

Interactive comment on “Interdependence of the Northern Hemisphere ice-sheets build-up during the last glaciation: the role of atmospheric circulation” by P. Beghin et al.

Anonymous Referee #3

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General comments

This study addresses the important question of the remote interaction of evolving ice sheets through the perturbations they cause to atmospheric circulation. As far as I know this hasn't been done in a time-dependent coupled model before and the approach is sensible. The authors acknowledge that the model they use cannot directly simulate the relevant effects, since it has too low a resolution for the atmospheric dynamics. This is an important caveat because it is hard to know whether the effects described are realistic, although the general conclusion that such effects will be important is probably robust. In view of this limitation, I suggest that the paper would be strengthened (a) by explaining the physical basis and showing more of the evaluation

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of the parameterizations. Especially, in sect 3.1, please could you give the physical motivation for the form of equation 6, and demonstrate that it works better than other choices which could have been made. A really useful justification would be to show that it correctly represents the effect of topography change imposed in a GCM, since the whole paper depends on the correct response to *change* in topography. (b) by relating the effects described more directly to atmospheric circulation i.e. the stationary wave pattern. Page 2194 lines 11-16 suggest that it is practically difficult to understand the temperature and precipitation perturbations that result from the pressure parameterizations, and I accept that it is complicated. However, I have to say that I feel doubtful unless there is some amount of such explanation given. To have confidence in them, I would like to be shown that the results make sense physically. If these concerns could be addressed somehow, I think the paper should be published.

Specific comments

page 2191 line 4. It is confusing to use p_0' with two different meanings, distinguished only by the arguments. Two different symbols would be better.

page 2191 line 5. It would be good to see the evidence that this is the best choice.

page 2191 line 12. Northern winter, I presume. Why do you not also examine the performance in northern summer, which is when the melting takes place?

page 2192 line 12. In Fig 1c, these highs appear to be over the Caspian Sea and central America.

page 2193 line 18. Please explain why σ_0 is so different for FIS and LIS (as shown in Table 1). If such different numbers are needed, it is hard to be confident in the reliability of the PDD scheme under a variety of climates. How did you choose the step in σ_0 between the experiments?

page 2193 line 18-20. This use of "resp." is not usual English and consequently not clear. I would suggest "we used different values of σ_{0FIS} and σ_{0LIS} to obtain

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larger or smaller Fennoscandian and Laurentide ice sheets, respectively. This allows us to study the impact of the FIS geometry on the LIS and vice-versa."

page 2193 line 24. And no other NH ice-sheets, presumably. What about Antarctica?

page 2194 line 6. "waves".

page 2194 line 7. I suggest "the impact of the Greenland ice sheet on the Laurentide and Fennoscandian is likely ...".

page 2194 line 19. Why do you start from a 126 ka state but analyse at 125 ka?

page 2195 line 3-4. I do not see this point discussed in sect 3.1. As remarked above it seems to me that this effect on JJA ought to be discussed.

page 2195 line 19. "combined with". Is temperature or accumulation more important?

page 2195 line 24. Unclear which "effects" you mean. I suggest "slp perturbations" instead (if that's what you mean).

page 2196 line 6 Fig 4. Why do the ice sheets begin to grow so early in some configurations?

page 2196 line 13. It would be good to understand the relative sizes of these effects.

page 2197 line 14-15. Why doesn't it affect the growth of the LIS (red lines in Fig 4b)?

page 2198 line 6. Summer insolation at northern high latitudes, I guess.

page 2202 line 8. What does "former" refer to?

Fig 2. It might be helpful to see results for the present climate as well, to compare with 125 ka. What does the green mean in the difference figures? The caption is rather hard to follow, I find; however, the labels of the individual figures make it clearer.

Fig 4. What do the downward-pointing arrows mean? I would suggest not using "resp.", which is not usual English and not clear.

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Fig 7. What do the downward-pointing arrows mean?

Fig 8. The two panels are identical.

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