

Insights into WAIS and GIS dynamics: Summary of modeling results

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Thermomechanical flowline simulations based on regional basal thermal controls on ice-stream behavior suggest that post-glacial warming initiated grounding-line retreat in the Ross Embayment with evolution of the ice sheet responding more to climate-forcing feedbacks than to changes in sea level. In addition, results imply that ice in the central Ross Embayment experienced small deglacial thickness changes. Subsequently, simulated modern ice streams are thinning more rapidly than their beds are rebounding at the grounding line. Thus, ice-sheet thermodynamic and isostatic considerations indicate ice streaming along the Siple Coast will continue amidst ongoing retreat.

Meltwater-filled crevasses have been cited as the catalyst to the catastrophic break-up of the Larsen B ice shelf in West Antarctica (Scambos et al., 2000; Scambos et al., in review). In west central Greenland, field observations at the Swiss Camp suggest that surface meltwater reaches and lubricates the bed through moulins, leading to enhanced ice-flow velocities with increased surface melt (Zwally et al., 2002). Alley et al. (in review; this meeting) offer theoretical bases for crack-propagation mechanisms by which surface meltwater can penetrate more than a kilometer of cold ice. Citing these studies, we assume that surface meltwater can access the bed through thick, cold ice and enhance ice flow. With the addition of a sliding parameterization of Zwally et al.'s (2002) correlation between seasonal surface melt and ice velocities, flowline-model results predict an enhanced sensitivity of the Greenland ice sheet to surface warming.