Geophysical Research Abstracts, Vol. 9, 04918, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04918

GPR investigations on talus slopes - towards bridging the gap between short-term and long-term debris fall rates

O. Sass

Institute of Geography, University of Augsburg, Germany, oliver.sass@geo.uni-augsburg.de

The time frame covered by direct estimation of present-day geomorphological processes is usually very short. This is exceedingly valid for measurements of debris falls which are very inhomogeneous in time and space. Quantifying talus debris at the foot of rock faces in closed settings (e.g. cirques) allows for a quantification of mean process rates since deglaciation. However, several fundamental problems are associated with this apparently simple approach. Firstly, the thickness of the deposits is hard to evaluate by drillings due to remote terrain and coarse grain sizes. Secondly, the time span of talus formation is uncertain because basal till layers may have survived glaciation. Thirdly, considerable fluctuations of process rates throughout the Holocene are to be expected and thus, any mean values may be misleading.

In various study areas (chiefly in the Eastern Alps), debris falls were recorded using more than 50 wire mesh collectors. Widely in the same areas of investigation, extensive geophysical measurements were carried out on adjacent talus sheets and cones with the aim of assessing sediment thickness and structure. The emphasis was on ground-penetrating radar (GPR) profiling. A total of more than 60 profiles on roughly 30 slopes were measured. 2D-resistivity and seismic refraction measurements were performed to complete comprehensive subsurface information and to validate the results.

The results highlight the great potency of GPR for investigating alpine debris bodies. Penetration depths of up to 50 m were achieved and the typical structural patterns found in the radargrams facilitate an accurate and reliable delimitation of debris and till layers. In the straightforward case of debris overlying bedrock, the geophysical techniques applied are in good coincidence. Whenever further subsurface layers like

basal till or permafrost are present, parallel application of two or three methods is advised to permit a full-fledged interpretation. All results obtained give evidence for layers of glacigenic debris under many of the talus slopes investigated. Thus, the calculation of total volumes may derive misleading results in terms of sediment budget calculations.

Considerable deviations between talus thickness and short-term debris fall rates were found. The calculated long-term backweathering rates (200-1000 mm/ka) are two or three times higher than the rates derived from present-day rockfall (50-300 mm/ka). This discrepancy presumably reflects (1) phases of enhanced rockfall due to Holocene climatic fluctuations and (2) the paraglacial effect as an aftermath of the last major glaciation. Pronounced stratification found in the GPR sections supports the conception of considerably changing process types and magnitudes during the Holocene.