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Impact of a Greenland deglaciation on climate during the next millennia

E. Driesschaert (1) , V. Brovkin (2) , T. Fichefet (1), H. Goosse (1), P. Huybrechts (3), I. Janssens (3), A. Mouchet (4) and G. Munhoven (4)

(1) Université catholique de Louvain, Institut d'astronomie et de géophysique Georges Lemaître, B-1348 Louvain-la-Neuve, Belgium, (2) Potsdam Institute for Climate Impact Research, D-14412 Potsdam, Germany, (3) Vrije Universiteit Brussel, Departement Geografie, B-1050 Brussel, Belgium, (4) Université de Liège, Institut d'astrophysique et de géophysique, Laboratoire de physique atmosphérique et planétaire, B-4000 Liège, Belgium. (driess@astr.ucl.ac.be/ Fax:+32 10 474722 / Phone:+32 10 473067)

A new Earth system model of intermediate complexity, LOVECLIM, has been developed in order to study long-term future climate changes. It includes an interactive Greenland and Antarctic ice sheet model (AGISM) as well as an oceanic carbon cycle model (LOCH). Those climatic components can have a great impact on future climate. The few studies in recent literature assessing the impact of polar ice sheets on future climate draw very different conclusions, which shows the need for developing such a model. A set of numerical experiments have been performed in order to study the possible perturbations of climate induced by human activities over the next millennia. A particular attention is given to the Greenland ice sheet. In most of the projections, the Greenland ice sheet undergoes a continuous reduction in volume, leading to an almost total disappearance in the most pessimistic scenarios. The impact of the Greenland deglaciation on climate has therefore been assessed through a sensitivity experiment using the scenario SRES A2. The removal of the Greenland ice sheet is responsible for a regional amplification of the global warming inducing a total melt of Arctic sea ice in summer. The freshwater flux from Greenland generates large salinity anomalies in the North Atlantic Ocean that reduce the rate of North Atlantic Deep Water formation, slowing down slightly the oceanic thermohaline circulation.