Geophysical Research Abstracts
Vol. 18, EGU2016-13813-1, 2016
EGU General Assembly 2016

The use of ground based photogrammetry for the monitoring of seasonal movement of a glacier: the case study of Planpincieux Glacier, Grandes Jorasses massif, Mont Blanc

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In September 2013, an experimental low cost monitoring station has been installed on the top of Mt. de La Saxe (Val Ferret, Aosta Valley, NW of Italy) to monitor the Planpincieux Glacier, located on the Italian side of Mont Blanc Massif. This system is based on two commercial APS-C DSLR cameras equipped with a 297 mm and 120 mm optical zoom respectively. Every hour cameras automatically acquire pictures of the lower part of the glacier, which showed to be the most active. The available dataset is analyzed using both change-detection and pixel-offset techniques, to detect the main surface changes over time, as well as to retrieve quantitative measurements of the glacier displacements.
The system is able to work throughout the year. The available dataset has been used to analyze the daily evolution of the lower part of the glacier over the May-November period (when the glacier is free from snow) both in 2014 and 2015.
The pixel-offset approach allows to measure the displacement of different parts of the glacier and to describe its seasonal evolution. Furthermore, change detection algorithm allows highlighting sudden changes of the scene, usually due to icefalls. The available dataset shows that the displacement rate of the glacier increases during the warm season, that in 2014 it was higher than in 2015, and that it was distributed in a different way. Actually, in 2015, the maximum rate was reached in August, whereas in 2014 the measured summer velocity was lower but it lasted over the months of July, August and September. The results have been validated using different ground based SARs, both in 2014 and 2015.
Here we present the results of a three years monitoring, demonstrating the efficiency of pixel-offset and change-detection techniques for contactless monitoring of unreachable glacier surfaces.
Furthermore, we present cross-analysis, considering displacements vs. weather measurements, in order to understand glaciers dynamics.