



Distribution of cold ice in the tongue of Gornergletscher from radar surveys

O. Eisen (1), A. Bauder (2), M. Lüthi (2), M. Funk (2)

(1) Alfred-Wegener-Institut für Polar- und Meeresforschung Bremerhaven, Germany (2)
Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie, ETH Zürich, Switzerland

Gornergletscher, Valais, Switzerland, originates in the highest regions of the Monte Rosa massif. Substantial portions of its ice are still below the pressure melting point in the glacier tongue. To map the distribution of the cold-temperate transition surface (CTS), extensive field campaigns have been carried out over the last years. As has been demonstrated for other glaciers, the position of the CTS is a long-term integrating indicator of changing climatic conditions. Ice-penetrating radar surveys were used to map ice thickness and determine bedrock topography at 3 and 40 MHz. The 40 MHz data displays a thick layer of low backscatter in the center of the glacier. This zone is clearly present in all seven cross profiles over an along-glacier distance of several kilometers. Based on data sets of borehole temperature measurements and glacier dynamics, we interpret this zone of low backscatter as a core of cold ice, advected from the accumulation region of Grenzletscher into the tongue of Gornergletscher. On Gornergletscher, along our profiles the CTS can be found in a maximum depth of about 180 m and extends laterally about 300-400 m, about 1/3 of the whole width. The migration of the CTS depends on surface ablation, heat flow related to temperature gradients, and advection of cold ice from upstream regions. We analyse the current state of the CTS, laying the baseline for future observations, and provide estimates for the expected future development.