

Name of research institute or organization:

WSL Institute for Snow and Avalanche Research SLF

Title of project:

Influences of the snowcover on thermal and mechanical processes in steep permafrost rockwalls

Project leader and team:

Marcia Phillips (Project leader, permafrost researcher)
Anna Haberkorn (PhD Student)
Hansueli Rhyner (Mountain guide)
Robert Kenner (Geodetics engineer)
Martin Hiller (Electronics engineer)
Marco Collet (Mechanic)

Project description:

In the SNF DACH project entitled 'Influences of snow on permafrost rock walls' we investigate the role of snow on the thermal regime and mechanical stability of steep rock walls in collaboration with the Universities of Bonn, Fribourg, Zurich and the ETH Zurich. The research sites include the Sphinx north and south rock walls, which were equipped with various temperature and deformation logging devices by ETH and the University of Zurich in the context of the PermaSense project (www.permasense.ch). The data obtained is kindly made available by these institutions.

In-situ investigations of the snow cover on both sides of the Sphinx ridge show that snow accumulates on rock slopes up to 70° steep, depending on surface roughness. On the north side, the snow cover typically consists of faceted crystals and depth hoar. On the south facing slopes the snow cover typically includes rounded grains, melt crusts and ice lenses at the snow-rock interface. All aspects and steepnesses can accumulate ephemeral rime and glazing during storms - the formation of these causes latent heat exchange at the rime/ice-rock interface. In the absence of snow, south facing rockwalls are subject to daily temperature variations of around 20°C. The infiltration of snow melt water and liquid precipitation through rock discontinuities can rapidly influence the temperatures at depth. The influence of such advective flows and other types of heat transfer to depths far from the rock surface can be seen from borehole temperature measurements at similar sites (e.g. Gemsstock ridge in Andermatt) or in the nearby Jungfrau Ostgrat ridge.

The sub-horizontal Jungfrau Ostgrat borehole is located at 3590 m in the north facing wall of the Jungfrau Ostgrat. It is 20 m long and equipped with 9 thermistors and a data logger. Rock temperatures vary between -4 and -8°C. The main form of heat transfer is conduction here. The high elevation of the borehole and the fact that it is located in a steep, exposed rocky ridge make the data particularly valuable. In September 2013 rock surface temperature loggers were installed at the rock surface at the outer end of the borehole. In 2013 the borehole was included in the PERMOS network (www.permos.ch).

Key words:

Mountain permafrost, thermal regime, active layer, rock walls, snow cover distribution, snow characteristics

Internet data bases:

<http://www.permos.ch>
<http://www.permasense.ch>

Collaborating partners/networks:

Universities of Bonn, Fribourg and Zurich, ETH Zurich
PERMOS Network: www.permos.ch
PermaSense Network: www.permasense.ch

Scientific publications and public outreach 2013:

Conference papers

Haberkorn A., M. Phillips, R. Kenner, M.-O. Schmid, Influences of snow cover on thermal processes in steep alpine rockwalls, Proceedings of the Davos Atmosphere and Cryosphere Assembly DACA-13, p. 868, Davos, Switzerland, July 8-12, 2013.

Haberkorn A., M. Phillips, M. Hoelzle, R. Kenner, Influences of the seasonal varying snow cover on thermal processes in steep Alpine permafrost rock walls, Swiss Geoscience Meeting, Lausanne, Switzerland, November 15-16, 2013.

Excursions

SEP (Swiss Society for Snow, Ice and Permafrost) Excursion to Jungfrauoch on August 23-24, 2013.

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