Later, during the processing we looked for a reliable tool which powerful enough to process more than 500 photos taken during flights. After testing several software Agisoft PhotoScan was used to create 3D point cloud and mesh about bog and its environment. Due to large number of photographs PhotoScan had to be configured for network processing to get reliable results and resolution.

Based on the sediment layers of the peat bog together with the generated 3D surface model the paleoenvironment, the largest paleowater level can be reconstructed and we can estimate the dimension of the landslide which created the basin of the peat bog.