The Cryosphere Discuss., 4, C1274–C1276, 2010
www.the-cryosphere-discuss.net/4/C1274/2010/

The Cryosphere Discussions

Interactive comment on "Thermal structure and drainage system of a small valley glacier (Tellbreen, Svalbard), investigated by Ground Penetrating Radar" *by* K. Bælum and D. I. Benn

K. Bælum and D. I. Benn

karolineb@unis.no

Received and published: 6 December 2010

First of all we would like to thank the referee for a fast, efficient and well structured review. We find the comments both helpful and constructive and have incorporated the majority of them into the paper. The suggestions we have chosen to not incorporate into the paper are described in the following.

The suggestion of comparing borehole radar and temperature profiles (p. 1012) would undoubtedly add valuable information to the paper. However there might have been some unclarity regarding what data exist from Tellbreen and this is a point we will aim clarify in the paper. Compared to Storglacieren, which the referee refers to in

the attached papers, Tellbreen is essentially uncharted territory. There are so far no boreholes, no temperature data, no mass balance stakes, no weather stations and no velocity data. This of course limits our options. The only data available, in addition to the maps, are the 2004-2010 radar lines and arrial photos from 1995. Unfortunately we also do not, as stated in the paper, have the necessary equipment to do CMP surveys.

Looking into stain heating and thermodynamics as suggested by the referee (p. 1012) would be interesting and indubitably contribute to the understanding of the glacier system. But again the limited data available is a hindrance. Approximating the strain rate without data regarding surface temperature, horizontal or vertical velocity or geothermal gradient would be difficult.

We agree that elaborating on the subject of the thermal regime of Tellbreen is necessary and have therefore following the advice of Dr. Gusmeroli (p. 1013 -1016) restructured section 4 (results). This now contains three distinct parts; first a short description of the temporal geometric and volumetric changes, then a section solely devoted to the thermal regime and a third section concerning the water in the glacier. We have also upon the advise of the referee restructured sections of the paper and made several of the figure captions more descriptive. Figure 9,10, 11 that depicts the radar returns from different channel types will be collected in to one figure.

The limited data is also the reason why the ELA is not plotted on the maps (p. 1014). The only indication we have of its position is the surface shape from the maps and the snowline from the 1995 aerial photo. However the photo is not from the end of the melting season and the maps are based on photos from the 1930's. A description of the location of the 1995 snowline has been added into the paper.

As the referee correctly points out the absence of scattering rich ice does not preclude the existence of temperate ice (p. 1012). In this paper the lack of such a reflection zone has been taken as one of the indications that the glacier is cold through out. This is based on a number of publications reporting clear cold-temperate transition surfaces

(CTS) in radar data from polythermal Svalbard glaciers. References to some of these papers have been included in the paper. We have found no evidence that the glacier has widespread wet basal conditions or other evidence pointing towards a polythermal regime. The accumulation zone is close to non-existent and no signs of temperate ice have been found near the surface in the upper parts of the glacier. If this had not been the case the glacier could indeed have been classified as a type A arctic polythermal glacier according to the Blatter and Hutter (1991) paper recommended by the referee. We have taken the referees comments (p. 1016) into consideration and have on his advice elaborated on this conclusion as it was not documented thoroughly enough.

The reason behind not putting scales the maps (p. 1017) is that the coordinates for all of them, except figure 1, are in UTM. We have also corrected the list of errors regarding the references, figures and other inconsistencies pointed out by the referee on pages 1017 and 1018.

Interactive comment on The Cryosphere Discuss., 4, 2169, 2010.