



3D data visualisation of the internal structure and bed morphology of Rutford Ice Stream, Antarctica

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One of the distinctive indicators of the location of former ice stream tracks is the presence of extensive sets of highly-elongate bedforms known as mega-scale glacial lineations (MSGSL). Knowledge of the conditions of formation of MSGSL has been hampered by the lack of direct observation of such landforms beneath contemporary ice sheets. I conducted a detailed ground-penetrating radar survey of a fast-flowing area of the Rutford Ice Stream, West Antarctica, where repeated seismic surveys over a 13 year period have demonstrated the rapid formation of subglacial bedforms beneath 2.5 km of ice. The majority of the bed of the 18 x 18 km area is covered by MSGSL. There is a strong correlation between the location of the MSGSL and the presence of deforming till (which is several metres thick). The MSGSL are absent from an area of the bed where stiff, non-dilatant till outcrops, although there is evidence that the MSGSL are migrating onto the stiff-till area. These data provide the first direct test of the hypothesis that MSGSL are formed beneath ice streams and the first opportunity to use observations to critically examine process models for their genesis.

The data were collected with a 3 MHz ground radar (constructed at the British Antarctic Survey) on profiles separated by 500 m. Data processing used a simple, conventional workflow but the effective 3D visualisation of the bedforms required well-controlled gridding of the bed elevation data followed by the application of spatial filtering. To investigate the relationship between flow directions at the surface and at the bed, commercial seismic interpretation software (Schlumberger Petrel) has been used to visualise the internal layering within the ice stream. The ability to handle large 3-D data volumes in this way will significantly enhance our understanding of glacier dynamics.