

Interactive comment on “Investigating the evolution of major Northern Hemisphere ice sheets during the last glacial-interglacial cycle” by S. Bonelli et al.

Anonymous Referee #3

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The paper by Bonelli investigates the evolution of Northern Hemisphere ice sheet for the last 126kyr by CLIMBER climate model and GREMLINS Ice sheet model. The paper is well written except that the explanation and discussion are insufficient. The paper should be published after adding the explanation/discussion for the following points to aid readers for better understanding.

(1) Explanation on the climate: The work uses a coupled model, which is more than a energy balance model, to simulate the ice sheet evolution. For readers' understanding, more information on the performance of climate is needed than just showing the temperature in Fig. 3 for 3 time slices in the beginning of the ice age cycle. At least the

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climate at present day (0ka, by showing the difference from the observation) and the LGM (at 21 ka, by showing the difference from 0ka) as many studies including PMIP experiments used in several works driving ISMs. It would help understanding the climate, since there are several sentences, saying the model has problem simulating the Kuroshio influence and the Rockies etc... The information may explain the missing ice sheet over Canadian archipelago or the overestimation in Alaska.

(2) Dust in the sensitivity study: The sensitivity study aims to show the relationship between the external forcing and the evolution of ice volume. It is not shown, however, whether the dust was changed when the change of CO₂ was prescribed. Does the dust follow the equations in section 2.1 in every case? Does that mean the model is driven by both orbit and dust in the sensitivity studies? Please explain and discuss about the dust since it is important to understand the mechanism of termination of the ice age.

(3) The model has several changes from the previous studies by authors but the role of changes are not described. Please explain it. Why was the coupling method changed from kageyama 2004? This is helpful for other modellers to improve their models.

(4) The work shows an underestimation of ice volume near the North Atlantic, but how is this related to the NADW in the study? How is the NADW in this work? How is the time series of the strength of NADW if it is important?

(5) How was the basal sliding (in section 2.2) treated? Is it related to the result of rather thick ice sheet of 4000m?

(6) Please discuss the mechanism that makes the difference between Laurentide ice sheet and FennoScandian ice sheet.

(7) Please create a section of "Discussion" for discussion since there is only conclusion and summary after the result. Please discuss about the result compared to other previous studies which simulate the ice sheet evolution for the last 125 kyr such as

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Berger and Loutre (1999), Tarasov and Peltier, (1997, 1999) Charbit et al, (2007), Abe-Ouchi et al. (2007).

(8) How is the lapse rate calculated and how is the result? (section 2.3)

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