



Self-stabilizing ice-stream flow in Northeast Greenland

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We present radio-echo sounding (RES), global positioning system (GPS), and active-source seismic data from the central portion of the Northeast Greenland Ice Stream (NEGIS) showing that the dynamic effects of the streaming flow control ice-stream extent. NEGIS is the sole fast-flowing ice-stream to initiate deep in the interior (~700 km) of the Greenland Ice Sheet (GIS), and was previously shown to widen downglacier from a small region of high geothermal flux near the ice-divide. Our data reveal water-saturated till lubricating the ice-stream, with the ice-stream likely widening toward the coast from flow around basal roughness and other processes. Ice accelerates and thus thins as it flows into the efficiently lubricated NEGIS, producing marginal troughs in surface topography. These marginal troughs, which lack strong control in the basal topography, create steep gradients in the subglacial hydropotential that generate parallel well-lubricated and 'sticky' bands beneath the ice-stream margins. The 'sticky' bands limit ice entrainment across the margin and thus restrict further widening, producing the long, narrow, and relatively stable ice-stream. However, it remains possible that a sufficiently strong perturbation from the coast could thin the central ice-stream enough to remove the marginal troughs, allowing more efficient flow of ice into the stream and thus drawdown of the ice-sheet.