Geophysical Research Abstracts
Vol. 12, EGU2010-4657, 2010
EGU General Assembly 2010
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Ferrigno Ice Stream, West Antarctica: new boundary conditions for a catchment losing ice rapidly to dynamic thinning

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Satellite altimetry used over the last decade to map changes in ice surface elevation across Antarctica has exposed dramatic and increasing rates of ice surface lowering over several catchments draining into the Amundsen and Bellingshausen Seas. The hypothesis that ice in these catchments is being drawn-down by ocean-warming-induced basal melting and ice thinning at the grounding line – a process termed "dynamic thinning" - has renewed concerns that West Antarctic ice streams may be experiencing the first stages of a "collapse" accelerated by climate warming which could contribute significantly and rapidly to rising global sea levels. Yet most West Antarctic ice streams remain extremely remote and little visited, leaving basic parameters such as ice thickness and subglacial topography poorly constrained and thereby increasing uncertainties in modelling attempts to predict their future behaviour. Recent radar surveys prompted by these concerns have been mounted over the largest of these ice streams, Pine Island and Thwaites Glaciers, providing much-improved boundary conditions for the ice streams contributing dynamically to the Amundsen Sea Embayment; but ice streams and glaciers draining to the Bellingshausen Sea, also evincing significant dynamic thinning, have remained very poorly surveyed. Here we present the first results from a 2009/2010 ground-based radar survey of Ferrigno Ice Stream (74S, 85W), a 14,000 km2 catchment highlighted as a "hotspot" of strong dynamic thinning by satellite laser altimetry, and draining into ice-free Eltanin Bay, an embayment in the Bellingshausen Sea where ocean warming has been directly measured. A significant finding is a $\sim$12-km wide, up to 3 km deep subglacial trough extending all the way upstream from the grounding line 120 km to the divide with Evans Ice Stream. The trough is likely a major tributary to Belgica Trough, a large bathymetric trough in Eltanin Bay which has been shown to extend from the shelf edge back to within 70 km of the modern ice margin, in which Circumpolar Deep Water has been detected, and along which glacial lineations indicative of the presence of a palaeo-ice stream during the Last Glacial Maximum have been imaged. Critically, the inland trough surveyed here has a reverse-sloping bed, suggesting that much of Ferrigno Ice Stream may be at significant risk from rapid grounding-line retreat and marine incursion, aping the behaviour of neighbouring Pine Island Glacier.