The near-surface signature of flow bands in the onset regions of Ice Streams C1b and D1, based on grids of GPR data

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In the onset regions of the ice streams flow converges and accelerates. If this process occurs under conditions of steady-state flow and steady-state accumulation, then a regular pattern of internal layers should result. In order to assess whether or not the flow dynamics were steady-state, we recorded grids of ground-penetrating radar profiles in the areas immediately upstream of the marginal crevasse zones on Ice Stream D1 and the C1b tributary of Ice Stream C. The maximum effective penetration of the radar signal was approximately 120 m (equivalent to approximately 600 years).

The internal layers imaged by the radar reflections undulate in sequences of peaks and troughs on the transverse profiles. Many of the features can be traced between lines (which were 5 km apart on Ice Stream D1) and vertically through the sections, allowing the identification of 'flow bands' similar to those interpreted by Ng and Conway (2004, Geology 32/6) for deeper parts of Ice Stream C (a.k.a. Kamb Ice Stream). However not all the peaks and troughs observed at depth can be traced to the near surface, especially on Ice Stream D1. By tracking changes in the separation of layers though the grid it is possible to evaluate the influence of accumulation distribution and horizontal strain on the development of the internal layer pattern and thus identify changes in flow and/or accumulation.