EMS Annual Meeting Abstracts
Vol. 15, EMS2018-560, 2018

Meteorological control on summer mass balance evolution in a stato-dynamic ice cave by means of ground based SfM

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The study investigates the summer evolution of a permanent ice deposit in a stato-dynamic ice caves located in the European southeastern Alps through a photogrammetric approach based on SfM (Structure for Motion) algorithms. Several campaigns have been conducted during the summer 2017 aiming at monitoring the surface topographic evolution of the ice deposit during the ablation season. The ground-based photogrammetric approach represent a low-cost method with very limited logistic problems of transportation and human resources particularly important in such an environment. This method allows a very high resolution and makes the use of the more sophisticated terrestrial laser scanner survey (TLS) technique obsolete and inconvenient. This is expecially evident when looking at the easy data acquisition and data processing, as well as DTM accuracy which is comparable with those one obtained with the TLS. The obtained multi-temporal high-resolution DTMs acquired by SfM enable reliable calculation of the topographic changes between July and November 2017. Results are discussed together with the meteorological evolution of the area and the micro-meteorological patterns observed in the cave, in relation to the external weather conditions in the area. The melting seems to be mainly related to events of major warm air in-flows in the cave, while colder temperature are linked to more stable conditions. The response of such environments to the ongoing global warming, particularly effective in the studied area, is still not clear and apparently decoupled from the mass balance evolution of small glaciers and ice pathces. Furthermore, a higher frequency of more severe precipitation events observed in the last 2 decades represents an important feedback in the geomorphological evolution of the frozen-dominated landscapes of the southeastern Alps.