Geophysical Research Abstracts
Vol. 13, EGU2011-11223, 2011
EGU General Assembly 2011

Modelling Ground Penetrating Radar data gathered in the vicinity of the vestige of a glacier-dammed lake

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Glacial Lake Outburst Floods (GLOFs) are natural hazards threatening an increasing amount of people living near glaciated areas. Caused by the chaotic characteristics of a GLOF, forecasting is a very challenging business and only a few made the attempt to really quantitatively solve this problem. Comparing GLOF events of different field sites and even of the same field site often give an inconsistent picture indicating the existence of many outburst mechanisms. However, beside the non-linear behaviour of the outburst mechanism itself, the hydrology of a glacier is a key question.
The Austrian IPY contribution FERMAP aimed the East of Greenland. Based at the Danish Research Station Zackenberg (74°28'N, 20°34'W) two adjacent glaciers (Freya Glacier and A. P. Olsen Ice Cap) were of main interest. Ground Penetrating Radar (GPR) was applied to yield snow cover- and ice thickness distribution for the two glaciers. During the gathering of ice thickness data of the South East pointing outlet glacier of the A. P. Olsen Ice Cap (74°38'N, 21°26'W) dominant englacial and subglacial reflections drew attention to itself. Dominant englacial and subglacial reflections are all located downwards in flow direction of the remaining structures of a lake outburst. The glacial stream of the investigated outlet glacier drains into the Zackenberg River, which passes directly the Zackenberg Research Station. Since 1997 annual floods were documented qualitatively by photos and quantitatively by discharge data, showing obvious peaks. Registered floods mostly occurred in the period July-November. Following these observations the noteworthy englacial and subglacial reflections are most likely part of a drainage system conducting water of the outburst flood through the glacier. As a first assumption the dominant englacial reflections were regarded as channels. Throughout forward modelling potential channel dimensions and fillings were estimated. Furthermore the bed reflection power (BRP) of the basal reflections were calculated which are showing high values in the vicinity of the glacier-dammed lake downward the flow direction of the glacier. Analysing the calculated BRPs without any attenuation correction for traveltime in the ice column, reveal an inverse relation between reflected energy at the glacier bed and traveltime. By means of forward modelling geological/ hydrological settings are discussed which can produce this inverse relation.