Submitted Abstract

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Title	Optical Flow Compared To Phase Correlation Of Uas Images Used To Analyse Alpine Mass Movements In A High-Alpine Setting.
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Abstract

Optical remote sensing analyses of mass movements are required for future alpine safety. High spatiotemporal UAS (unmanned aerial system) data can be employed, using digital image correlation (DIC), to derive ground motion. This enables to investigate the evolution of mass movements and relate them to influencing processes caused by climage change impacts.

This study compares the effective detection and monitoring potential of image registration techniques of the area-based phase correlation algorithm, implemented in COSI-Corr, and the intensity-based dense inverse search optical flow algorithm, performed by IRIS, for UAS data. The dataset consists of seven high accuracy orthophotos of 0.16 m resolution acquired between 2017 and 2021. We studied mass wasting processes of the Sattelkar complex landslide, situated in a steep, glacially-eroded, high-alpine cirque (2,130-2,730 m asl), Austria. The cirque infill is characterised by massive volumes of glacial and periglacial debris, remnants of a dissolving rock glacier and rockfall deposits. The latter are continuously fed by low magnitude high frequency rockfalls from the surroounding headwall of granitic gneiss. Since 2003 there is an increase of dynamic processes and between 2012-2015 rates up to 30 ma-1 were observed. After ongoing heavy precipitation in August 2014 a 170.000 m^3 debris flow was triggered. It is assumed that high water (over)saturation causes spreading and sliding of debris on the glacially smoothed bedrock floor.

Displacement calculations from both algorithms provide knowledge about the extent and internal zones of the mass movement and are qualitatively supported by manually traceable boulders (<10 m). For phase correlation excessive ground motion and surface changes limited the signal to 12 m because of decorrelation and ambiguous displacement vectors. In contrast, optical flow returns more coherent displacement rates with no upper motion limit but some underestimated zones. Increases of motion in our displacement calculations and acceleration curves can be associated to observations of high precipitation in summer 2020 as well as the strong precipitation event in August 2021. We show that UAS data provides trustworthy, relative ground motion rates for moderate velocities, thus enabling us to draw conclusions regarding internal landslide processes.