Contribution: Poster presentation

Chemical, physical and microbiological characterisation of water in an alpine permafrost area (Istituto Mosso LTER site, NW Italian Alps)

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High altitude areas in the Alps are characterised by the permafrost environment, which reacts sensitively to climate change effects. During the last decades several studies on alpine permafrost-related hazards have been performed but few studies have focused on the geochemical content of the water that drains permafrost areas. For example, rock glaciers physically and chemically influence the water that passes through them and their discharge can be highly enriched in solutes. Unexpected high nickel and manganese concentrations exceeding the EU limits for drinking water have recently been reported in some studies investigating rock glacier discharges.
The present study aims to evaluate rock glacier solute fluxes into a high altitude lake in the NW Italian Alps (Istituto Mosso LTER site, www.lteritalia.it/) in order to understand the impact of climate parameters on alpine permafrost, in particular the effects of permafrost ice melt on the water quality of mountain headwaters. This objective has been achieved through an integrated-multidisciplinary research programme involving climate analysis, rock glacier ground surface temperature investigation, water physiochemical and microbiological analyses.
Nine automatic and three manned weather stations located in the surrounding areas of the rock glacier (2700 m a.s.l.; radius: 12 km) have been used to study the relationships between climatic parameters and permafrost dynamics. Moreover, meteorological data have been collected by installing portable instruments in situ, integrated in a Mini Automatic Weather Station.
To investigate the correlations between physiochemical features of water and the thermal state of the rock glacier surface, the ground temperature monitoring has been conducted. Temperature dataloggers have been buried 5/10 cm into the ground, regularly distributed on the rockglacier surface and in few surrounding sites. Total Station was used to achieve position for each datalogger and differential GNSS was used to acquire global geographic coordinates with centimetric precision in order to accurately interpolate ground temperature data grid.
Water quality monitoring was conducted using a multiparameter probe. In particular, NO3-N, DOC, TOC and turbidity were analysed, and UV-visible absorbance spectra were recorded every three hours during summer and early autumn seasons. Water sampling in the rock glacier lake was conducted on weekly basis during the ice-free season; moreover, the ablation water of the Indren Glacier, 2 km far from the main study area, has been analysed in order to use it as reference data. Water samples have been analysed for anions, cations, trace elements, nutrient content, EC, Eh and pH. Finally, in order to assess microbial diversity and abundance of communities, functionally related to ecosystem nutrient dynamics, diversity and abundance of microbial communities were analysed. The fine material in the permafrost feature has been characterised through the determination of Ntot, Corg, N forms and heavy metals.