Name of research institute or organization:

Alpine Cryosphere and Geomorphology, Department of Geosciences, University of Fribourg

Title of project:

Geophysical monitoring of the evolution of permafrost on Stockhorn

Project leader and team:

Dr. Christin Hilbich (PostDoc Uni Zürich, lead geophysical measurements)
Prof. Christian Hauck (Uni Fribourg, lead geophysical measurements)
Prof. Martin Hoelzle (Uni Fribourg, lead boreholes and meteo station)
Dr. C Fuss (Geolog, maintenance of the automated system)
David Sciboz (technician Uni Fribourg, maintenance of boreholes and meteo station)
Etienne Rosset (MSc. Student Uni Fribourg)

Project description:

Within the Swiss Permafrost Monitoring Network PERMOS, the Stockhorn plateau represents the highest monitoring site (3410 m a.s.l.) and one of the two sites with deep (100 m) permafrost boreholes of the network. It is thus a very important site for the observation of permafrost evolution in high elevations.

The Stockhorn plateau is located between the Gornergrat and the Stockhorn summit separating the steep and glacier-covered northern rock face from the non-glaciated and gently inclined south face. Significant amounts of ground ice could be observed in large ice-filled cracks during construction works of a new ski lift in summer 2007.

In summer 2000 two boreholes (100 m and 30 m deep) have been drilled on the plateau for regular subsurface temperature logging, and a meteorological station was installed to complement the information by e.g. air temperature, wind speed and direction, radiation, etc. In summer 2005, in addition, a permanent 2D geoelectrical profile was installed from the northern edge of the plateau in NS direction 96 m to the south. The profile covers an investigation depth of about 15-20 m. The aim is a long-term observation of temporal changes in the electrical resistivities in response to climate change. This is possible by relating the change in electrical resistivities to freeze and thaw processes, as liquid water in the pore space of the subsurface material serves as electric conductor, but in frozen state as electric isolator causing much higher resistivities than unfrozen material.

After five years of manual and therefore sporadic geoelectric measurements on Stockhorn plateau, in summer 2010 we installed an automatic instrument, which now allows the measurement of the 2D resistivity distribution with a daily resolution, and helps to understand the observed resistivity changes as a function of seasonal processes.

The automated instrument is controlled by a computer, which is based at the Gornergrat research station, communicating via directed antennae with the instrument on Stockhorn plateau. This enormously facilitates our work, because physical access to the Stockhorn plateau is complicated and would take about two hours (one-way) from Gornergrat. The set up of this new instrument is now finished and first results of this newly implemented system can be expected from now on.

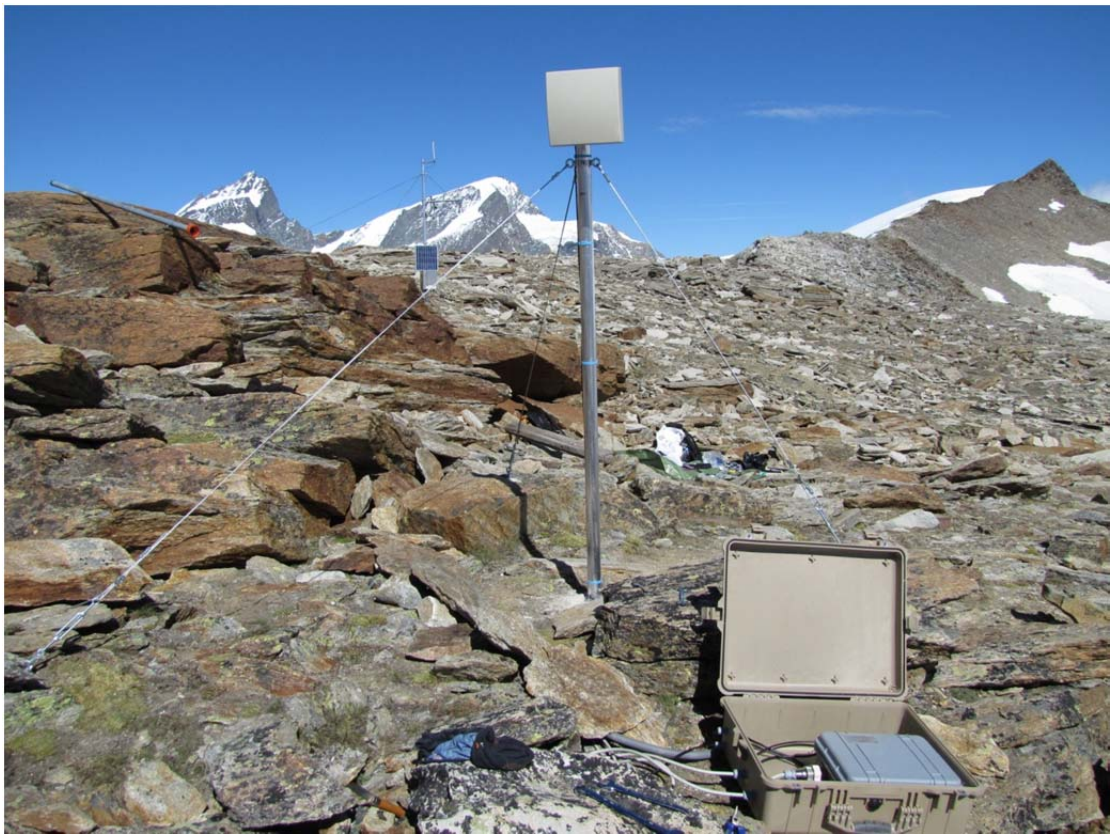

Figure 1: The Stockhorn plateau with the automated resistivity instrument in front and the antennae for communication with the computer at Gornergrat research station behind.

Key words:

Permafrost, electrical resistivity, freeze/thaw processes

Internet data bases:

www.permos.ch

Collaborating partners/networks:

Permafrost Monitoring Switzerland (www.permos.ch)

Scientific publications and public outreach 2010:

Data books and reports

PERMOS 2010. Permafrost in Switzerland 2006/2007 and 2007/2008. Noetzli, J. and Vonder Muehll, D. (eds.), Glaciological Report (Permafrost) No. 8/9 of the Cryospheric Commission of the Swiss Academy of Sciences, 68 pp.

Peer-reviewed papers

Hilbich, C., Fuss, C. & Hauck, C. (in review). Automated time-lapse ERT for improved process analysis and monitoring of frozen ground. Submitted to Permafrost and Periglacial Processes.

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