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Radio Echo Sounding of Bed Reflection Power on Rutford Ice Stream

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As part of the RABID project, Radio Echo Sounding (RES) data were collected in December 2004 on Rutford Ice Stream, about 50 km upstream of the grounding line along two parallel segments (about 5 km apart) across the ice stream. One of the segments is coincident with a seismic line where a survey was completed in 1997 and repeated two weeks before the radar flight. Hence, two independent sets of geophysical data, are available to calculate ice thickness and investigate the basal condition beneath of the ice stream. Seismic data can be used to identify regions of deforming bed. We want to test whether radar data, which are cheaper and faster to collect, can provide the same information as the seismic data or if the two methods are independent due to the fact that they sample different physical properties.
We analysed the seismic data to calculate ice thickness and identify areas where deforming bed or basal sliding is present. The two time-lapse seismic surveys show 9 meters high drumlin formed over a period of 7 years.
Ice thickness was also calculated along the RES profiles and the bed shows a similar morphology along both as along seismic survey. Ice thickness in the central part of the ice stream ranges from 2100 to 2200 metres and shows a good agreement with the thickness from the seismic survey. Errors in ice thickness calculation are estimated to be about 20 metres and differences between the two geophysical methods can be ascribed to uncertainties in the electromagnetic wave velocity. RES data do not allow detection of the presence of the drumlin observed in the seismic data. In the RES data, making the assumption of a constant transmitted power, internal reflection power and bed reflection power can be calculated. Internal reflections are quite constant all along

the profile, suggesting no differences in the internal structure of the ice across the ice stream. Bed reflection power can therefore be assumed as indicative of different kinds of bed which we discuss in relation to the seismic interpretation. Of particular interest the presence of a high reflectivity spot coincident with the position of the drumlin.