



## **Permafrost distribution assessments in the North-Ossetian Caucasus: first results**

**R. Frauenfelder** (1), S. Zraggen-Oswald (1), C. Huggel (1), A. Kääh (1), W. Haerberli (1), I. Galushkin (2), A. Polkvoy (3)

(1) Department of Geography, University of Zürich, Switzerland, (2) InfoTerra, Vladikavkaz, North Ossetia-Alania, Russia, (3) Department of Natural Resources and Environment Protection MNR, Vladikavkaz, North Ossetia-Alania, Russia

Glacier retreat and thawing permafrost affect the stability of steep slopes in cold mountain ranges. Ice break-off from hanging glaciers (a natural form of ablation) as well as glacier retreat change the stress distribution of a slope and may induce destabilization. Unstable slopes potentially threaten infrastructure, cultivated land and inhabited places.

On 20 September 2002, an enormous rock/ice avalanche and subsequent mudflow occurred on the northern slope of the Kazbek massif, Northern Ossetia, Russian Caucasus, starting from the NNE wall of Dzhimarai-khokh (4780 m a.s.l.) and heavily affecting the valley of Genaldon/Karmadon. Shortly after this incident, the government of North Ossetia started collaboration with the Hazard Prevention Group of the Swiss Humanitarian Aid Unit and the Russian Academy of Sciences in order to assess the arisen risks and to help implement mitigation measures. The present contribution reports about a regional permafrost analysis that was initiated within this context.

Two empirical models, both originally developed to estimate the regional scale permafrost distribution in the Swiss Alps, were applied to assess the mountain permafrost distribution in the North Ossetian Caucasus. Although climatic conditions (general parameters, seasonal variability, precipitation values) are quite comparable for the two regions, the models have to be adapted to Caucasian conditions in order to account for differences in latitude and mean annual air temperature (MAAT).

Using temperature data from a meteorological station close-by, the altitude of the 0°C-isotherm in the Genaldon/Karmadon valley was determined at approximately 2640 m

a.s.l. This value agrees well with temperature measurements at Djankuat glacier in the central section of the Main Caucasus Ridge which suggest a 0°C-isotherm at about 2500-2660 m a.s.l. Therewith, the 0°C-isotherm in the Kasbek massif is approximately 400 m higher than in the Swiss Alps, and the Caucasian permafrost distribution subsequently estimated by using this 0°C-isotherm altitude.

As a qualitative first order verification, the results of the models were compared with each other and with inventoried occurrences of active rockglaciers. In order to get quantitative reference data, ten miniature temperature loggers were installed in the upper part of the Karmadon valley. The data of these loggers will be available in summer 2005. This data will help to better calibrate the models and to get insights into the temperature distribution in the Dzhimarai-khokh wall. This will contribute to the understanding of the very complex thermo-mechanical conditions, which most likely contributed to the enormous ice/rock slide.