GPR Bathymetry

A Noggin 250 with GPS positioning unit mounted in a small rubber boat and towed by a canoe

Used to determine water depth and sediment stratigraphy on Methuen Lake, Canada - September 2005

SEE THE FULL STORY ON THE NEXT PAGE.

Sensors & Software

Freshwater lake is a hard-to-access area

GPR can see though many meters of water

Overview

Hydrologists and engineers often require accurate water depth and information about sub-bottom stratigraphy in shallow freshwater lakes and rivers. Uses can vary from estimating available water volumes to the engineering design of new structures.

Problem

Many small lakes, weed-invested waters, and fast-flowing streams are difficult areas in which to get reliable water depth or to define sub-bottom structure. Projects such as bridge or pipeline crossings need substantive subsurface control data. Use of large boats with conventional acoustic sounding equipment is often not possible.

GPR Contribution to Solution

Many bodies of freshwater are quite transparent to radiowaves, much to the surprise of many people. Depending on the level of dissolved solids (essentially salinity), GPR can actually see though many meters of water.

The compact nature of GPR instruments and the integration of modern units with GPS positioning makes GPR a natural tool for these applications. GPR surveys can be conducted from boats, rafts, or even through the ice in areas where open water freezes.

The present case study illustrates results obtained on a small freshwater lake in the Precambrian Shield in Canada; the water depth, soft sediment layer, and rock boundary are shown. Surveys were conducted using a canoe and rubber raft in summer and a sled towed unit operating through the ice in winter.

Applications for GPR bathymetry abound. In northern regions through-the-ice bathymetry can be invaluable.

While these results are spectacular, some fresh water lakes can have substantial salt content. Though still considered fresh, the water electrical conductivity can be elevated by the presence of winter road salt run-off, natural rock solutioning, human or agricultural waste dumping, and fertilizer dissolution. The electrical conductivity of a large river has been seen to jump ten-fold when winter snow was disposed of directly into the river.

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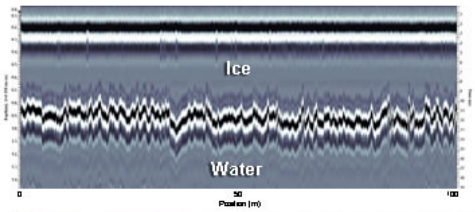
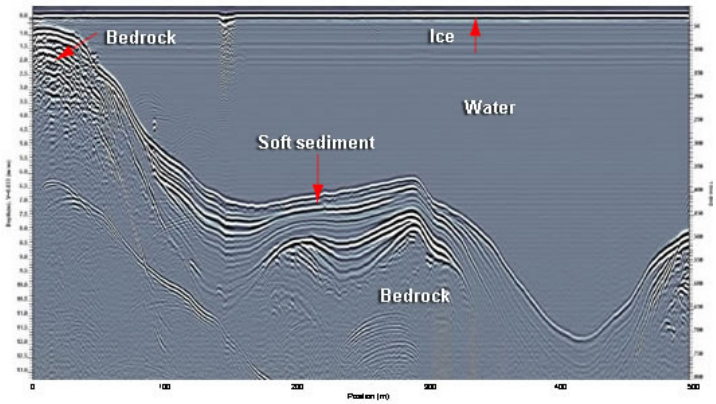


Zoom into a pulseEKKO PRO 500 MHz cross-section showing ice thickness.



pulseEKKO PRO 100 MHz cross-section showing lake-bathymetry and sub-bottom profiling.

Through-the-ice GPR cross-section showing data collected using a SPIDAR configured pulseEKKO PRO concurrently running both 500 MHz and 100 MHz sensors. The dual sensor configuration enables acquisition of detailed ice thickness while also obtaining larger scale water depth and sub-bottom data.

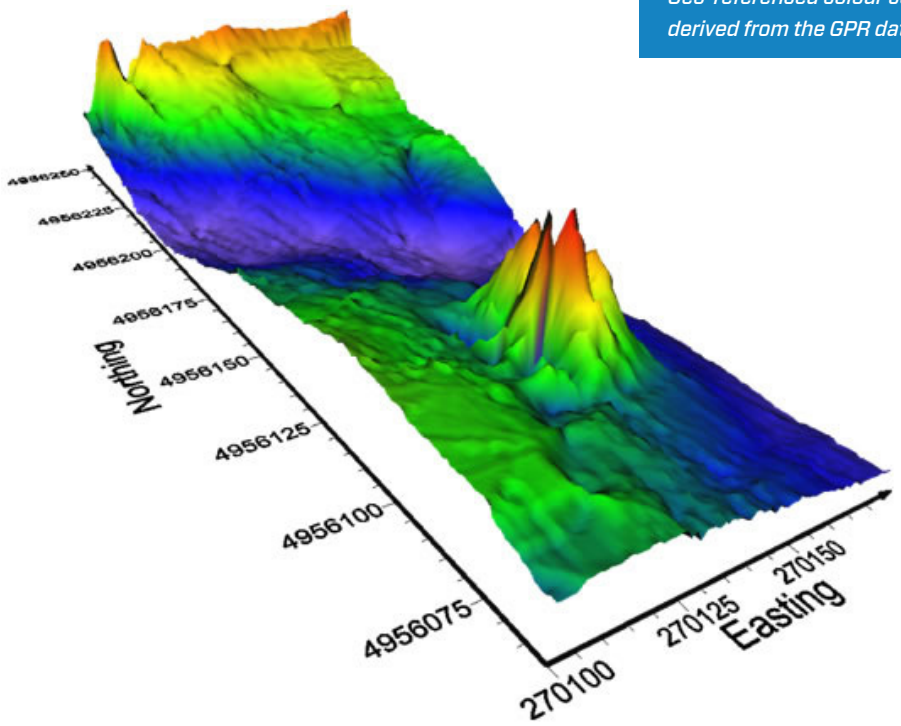
pulseEKKO PRO 500 and 100 MHz Dual-Channel SPIDAR configuration with GPS positioning for concurrent collection of ice thickness, bathymetry, and sub-bottom stratigraphy - Methuen Lake, Canada - winter 2008.

Results & Benefits

GPR bathymetry is a little-appreciated GPR application. Some key benefits are:

- Ability to survey hard-to-access areas
- Ability to see though shallow water and determine subsurface structure
- Simple and easy-to-use GPR systems like the pulseEKKO PRO and Noggin units make field operations practical
- Integrated operation with GPS delivers geo-referenced interpretations
- Users can be effective with minimal training
- Unified data analysis delivers geo-referenced results

GPR responses vary greatly depending on the target being sought and on 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.



Geo-referenced colour contour map of bedrock surface as derived from the GPR data.

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