

Using glacio-speleological methods to test GPR interpretations about changes in dynamics, thermal state and drainage system of Tellbreen, a high Arctic glacier on Svalbard

Kathrin Naegeli

Department of Geography, University of Zurich / The University Centre in Svalbard (UNIS)

Douglas Benn

The University Centre in Svalbard (UNIS)

Michael Zemp

Department of Geography, University of Zurich

Glacier response to climate change has attracted a large amount of research effort in recent years. Besides changes in length, area, volume and mass, glaciers can also respond to climate change by altering their thermal condition and drainage system configuration. Relatively little research has been conducted on long-term internal changes to glacier systems, largely due to the difficulty of obtaining data on past glacier states. Recent developments in glacio-speleology have opened up new opportunities to make direct observations of glacier drainage systems, and gain access to glacier beds and basal ice sequences. During two field seasons (2011/12) speleological mapping of 3 different conduit systems has been conducted in Tellbreen, a cold-based glacier in central Svalbard, Norway. Exploration of englacial and subglacial conduits allows both the investigation of the present state of the glacier drainage system and basal thermal regime, and past states of the glacier through study of basal ice characteristics. The explorations in Tellbreen have shown that the conduits have both englacial and subglacial components, and some sections are even incised into the glacial till. Furthermore, the findings indicate that Tellbreen had formerly at least partly a temperate bed and was much more dynamically and geomorphologically active during its Little Ice Age maxima than it is today. This study demonstrates the capability and applicability of glacio-speleology to test findings based on indirect methods such as Ground Penetrating Radar (GPR). Additionally it reveals the present and especially the past behaviour of Tellbreen in a new light.