Geophysical Research Abstracts
Vol. 21, EGU2019-15159, 2019
EGU General Assembly 2019

Temporal evolution of supraglacial debris-cover using the Landsat archive and automatic thresholding

Deniz Gök (1) and Dirk Scherler (1,2)

(1) GFZ German Research Centre for Geoscience, GFZ-Potsdam, Germany , (2) Institute of Geological Sciences, Freie Universität, Berlin, Germany

Supraglacial debris cover influences melt rates, and thus the mass balance of glaciers. Debris cover is widespread in mountainous regions, as a result of various interacting hillslope and glacier processes. The extent and thickness of the debris depends on the rate of debris supply from bedrock hillslopes, the rate of ablation, which exposes englacially transported debris, and surface processes as well as ice dynamics, which distribute debris across the glacier surface. As all of these processes vary with time, supraglacial debris-cover varies with time, too. Therefore, mapping of debris-cover and its changes is essential for regional to global scale predictions of glacier evolution in response to climate change. Current challenges in automated remote-sensing mapping of debris cover are 1) accurate glacier geometries, 2) sufficient image coverage and 3) varying threshold values applied to multispectral band ratios to distinguish debris-free and debris-covered parts of a glacier.

To overcome these limitations we propose to use multi-temporal glacier outlines from the Global Land Ice Measurements from Space (GLIMS) database in conjunction with multispectral satellite imagery from the Landsat archive (TM, ETM+ and OLI sensors). We used the cloud-computing platform Google Earth Engine to create cloud-free annual composite images associated to the date of the GLIMS glacier outlines. To address temporal differences in optimal threshold values, we automatically define thresholds based on histogram shape prior to image segmentation. Initial experiments using Otsu's method and image normalisation are promising, but tend to overestimate debris coverage. To apply these methods broadly, we currently test for general patterns in the distributions of spectral intensities in band ratio images. We present from our ongoing work preliminary debris cover changes between 1998 and 2008, from ∼490 glaciers in the European Alps, using ∼1695 geometries.