

Basal conditions on Pine Island Glacier

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During the 2006/07 season we completed two seismic reflection profiles approximately half-way up Pine Island Glacier to investigate the basal conditions. One line was perpendicular to ice flow (~12 km long) the other was in line with the flow (~4 km long). The data allow an interpretation of the nature of the bed material, its interaction with the ice motion and some speculation over the bed's potential to change over time.

In the area of the seismic surveys, the main trunk of Pine Island Glacier is joined by a number of large tributaries. The cross-flow seismic line straddled the main glacier trough and the rising bed slope into an adjacent tributary. Along virtually all of this line, the bed is composed of wet sediments. There are areas where the bed is dilated, deforming sediment and others where ice flow appears to be mainly by basal sliding. Areas of each bed type, varying in width from a few hundred metres to a few kilometres, alternate along the line. In the deep trough beneath the main part of the glacier, there is an area of free water, at least 400 m wide.

In the deeper part of the bed, the along-flow seismic line also shows a water-saturated sediment bed. Most of this is deforming sediment, with the exception of a ~15 m high step, over which the ice rises. The upstream face of the step is harder sediment and the ice is sliding over it, whereas both further upstream and downstream, the bed is deforming.

Pine Island Glacier, therefore has a mixed type of bed - both deforming bed and basal sliding, with some areas of free water. This is much more similar to Rutford Ice Stream than to the Ice Stream B fully-deforming bed model. The large areas of basal sliding and the large amounts of water present, combined with the fast ice flow, may reflect a potential for incorporation of water into the harder sediment areas and a reduction in overall basal friction. The basal conditions and topography on the along-flow line may indicate the presence of a drumlin or other subglacial bedform type.