

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.

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The manuscript by Beghin et al. highlights the potential role of stationary waves in the evolution of Northern Hemisphere ice sheets during the last glacial cycle. This is the first study I have come across that looks into the mechanism of interdependence of the Northern Hemisphere ice sheets. This study uses an intermediate complexity climate model coupled with a 3D ice sheet model. This is a standard approach and a good compromise between model speed and complexity of processes represented. As the manuscript points out, stationary waves aren't directly represented in the model, but their effect is parameterised. The results should therefore be interpreted carefully. The

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conclusion clearly states this. This study is novel and interesting. It makes several valuable contributions: (i) it presents a parameterisation of orographically-induced gravity waves that the authors have implemented in the CLIMBER model, (ii) it shows the importance of gravity waves parameterisation for simulating the northern hemisphere ice sheets and finally (iii) it highlights a mechanism of interdependence of these ice sheets. I can't see any major problem with this study. Only a few minor changes to the manuscript are needed. The manuscript also needs to be carefully proof read for grammar. Here are my suggestions for corrections: P 2184 L11: replace “Several parameterizations have been tested” by “We tested different parameterizations . . .”. Similarly in the rest of the manuscript, use the active form to emphasise what you have done in this study. P 2184 L23: remove second “be” in “be partly be”

P 2184 L14: “We show that the response of ice sheets to thermal and/or orographic forcings is rather different.” is an overstatement. What you show only relates to the parameterisations you use. You can only *suggest* that it applies to the real world. As you clearly point out in the manuscript, your parameterisations aren't perfect and your results are influenced by the low resolution of the model.

Give a bit more background to the gravity wave parameterisation in equation (2), what is it scientifically based on? Similarly, there needs to be more background on the orographic term of the gravity wave parameterisation. Are there similar parameterisations used in other EMICS?

Equation 2: There is a 'P' that I think should be a lower case p

P2191 L19 slp anomaly : write in full or define the SLP acronym and use upper case.
P 2195: line 2: what do you mean by eastern longitudes? P 2195 L5 “Over North America, . . .”: Is there a word missing in that sentence? Table 1 : describe the table (eg. Table of experiments) Figure 1 and text associated: In panel d, we see that the parameterisation of gravity waves produce a SLP anomaly of the wrong sign over North America. In the discussion, please comment on how this might influence the results.

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Figure 2 : add snow before accumulation so that the figure can be understood without looking at the text. Figure 6 could benefit from a few labels (eg. describing lines and columns). Section 4: I found it hard to follow the description of the experiments. Please consider revising the text to make a flow a bit better and highlight the main results.

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