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Internal structure and evolution of a small debris-covered glacier: Les Diablerets, Switzerland

J.-B. Bosson and C. Lambiel
Institut de Géographie, Université de Lausanne, Switzerland (jean-baptiste.bosson@unil.ch)

The negative mass balance of alpine glacier systems can lead to their discontinuous or continuous burial under debris: the glacier becomes too weak to remove intra and supraglacial debris. A mantle that is a few centimeters thick, leads to partial insulation of the ice from the atmosphere and melts rates are reduced. Otherwise, within the discontinuous periglacial domain (roughly above the isogeotherm of -2°C), glacier/permafrost interactions occur frequently. Thus, a continuum of complex forms exists between debris-covered glacier and rock glacier. Finally, in the case of small glaciers located under high rock walls, intense rock falls associated with several Holocene fluctuations leaded to the formation of hypertrophied sedimentary accumulations called morainic bastions.

Thus, high mountain glacier systems may be characterized by a massive buried ice body, some glacier/permafrost interactions and an important stock of sediments. In the current context of global change, the responses of these systems are complex and atypical, compared with the response of "white" glaciers. Moreover, the stability of these ice/sediments accumulations can also be disturbed.

The objective of this study is to investigate the internal structure of these debris-covered glaciers systems and to quantify their response to recent and current climate modifications. This poster presents results from 2011 and 2012 measurement campaigns on the debris-covered glacier system of Entre la Reille (Les Diablerets – ski area of Glacier 3000, Switzerland, 46°20'22" N / 7°13'11" E). Located between 2350 and 2550m, this small landform (0.05 km2) comprises a rock glacier morphology with morainic ridges, small outcrops of massive ice and permanent snowfields uphill. Multiple methods (Electrical resistivity tomography, DGPS, Ground surface temperature measurements, BTS, Geomorphological mapping) have been carried out on the landform. The results show, in the upper part, an ice-cored buried body (resistivity values > 470 kΩm) and in the distal part, a body of ice-cemented deformed sediment (resistivity values > 10 kΩm). Pluri-decimeter annual movements have been measured, especially in the upper part. Their high vertical components seem to indicate massive ice melt out.