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Simulation of large-scale ice-sheet surges for the ISMIP HEINO set-up

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Heinrich Events (HEs), which have been discovered in North Atlantic sediments as layers of ice-rafted debris, are associated with episodes of massive iceberg discharge from the glacial Laurentide Ice Sheet into the Atlantic Ocean. The discharge events are likely caused by quasi-periodic collapses of the ice sheet over Hudson Bay and Hudson Strait, which occur when the basal temperature reaches the pressure melting point, so that very rapid basal sliding on a lubricating sediment layer develops. Besides representing catastrophic glaciological events, HEs are also closely related to abrupt climate changes via their impact on the Atlantic thermohaline circulation.

Calov et al. (2002; Geophys. Res. Lett. 29, 2216) demonstrated that large-scale instabilities of the Laurentide Ice Sheet resembling HEs in periodicity, amplitude and spatial extent can be simulated with a 3-D dynamic/thermodynamic ice-sheet model (SICOPOLIS) coupled to an Earth system model (CLIMBER-2). In order to further investigate the dependence of these instabilities on atmospheric and basal conditions and compare the results of different ice-sheet models, the ISMIP HEINO (Ice Sheet Model Intercomparison - Heinrich Event INtercOmparison; see http://www.pik-potsdam.de/calov/heino.html) experiments have been designed. A simplified geometry resembling that of the EISMINT Phase 2 Simplified Geometry Experiments (Payne et al., 2000; J. Glaciol. 46, 227-238) together with atmospheric boundary conditions representative for a glacial climate is employed, and rapid sediment sliding is assumed for an area similar to Hudson Bay and Hudson Strait. Here, the results of the ISMIP HEINO experiments obtained with the model SICOPOLIS will be presented, and the dependence of the ice-sheet instabilities on the surface temperature, the surface mass balance and the strength of the basal sediment sliding will be discussed.