Geophysical Research Abstracts, Vol. 6, 05153, 2004
SRef-ID: 1607-7962/gra/EGU04-A-05153

SIMULATING SUBGLACIAL SEDIMENT TRANSPORT USING A SEMI–LAGRANGIAN METHOD.

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Temperate ice sheets have the capacity to erode, transport and deposit large quantities of sediments. These products of past ice sheet activity can be observed in the geological record. Simulating the sediment record, therefore, helps constrain reconstructions of past ice sheets.

The formulation developed, here, supports two modes of sediment transport: i) sediments can be transported in a thin basal ice layer, and ii) transport can occur within a deforming layer of sediments below the ice bed. The amount of sediments transported within these layers depends on their rheology and the thermal conditions at the ice base. The model is simplified by assuming that transport velocities are proportional to the sliding velocity of the ice sheet. The resulting advection equation describing the two–dimensional sediment transport is then solved using a semi–Lagrangian approach. This method ensures conservation of mass and avoids numerical diffusion. The evolution of the ice sheet and its basal velocity is simulated by a three–dimensional, thermomechanical ice sheet model with a simple sliding law. The combined model is tested by applying it to simulate the past Fennoscandian ice sheet during the last 120ka. The resulting patterns of sediment distribution compare well with geological evidence.