Sensors & Software

GLACIER MAPPING

University of Calgary researchers mapping of Stagnation glacier to determine subsurface shape and estimate ice volume using a pulseEKKO GPR system

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Overview

Glaciers are a major source of fresh water and in places are the critical supplier of water for drinking, irrigation and hydro electric power generation. Modern water resource management requires understanding the volume of supply available.

Problem

Glacier depth and subsurface geometry can vary greatly and defining the 3D shape of the glacier provides the answer to the volume of fresh water held in the form of ice. Survey techniques are needed to defined glacier depth and shape. In addition, since glaciers are growing and receding continuously, the means to monitor changes with time are also important.

GPR Contribution to Solution

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Modern GPR systems are light weight, portable and easy to use. When combined with GPS positioning, digitally recorded GPR data can be geo-referenced and analysed to create 3D representations of a glacier or ice sheet.

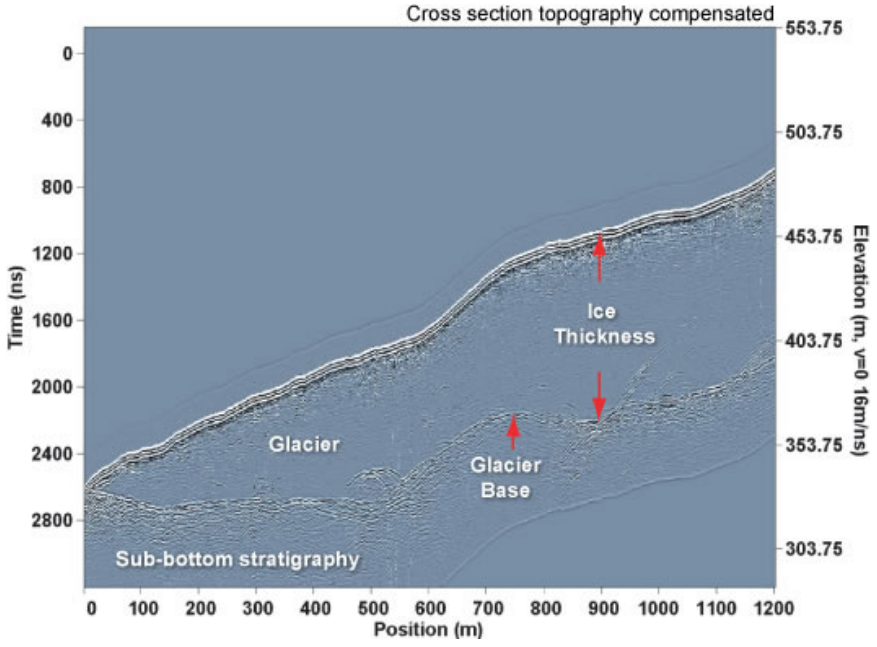
The current survey was conducted on Stagnation Glacier. The University of Calgary team surveyed a number of transects across and down the axis of the glacier.

After appropriate processing, the estimated ice depth over the extent of the glacier was determined. The results were then presented in the form of a contour map.

Results such as this can be obtained by autonomous crews in a few days. In this case the survey team carried out the survey on foot and back-packed the survey equipment. The issues of crevasses and other local hazards are always a concern to field crews. In many cases towing the GPR with a snow mobile or similar snow vehicle can vastly speed up data acquisition.

Data courtesy of Brian Moorman - University of Calgary.

Stagnation glacier on Bylot Island in the Canadian Arctic



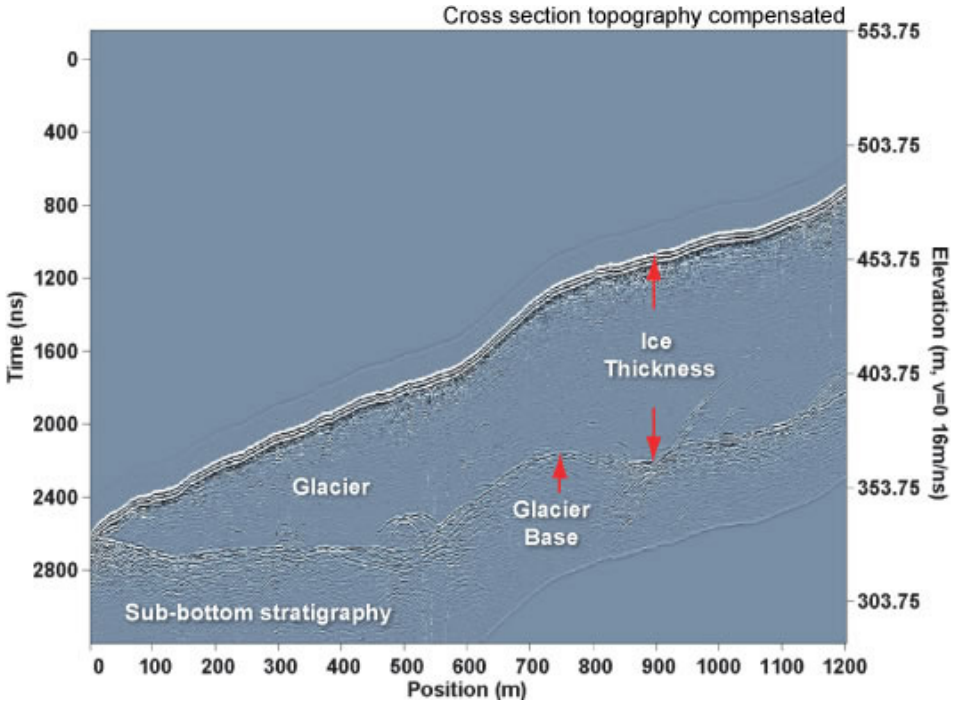
GPR profile along the axis of the Stagnation Glacier after compensating the data for topographic changes as determined from the GPS data.

Results & benefits

With climate change impacting ice covered areas worldwide, GPR for glacier mapping is becoming common. Some key benefits are:

- GPR provides a compact and readily used survey method for determining the subsurface shape of ice sheets.
- The pulseEKKO system used in this study demonstrated use of a man-portable system with integrated GPS.
- GPR operation is simple and intuitive and full digitial recording makes post-survey geometry assessment quick and easy
- Users can be effective with minimal training
- Processing software make data analysis practical on a PC
- 3D GPR visualization software delivers memorable images to decision makers

GPR responses vary greatly depending on the target being sought and the host material. GPR response variability can be challenging to new GPR users. When learning about GPR, the best practice is to review several similar case studies to develop an understanding of variability. Check for other insightful information on the resources tab to learn more. Use Contact Us or Ask-the-Expert to reach our Application Specialists who can help you tap into Sensors & Software's vast array of technical information.



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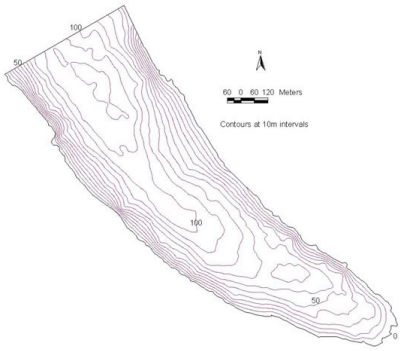

Ice thickness contour map of the Stagnation Glacier derived from GPR survey data.

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