Geophysical Research Abstracts
Vol. 20, EGU2018-7195, 2018
EGU General Assembly 2018

Snow extent mapping as a tool for refining UAV-SfM snow depth reconstructions

Tomasz Niedzielski, Damian Szafert, Bartlomiej Mizinski, Waldemar Spallek, and Matylda Witek-Kasprzak
University of Wroclaw, Wroclaw, Poland (tomasz.niedzielski@uwr.edu.pl)

Recent developments in the remotely-sensed snow depth estimation include the use of the structure-from-motion (SfM) algorithms to process oblique aerial images acquired by unmanned aerial vehicles (UAVs). A digital surface model (DSM) of snow-free terrain is subtracted from the SfM-based DSM of snow-covered terrain, and the resulting difference is an estimate of snow depth. Although this concept is straightforward, there exist several sources of estimation errors which have already been identified and reported in the literature. On average, these errors range from a few centimetres (rather rare cases) to a few tens of centimetres (more cases). One of the sources of over- or underestimation is the SfM method itself which, not uncommonly, fails to reconstruct the snow-covered DSMs. This constraint is driven by the scarcity of keypoints on texturally-uniform snow surfaces. In particular, the errors in question may occur either in the vicinity of trees and other land cover objects which protrude through snow surface or in places where snow cover is thin and transforms to the snow-free surface. In this study, we attempt to mitigate these errors by combining two dissimilar UAV measurements of snow cover, namely: snow depth reconstruction with the use of SfM and snow extent estimation with the use of k-means clustering. We carried out several field experiments using three fixed-wing UAVs (swinglet CAM by senseFly, eBee by senseFly, and Birdie by FlyTech UAV) within test sites located in the Izerskie Mountains in southwestern Poland. Snow cover was recorded in oblique RGB images, and snow depth and snow extent were estimated. Having compared the two spatial datasets, we attempted to estimate threshold snow depth values for which snow extent maps based on snow colour classification (k-means-based) and DSM reconstruction (SfM-based) are as close as possible. We found that it is impossible to find such a threshold globally, but its local estimation is feasible.