



## **Rock glacier analyses in the Tyrolean Central Alps based on airborne lidar-data**

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Airborne LIDAR-datasets offer a high potential for the monitoring of surface changes within high mountain environments. Based on an analysis of rock glaciers with airborne LIDAR-datasets a rock glacier activity index is developed. The results are then compared to the classified rock glacier activities from the Tyrolean rock glacier inventory.

LIDAR-data from 2006 and 2010 are used to generate bi-temporal, high-resolution DTMs, for more than 400 rock glaciers in the Tyrolean Central Alps (Austria). The differential DTMs are used to identify basic processes on rock glacier surfaces including vertical and horizontal displacement rates. In order to calculate the vertical displacement rates the DTMs from 2006 are subtracted from 2010 DTMs, whereas the velocities are calculated by image matching. Based on the DTMs the mean and standard deviation of the surface elevation changes and the surface velocities are calculated for each rock glacier. The accuracy of the results of the surface elevation change calculations is improved by applying a simple stable area approach. This approach allows to correct the systematic error between the bi-temporal DTMs, yielding a higher accuracy for the vertical displacement rates.

By combining the normalized mean and standard deviation of the surface elevation changes and velocities, a rock glacier activity index is developed. The activity index ranges from values between zero and one indicating low and high activity rates for each rock glacier. A clear trend between the activity index and the rock glacier inventory is found. Most of the active classified rock glaciers show a high activity index with values exceeding 0.4 and most of the fossil classified rock glaciers show a low activity index with values around zero. Discrepancies between the two methods, the developed rock glacier activity index and the prior manual rock glacier classification, will be discussed. The activity index is in good agreement with the standard classification of an already existing rock glacier inventory. This activity index offers new possibilities in rock glacier research towards an independently reproducible and quantitative airborne lidar based classification.