Geophysical Research Abstracts, Vol. 9, 02456, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02456
© European Geosciences Union 2007

Radar velocity, attenuation and bed reflectivity from constant midpoint profiles on Kamb Ice Stream, West Antarctica

R. Pettersson (1), **R.W. Jacobel** (2), J.A. MacGregor (3)

(1) Department of Earth Sciences, Uppsala University, 752 36 Uppsala, Sweden, (2) Department of Physics, St. Olaf College, Northfield, MN 55057, USA, (3) Department of Earth and Space Sciences, University of Washington, Seattle, WA 98195, USA (jacobel@stolaf.edu / 507-646-3124)

Constant midpoint (CMP) gathers illuminate a sub-surface target from a variety of angles, which image the target using a range of path lengths through the overlying material. Here we use radar CMP gathers on Kamb Ice Stream, West Antarctica to study the *in-situ* dielectric properties of ice ($i.e.$, radio-wave velocity and attenuation) and bed reflectivity. We collected four, 3-MHz CMP gathers at sites where the KIS bed is either water-saturated or dry, as known or suspected from surface velocity patterns and borehole studies. Two of the CMP gathers are an orthogonal pair at the same location to look for anisotropy. We calculated root-mean-square velocities to all observed reflections using a semblance analysis; these velocities decrease with depth to values near 173 m μs^{-1} at the bed, where higher velocities within the firn have a smaller relative contribution to the mean velocity. We also measured the variation in reflected power with path length and fit it to predictions based on the radar equation, Fresnel reflectivity and the modeled radiation pattern of the antennas. From these fits, we calculated the depth-normalized attenuation rate within the ice using one bright internal layer and the bed. Results show that reflections from deeper ice have larger depth-normalized attenuation rates than reflections from shallower ice, presumably because ice near the bed has a higher temperature and therefore also a larger attenuation rate. Using a new radar-attenuation model, we modeled attenuation using earlier measurement of borehole temperatures at the CMP sites and the mean values of impurity concentrations from the Siple Dome ice core. We found that the modeled and measured attenuation rates match to within their uncertainty bounds. With confidence

in the measured attenuation, we calculated the bed reflectivity at the CMP sites and found that observed variations in bed reflectivities correlate with known or suspected basal conditions. This work shows that CMP gathers are a potentially powerful tool for diagnosing basal conditions.