Name of research institute or organization:

University of Zürich, Department of Geography, Glaciology and Geomorphodynamics Group

Title of project:

Measurement and modelling of rock-surface temperatures in steep alpine rock faces

Project leader and team:

Stephan Gruber, MSc, project leader
Marco Peter, MSc candidate
Martin Hoelzle, Dr.
Wilfried Haeberli, Prof. Dr.

Project description:

Knowledge on the spatial distribution of rock surface temperatures and a reliable method for their parameterisation is required for 2D and 3D ground temperature models as well as the retrieval of climate signals from deep permafrost boreholes. The virtual absence of winter snow cover on steep rock faces combined with the direct coupling of surface and subsurface energy balance (without complex thermal offset in a mixed-media active layer) is a unique chance for the calibration and verification of surface energy-balance models. Practical relevance is added to this topic by the influence of warm or degrading permafrost on the stability of rock walls in cold-mountains suggested by recent research.
A strategy for the measurement of rock surface temperatures in the Swiss Alps has been designed and in summer and autumn 2001, more than 20 specially redesigned UTL-1 data loggers were placed at locations between 2000 and 4500 m a.s.l. Sites were selected in order to cover a wide range of temperatures and expositions and mostly comprised near-vertical faces. Temperatures are recorded several times per day with a capacity to store more than a years worth of data. Test sites included the surroundings of Jungfraujoch, the Schilthorn area, Corvatsch, Gornergrat/Stockhorn, Kleinmatterhorn and Colle Gnifetti on Monte Rosa. In the context of safe and efficient access of our measurement sites, the research station Jungfraujoch was of key importance. In autumn 2002, 14 complete time series were recovered. The data collected is of good quality and will suffice as a basis for the intended analysis and modeling of the spatial distribution of Alpine rock-face temperatures. This is expected to provide necessary information for research related to the stability of frozen rock-walls under a warming climate and to be beneficial for investigations of weathering and landform evolution.

Key words:

Permafrost, rock faces, mean annual ground surface temperature, energy balance

Internet data bases:

Collaborating partners/networks:

Scientific publications and public outreach 2002:

The Thermal Regime of Steep Alpine Rock Faces. 2002. Gruber, S, Haeberli, W and Noetzli, J. American Geophysical Union, 2002 Fall Meeting, San Francisco.

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