

3D ground-penetrating radar over ice and permafrost

Robert R. Stewart*, Monica Moldoveanu, Julie Aitken, and Eric Gallant
Dept. of Geology and Geophysics Calgary, University of Calgary, AB, T2N 1N4
stewart@geo.ucalgary.ca

ABSTRACT

Ground penetrating radar (GPR) studies have been conducted at two sites (Devon Island, Nunavut and Bowness Park, Calgary) to study the character of ice, permafrost, and the shallow subsurface. We have used Sensor and Software, Inc.'s NOGGIN 250 MHz system as well as the Pulse EKKO 4 system with 50, 100, and 200MHz antennae. A 3D GPR survey was conducted over a frozen lagoon at Bowness Park in Calgary. Hyperbolic velocity analysis gave ice velocities of about 0.15m/ns with velocities decreasing into the sediments to about 0.11m/ns. We interpret the ice thickness to be about 0.4m from the GPR which is consistent with augur holes drilled through the ice. Channel sediments and stratigraphy beneath the ice are interpretable from the 3D radar reflectivity. Penetration of the 250 MHz data reached about 4m at several locations in the area.

On the Devon Island, we were surveying near or on the rim of the Haughton meteorite impact structure. A number of shallow excavations found the permafrost to be at a depth of 50-60cm beneath a silty or brecciated layer. We found a strong reflection returned from the surface layer-to-permafrost interface.