Geophysical Research Abstracts
Vol. 17, EGU2015-9815-1, 2015
EGU General Assembly 2015

Might short term rockglacier surface morphological changes be attributed to permafrost degradation ?

Romain Perrier (1,2), Etienne Cossart (2,3), Monique Fort (1,2)

(1) University Paris Diderot, Sorbonne-Paris-Cité, Paris, France, (2) PRODIG, UMR 8586 CNRS, Paris, France, (3) University Paris 1 Panthéon Sorbonne, Paris France

In high mountain environments, permafrost is increasingly affected by climate change. Rockglaciers represent the expression of creeping permafrost: they are generally considered as good geo-indicators of cryosphere distribution and evolution. Research dealing with the effect of climate change on rockglacier degradation is mostly based on photogrammetric studies as well as geophysics. Major results on rockglaciers behavior in relation to increasing mean annual air temperature are summarized as follows. Firstly, photogrammetry analysis shows that rockglacier surface velocities are higher when the permafrost temperature and/or water content increase within the rockglacier system; this can sometimes lead to the destabilization/collapse of rockglaciers. Secondly, geophysical studies demonstrate a decrease in resistivities within the rockglacier body in relation to a decrease in ice content hence suggesting a degradation of permafrost. Although these methods are appropriate for studying the effects of climate change on mountain permafrost and rockglacier evolution, their application is fairly costly and time-consuming, and are usually restricted to one or two study cases. Our investigations over a wider area up to regional scale require completing our approach by using surface morphological changes, a method that can identify potential degradation in a warming context.

In this context, this work intends to characterize short terms (multi-decades) surface morphological changes at rockglacier scale and to determine if these changes may be attributed to potential permafrost degradation. Our investigations have been carried out in both Clarée and Ubaye valleys, in the French Southern Alps. Here we present our results obtained from the Lac Rouge rockglacier (45°02'49"N, 6°30'16"E; 2600-2825m a.s.l, Clarée valley, French Southern Alps). Analysis of multi-temporal aerial photographs, geomorphological field mapping, electrical resistivity tomographies and surface kinematics data show that surface morphological changes are heterogeneously distributed despite rockglacier small area (0.1 km^2); these changes seem to depend on ground ice nature and distribution.

Two main behaviors can be highlighted: (i) Ice-cored rockglacier where ground massive ice has been identified is affected by an important surface lowering associated with thermokarst, depressions and melt furrows features. (ii) Ice-cemented rockglacier is characterized by less pronounced activity where both horizontal and vertical movement range within few centimeters. Significant surface morphological changes have not been observed.

We interpret the observed short term surface morphological changes of the Lac Rouge rockglacier as the melting of massive ground ice – most likely inherited from the LIA period – rather than to permafrost degradation.