



Applying an interactively coupled Atmosphere-Ocean-Ice Sheet Model to the late Glacial

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In the paleo model intercomparison project PMIP the LGM (Last Glacial Maximum, 21 kyr BP) was treated as a steady state for atmosphere-ocean general circulation models (AOGCMs). The ice sheets were prescribed. Transient simulations of the last Glacial cycle with a coupled climate-ice sheet models have hitherto only been possible with climate models of intermediate complexity. For AOGCMs this has not been done. Here we presents results from a first attempt to simulate a substantial part of the glacial cycle with an AOGCM coupled interactively with a state-of-the-art ice sheet model.

The ECHAM5/MPIOM AOGCM has been interactively coupled to the dynamical ice sheet model PISM. The latter is run for most of the northern hemisphere with a horizontal resolution of 20 km. This model has been applied before to a steady state simulation of the LGM (Ziemen 2013). Here it is used for a set of transient simulations of the last period of the last glacial. The model was initialized with the same glacial state derived from the steady LGM simulation at three different times: 42, 37 and 32 kyr BP. The model was integrated transiently from these starting dates, but with the AOGCM accelerated by a factor of 10. Ocean topography and land-sea mask were kept fixed, greenhouse gases and insolation were varying through time. At the LGM three distinct states were reached. The simulation starting at 32 kyr BP led to an extensive glaciation of northern Siberia at LGM. In the Atlantic deep water formation was concentrated in the Northeast Atlantic and the overturning circulation was stronger than today. When the model was intialized at 42kyr BP, the Fennoscandian ice sheet was relatively small at LGM. The pattern of deep water formation in the North Atlantic is relatively similar to present days pattern (Nordic Seas and Labrador Sea) and the overturning circulation is weaker than in the mode with extensive glaciation. Initializing the model at 37 kyr BP yielded an intermediate size Fennoscandian ice sheet, the ocean circulation in the Atlantic is rather similar to the circulation obtained with start date at 42 kyr BP. The simulations have been continued into the deglaciation.

Ziemen, F. A. (2013), Glacial climate variability. PhD Thesis, Universitaet Hamburg, Hamburg.
http://pubman.mpg.de/pubman/item/escidoc:1827332:4/component/escidoc:1850303/WEB_BzE_139.pdf