

Ice stream onset regions, shear margins and basal conditions: Observations from Rutford Ice Stream

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On-going analysis of new ground-based observations from the onset region and shear margin of Rutford Ice Stream are presented. They include some of the first direct observations of basal conditions within these glaciological regimes. The data were obtained from three survey lines, perpendicular to ice flow, which all straddle the boundary between ice sheet and ice stream. Two lines were located towards the downstream end of the onset region; the third line was further downstream where a distinct shear margin is well established. These three lines are supplemented by data from nearby Carlson Inlet (slow flowing) and Fletcher Promontory (ice sheet with frozen bed). Surface elevation and velocity were measured using GPS techniques; ice thickness and basal conditions were determined from seismic surveys; and shallow ice structure was obtained from ground-penetrating radar.

Observations so far include:

1. With downstream distance, both the bed trough and the width of the lateral flow increase, become increasingly well-defined.
2. The bed beneath all three survey lines is wet sediments (deforming in some places and not in others). There is no evidence for hard bedrock or frozen bed/permafrost.
3. The lateral change in ice flow is associated with a friction difference at the bed, though in the onset region the change in bed conditions does not correlate as well with the ice velocity or the bed as it does further downstream.
4. The difference in basal friction between the ice stream and the ice sheet increases downstream.
5. Within the ice stream, basal friction increases with downstream distance, though earlier work suggests a switch to a progressive decrease, from here onwards.

Comparisons are made with recent reviews and studies of onset regions and shear margins. Future work is aimed at incorporating more bed topography and ice velocity (from airborne radar and InSAR); and at investigating how well the data support theoretical models of ice stream shear margins.