Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01323, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01323
EGU General Assembly 2008

Rapid changes of Greenland tidewater outlet glaciers: insights from numerical modelling

A. Vieli (1), F. M. Nick (1)

Department of Geography, Durham University (andreas.vieli@durham.ac.uk)

Rapid dynamic changes such as surface thinning, flow acceleration and retreat have been observed for several outlet glaciers in Greenland in recent years and led to a significant increase in mass loss from this ice sheet. It has been suggested that the onset of these rapid changes is linked to the recent high summer air and ocean temperatures, the triggering mechanism and controlling feedback mechanisms are however not well understood. In this study we use a flowline model that considers longitudinal stress coupling and a moving grounding line to investigate the dynamical response of such outlet glaciers to near frontal perturbations such as enhanced sliding, weakening of margins, enhanced surface melt and reduced buttressing. Applications to Helheim Glacier (East Greenland) and Jakobshavn Isbrae (West Greenland) show that perturbations near the front propagate very rapidly upstream and that basal over deepenings play a crucial role for amplifying such perturbations. We further investigate the role of a floating tongue and an effective pressure dependent sliding relation for the dynamic stability of tidewater outlet glaciers in the situation of an over deepened bed. The performed model experiments give us important new insights for better understanding the dynamic of such tidewater outlet glaciers.