Geophysical Research Abstracts
Vol. 20, EGU2018-17420, 2018
EGU General Assembly 2018

Identification of hazardous glaciers in a new survey of surging glaciers on the Tibetan Plateau based on TanDEM-X elevation models

Silvan Leinss
ETH Zürich, Institut für Umweltingenieurwissenschaften (IFU), BAUG, Zürich, Switzerland (leinss@ifu.baug.ethz.ch)

The collapse of two neighbouring, almost identical glaciers near lake Aru Co in North West Tibet (34.0°N, 82.2°E) in July and September 2016 were not only unique events in the size of the resulting ice avalanche volumes (66 and 83 Mm3) but even more in the sense that both occurred in the same mountain ranges within less than 3 months. The only comparable event currently documented is the 2002 Kolka Glacier rock-ice-avalanche (Caucasus Mountains). The rareness of such events implies that they require very specific conditions which are currently poorly known or studied. It was also remarkable for the second Aru Co ice avalanche that its forthcoming collapse and the extent of the ice avalanche were predicted based on the surge-like evolution of its surface elevation within the preceding 3 years. Without knowledge of the specific conditions for such events height changes in combination with not-existent length changes are key indicators to identify possible hazardous surging glaciers. In contrast to common surging glaciers, both Aru glaciers did not advance despite showing the typical surface height change profile of surging glaciers. This obviously increased the internal stress and was likely one reason for the catastrophic collapse.
In this study we analysed height differences between three different digital elevation models, each with 30m resolution: SRTM, ALOS World 3D (AW3D30), and TanDEM-X. Surging glaciers are identified by their unusual mass redistribution pattern: glaciers in an active surge phase show elevation loss in the accumulation area and elevation gain in the ablation area. Glaciers during a quiescent surge phase, in contrast, show strong retreat and significant mass gain in the accumulation area. Using these characteristic patterns, we identified over 100 glaciers which are currently in an active surge phase and find a strong imbalance between active and quiescent surging glaciers. This imbalance raises the question whether the strong regional warming of the Tibetan plateau during the last 30 years shifted climatic conditions towards a climate which increases the probability of a glacier to surge. Or even that the regional climate changed too fast for glaciers to adapt by surface melt and instead triggers a temporary phase of increased surge activity, i.e. glaciers adapt by surging. Both, but especially the latter, could increase the risk of further catastrophic glacier collapses. To detect such possible collapse candidates we analysed the identified actively surging glaciers for their advance to select stagnant glaciers for which the height change profile indicates strong increased internal shear stress as it was the case for the Aru glaciers.