Geophysical Research Abstracts, Vol. 9, 04755, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04755

Seismic experiments on the Fourcade Glacier in the King George Island, Antarctica

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To define P- and S-wave velocities of ice layers and subglacial topography, we acquired seismic data along a 470-m profile on the Fourcade Glacier in the King George Islands, Antarctica in late November 2006. The profile in the NE-SW direction is roughly perpendicular to the flow direction of the glacier. The isolated, quiet, and relatively flat ice field, covered by a thin snow layer provided favorable conditions for seismic recording. To record both P and Rayleigh waves, twenty-four 4.5-Hz vertical geophones were spaced at 10-m intervals in each geophone spread. Seven to eight shots were fired within and beyond each geophone spread using near-trace offsets of 5-20 m. A 20x56 mm blank cartridge was fired using a seisgun in a hole of 0.2-0.3 m depth at each source point. A record length of 1024 ms and a sampling interval of 0.5 ms were chosen. After recording 7-8 successive source gathers, the geophone spread was moved forward, along the direction of profiling, by half of the spread length. A P-wave velocity section was derived by travel-time tomography using the SIRT algorithm. Shear-wave velocities were obtained by inversion of Rayleigh wave dispersion curves using the MASW method. The thickness of ice body generally increases to approximately 60 m near the NE end of the profile. A mound structure, greater than 100-m wide and 10-m high, under the ice body in the middle part is tentatively interpreted as a subglacial till. P-wave velocities of the ice are lower to the northeast (3,000-3,420 m/s) than to the southwest (3,060-3,870 m/s) of the mound. A similar pattern is observed for the S-wave velocities. The lower seismic velocities in the NE part may be due to the presence of more extensive fractures.