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Climate of the Past Discussions

Interactive comment on "Warm Nordic Seas delayed glacial inception in Scandinavia" *by* A. Born et al.

Anonymous Referee #2

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I also concur with the first reviewer that the submission by Born et al needs more detail (comments below were written before reading the first review) in the model setup description. Until more details are provided about the climate model, its biases and such, no significance can be gleaned from the stated magnitude of extra cooling required to get inception. Such a study also needs some analysis of the climate dynamically processes involved. What is happening to sea ice, storm tracks,... during the inception interval? Until I see more details on the model setup, I'm unable to judge whether this paper is worth publishing.

#specific comments

by 74 m (Peltier, 2004). Eurasia was covered with a ice volume equal to 2.5 times the Greenland ice sheet, or 17 m sea level equivalent. Additional 25-30 m of sea level

equivalent accumulated on the Antarctic ice sheet (Lambeck and Chappell, 2001) for a total sea level decrease of 120 to 130 m relative to present (Waelbroeck et al., 2002).
Peltier's ICE-5G is about 80 m eustatic equivalent for North
America. No reasonable glaciological model that I know of has
generated even 20 m of sea-level for Antarctica at LGM

perature decrease of about 3 C as inferred from planktic foraminiferal data. Ice-rafted detritus indicates that ice growth over Scandinavia started at about the same time.
IRD only indicates the presence of marine ice, ice growth could have
started much earlier and remained terrestrial

stereographic projection centered on the North Pole (Fig. 1). The horizontal resolution 15 is set to 40 km and there are 90 vertical layers: 80 equidistant layers in cold ice and 10
This is a relatively course resolution. Shallow ice models can
easily be run at 20 km resolution for such a region, given the time
interval covered.

monthly surface temperature and total precipitation. The snow fraction of monthly precipitation is estimated as a linear function between -10 and 7 C, with all precipitation
This is an outdated approach. It would be better to at least impose
a normal distribution of hourly temperatures around the monthly mean
and use a 2 degree C cutoff for snow. Better yet, extract an
accurate distribution from using hourly output from say 5 or 10
years of the GCM output.

s = 12 mm K-1 for ice. A constant geothermal heat flux of 55 mW/m2 is assumed at
# For future work, I would recommend temperature dependent degree day
# melt coefficients which can be made to fit closer to Energy Balance
# models. Also, Pollack et al (1993) provides a more physically based
# map of geothermal heatflux. The choice of 55 mW/m^2 is a weak

choice, though for inception studies this is not a major issue.

What land ice boundary conditions were used in the IPSL CM4 climate
model?

What temporal resolution of the GCM output did you apply to the
ice-sheet model? And how did you compute Positive Degree Days if
you did not use hourly time resolution?

A description of the inherent limitations and biases of the climate
model wrt capturing the physical dynamics of the
atmosphere/ocean/sea-ice is in order. What key relevant features of
the ocean/atmosphere circulation are not well captured by the model?
How biased are model fields (seasonal precip, temperature, sea-ice
extent) for PD conditions?

5 to simulate the last glacial inception and was validated against the available proxy data to simulate the transient warmth in the Nordic Seas at 115 ka (Braconnot et al., 2008;
Be more concrete/specific. What does "was validated" really mean quantitatively?
how were the climate fields down-scaled to the ice-sheet grid resolution?

much lower temporal resolution. Sea surface temperatures of the Nordic Seas need to 10 cool by at least 3 C from the 115 ka average for inception over southern Scandinavia. A 4 C cooling induces ice growth over northern Scandinavia. Cooling also has a positive
I can't evaluate the significance of the results without knowing
the present-day region biases of the climate model.

Interactive comment on Clim. Past Discuss., 6, 1503, 2010.