Geophysical Research Abstracts, Vol. 9, 00336, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-00336

Ice sheets: victims of their own success?

S. Jamieson and N. Hulton

Institute of Geography, School of GeoSciences, Drummond St., Edinburgh, EH8 9XP, UK.

(Stewart.Jamieson@ed.ac.uk / Fax: +44 (0) 131 650 2524 / Phone: +44 (0) 131 650 2572)

Our aim is to determine the importance of erosion and its feedbacks with ice sheet mass balance configurations over geological timescales. The impetus for this work is provided by evidence that temporal patterns of maximum ice sheet extents often do not match the temporal pattern of maximal global ice volume. For example, in Patagonia each successive glaciation since ca. 1.15 Ma has yielded an ice sheet less extensive than its predecessor – a pattern that conflicts with the δ^{18}O record. This implies that other processes and feedbacks are acting to confuse the way in which ice sheets interact with climate. We use GLIMMER - a 3D thermomechanical ice sheet model enhanced with the ability to erode its underlying bed - to test the hypothesis that erosion can cause ice sheets to self-limit. Our results show that ice sheets can self-limit their extents independent of any variation in climate. As a consequence of erosion, mass balances at the ice margins become increasingly negative and lead to differing behaviours depending upon the type of termination (i.e. land or sea) in the system. Under marine-termination conditions, periods of stable ice margin position are punctuated by rapid partial collapse events that result in new, less extensive ice mass configurations. Under non-marine conditions, ice sheet collapse is more gradual.