Geophysical Research Abstracts
Vol. 17, EGU2015-5311, 2015
EGU General Assembly 2015

Analysis of glacial and periglacial processes using the SfM-MVS approach

Livia Piermattei (1), Luca Carturan (1), Fabrizio de Blasi (1), Paolo Tarolli (1), Giancarlo Dalla Fontana (1), and Antonio Vettore (2)

(1) TESAF Department of Land, Environment, Agriculture and Forestry Legnaro (PD), University of Padova, Legnaro (PD), Italy (livia.piermattei@studenti.unipd.it), (2) CIRGEO Interdepartmental Research Center of GEOMATICS, University of Padova, Italy

In the field of glaciology Digital Terrain Models (DTMs) are commonly used to map glacier structure, to analyse surface morphology, to measure changes in geometry and volume and hence to infer the mass balance. The development of the Structure from Motion (SfM) photogrammetric technique, which coupled with dense image matching algorithms (such as multi-view stereo, MVS) generated a great interest in the field of glaciology as well as in glacial and periglacial geomorphology.
This study investigates the potential of the SfM-MVS approach in reconstructing the surface of a glacier and of a neighbouring rock glacier located in Alta Val de La Mare (Ortles-Cevedale, Eastern Italian Alps), and the feasibility of using this technique for calculating the annual mass balance of the glacier and the surface velocities of the rock glacier. The terrestrial photogrammetric surveys were made using a consumer-grade SLR camera and processed using the computer vision-based software package Agisoft PhotoScan, in order to generate the 3D models. The GCPs (Ground Control Points) needed to georeference the SfM-MVS 3D model were extracted from a LiDAR survey carried out in 2013, which was also used to assess the accuracy of the photogrammetric DTMs in the stable area outside the glacier and the rock glacier. The effectiveness of the photogrammetric method was also evaluated in light of the different substrata which were present at the moment of surveys (fresh snow, old snow, firn, ice and debris), and of spatial characteristics as the distance from the camera and the terrain gradient.
The results show that from a series of digital images taken from the ground it is possible to reconstruct the surface of glaciers and rock glaciers with good accuracy. Multi temporal DTMs obtained by SfM-MVS allow the detection of annual to multi-annual topographic changes occurring at the surface of glaciers and active rock glaciers. However, several issues typical of this approach have to be taken into account for operational applications in glacial and periglacial environments. In particular, the highly variable distance from the camera positions to the target, the occurrence of shadows from ground and clouds, the low contrast of fresh snow and the selection of suitable GCPs for the georeferentiation.