Geophysical Research Abstracts
Vol. 19, EGU2017-6251, 2017
EGU General Assembly 2017

Quantifying ice cliff contribution to debris-covered glacier mass balance from multiple sensors

Fanny Brun (1,2), Patrick Wagnon (1), Etienne Berthier (2), Philip Kraaijenbrink (3), Walter Immerzeel (3), Joseph Shea (4,5), and Christian Vincent (1)

(1) Univ. Grenoble Alpes, France (fanny.brun@univ-grenoble-alpes.fr), (2) LEGOS, Université de Toulouse, CNES, CNRS, IRD, UPS, Toulouse, France, (3) Department of Physical Geography, Faculty of Geosciences, Utrecht University, Utrecht, the Netherlands, (4) International Centre for Integrated Mountain Development, Kathmandu, Nepal, (5) Centre for Hydrology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

Ice cliffs on debris-covered glaciers have been recognized as a hot spot for glacier melt. Ice cliffs are steep (even sometimes overhanging) and fast evolving surface features, which make them challenging to monitor.
We surveyed the topography of Changri Nup Glacier (Nepalese Himalayas, Everest region) in November 2015 and 2016 using multiple sensors: terrestrial photogrammetry, Unmanned Aerial Vehicle (UAV) photogrammetry, Pléiades stereo images and ASTER stereo images. We derived 3D point clouds and digital elevation models (DEMs) following a Structure-from-Motion (SfM) workflow for the first two sets of data to monitor surface elevation changes and calculate the associated volume loss. We derived only DEMs for the two last data sets. The derived DEMs had resolutions ranging from < 5 cm to 30 m.
The derived point clouds and DEMs are used to quantify the ice melt of the cliffs at different scales. The very high resolution SfM point clouds, together with the surface velocity field, will be used to calculate the volume losses of 14 individual cliffs, depending on their size, aspect or the presence of supra glacial lake. Then we will extend this analysis to the whole glacier to quantify the contribution of ice cliff melt to the overall glacier mass balance, calculated with the UAV and Pléiades DEMs. This research will provide important tools to evaluate the role of ice cliffs in regional mass loss.