Geophysical Research Abstracts
Vol. 14, EGU2012-4341, 2012
EGU General Assembly 2012

Interactions between glacial erosion, the extent of glaciation, and topography investigated using numerical modeling

V.K. Pedersen (1) and D.L. Egholm (2)

(1) Department of Earth Sciences, University of Bergen, Norway (Vivi.Pedersen@geo.uib.no), (2) Department of Geoscience, Aarhus University, Denmark

Landscapes modified by the glacial erosion processes associated with warm-based glaciers in alpine settings seem to have a distinct distribution of surface area with elevation (hypsometry). The distribution is closely related to the local snowline altitude, demonstrating a significant maximum in the hypsometric distribution just below this level. The emergence of this distinct hypsometric signature can be predicted by surface process models, and is suggested to be due to effective glacial erosion above the local snowline.
Using numerical model experiments, we focus here on how the development of this distinct glacial hypsometric maximum influences the extent of glaciation in the landscape on timescales of several 100 kyrs, and how the existence of this distinct topographic configuration will influence the general relation between climate change and the extent of glaciation, even on shorter time scales.
We start from a steady-state fluvial landscape, and introduce oscillating temperature and glacial conditions, in order to generate a glacial hypsometry comparable with an observed global hypsometry for glaciated regions. The emergence of a distinct glacial hypsometry enables us to investigate the importance of the topographic distribution on the extent of glaciation both for a constant climatic forcing and for a climatic cooling. The results are obtained using iSOSIA, a higher-order ice sheet model approach, for simulating the flow of ice. Glacial erosion is assumed to be controlled by abrasion and quarrying processes, and is therefore a function of both sliding velocity, the amount of entrained sediment in the ice, and the bed slope in the direction of sliding.

Our results suggest that glacial extent is highly sensitive to the hypsometry of the landscape, and that the importance of the resulting non-linear relationship between climate change and glacial extent will increase during glacial modification of the landscape.