Review of the revised manuscript "Greenland Ice Sheet influence on Last Interglacial climate: global sensitivity studies performed with an atmosphere–ocean general circulation model" by M. Pfeiffer and G. Lohmann

Having reviewed an earlier version of the manuscript, I have evaluated the paper in its current form as such and in view of the author's response to the review comments. I would like to thank the authors for all the work and efforts they put in the preparation of this revised version of their manuscript.
Many of my earlier comments have been addressed with the revised version of the manuscript and as far as I can see, that also holds for many of the comments of the other reviewer too. The clarity and the structure of the paper have improved in several sections but unfortunately not everywhere. Therefore, before accepting the manuscript for publication, I still have some important comments that I would like to see being addressed.
First, there are still two important remaining issues that need to be addressed:

1- Although I really appreciate the fact that the authors shortened and clarified some sections, I still believe that more is necessary. Especially, there are several places where information is redundant (e.g. in the introduction) and where it is really hard to extract what is the main message the authors want to get across (e.g. results):
→ One of my main concerns is about the introduction. I think it could be written much more to the point and ideas need still to be reorganised as well to appear in a more logical order. I have made some suggestions below.
→ I still think that the result section is too long and very hard to follow and to extract the main message. There are still some very long descriptions that could certainly be synthesised and written in a more concise way. Especially, Sections 3.4 and 4.3 are still very long and would benefit from being shortened : the text can be written in a more concise way but also only the most important observations and patterns should be kept.

2-Several sentences that have been added in the revised version convey incorrect information and they absolutely need to be rephrased. I have highlighted them below.
Second, still for the purpose of clarity I believe that the readability of the various maps showing model simulations displayed in the figures (both in the main manuscript and the Suppl. Material) should be further improved. It would make it much clearer if the authors were adding short title above each of them indicating the acronym of the simulation displayed (as well as the reference). Similarly "annual mean ", "local winter", etc... should be added on the side of each panel in Figure 5 and it should indicated on the top of the panel that simulations are for the Northern high latitudes (60-90 degrees lat.). I would thus ask the authors to modify the figures (both in the main manuscript and the SM) accordingly.

I list below more specific changes that I would like to see considered in the next version of the manuscript.

P1:
Line 23: write instead: "….of the timing are estimated from NEW transient model simulation…"
Line 25: write instead: "…when PROXIES ARE INTERPRETED AS REPRESENTING ANNUAL MEANS rather than RECORDING summer temperature

Line 26: this is a strong statement, I suggest you'd rather write: "Additionally, THE COMPARISON BETWEEN OUR MODEL RESULTS AND TEMPERATURE RECONSTRUCTIONS SUGGEST that the GIS elevation……"

P2:
Line 5: you should remove the sentence segment "this is necessary since…."; this is not needed.
Line 13: remove the sentence segment "represents…..and" and write directly "the last interglacial is considered to be …." And move the dates for the holocene at the end of this sentence.
Line 22: the sentence "According…" should be removed, you already refer to this paper above.

P3:
Line 8: you should not refer to Dahl-Jensen et al 2013 in this bracket since you mention the actual result of this study after; Also please change the reference, it should be refer as NEEM Community members 2013 and not Dahl-Jensen et al. 2013.
Line 11: please see and refer to Dutton et al. Science 2015 for the latest sea level variations assessment over the LIG.
From Line 2 to Line 13: I feel that this could be shortened as somehow the information are redundant, you may consider shortening the very first sentence that is relatively vague, you should go straight by mentioning the numbers proposed for the contribution of the Greenland ice sheet.
Line 29: remove "even when taking into account…".
The sentence referring to the work by Bakker and Renssen should arrive later: after you have listed all the studies that show mismatch between model and data. For instance, please consider moving it after the sentence that currently finishes at line 11; This same sentence referring to the work by Bakker and Renssen also needs to be re-written has at the moment the formulation could lead to misunderstanding.
Here is a proposition: "... may stem from the fact that commonly-used climate syntheses represent a single time-slice assuming synchronous LIG thermal maximum in space and in time".

P4:
Line 11: "The lack of …" this statement is somehow incorrect.
If you want to mention the issue with the dating of paleoclimatic records, you need to say something along the lines suggested below and also change the reference for a more appropriate paper that has just been published: "The lack of climate synthesis for the LIG going further than proposing a single snapshot on LIG maximum warmth and thus accounting for asynchronous changes across the globe is due to the difficulty in building robust and coherent age models for different climatic archives during the LIG (Govin et al. 2015)"
Line 13: you should remove the sentence "for example…."
Line 16: with the sentence I propose above, you don't need this exact sentence, however you could present the Capron et al new data synthesis with a sentence as such: Recently, Capron et al. propose a new climate synthesis for the high latitude regions based on a coherent temporal framework between ice and marine archives. This allows for the first time to assess both the temporal and the special evolution of the climate throughout the LIG (Capron et al. 2014)."

Line 20: I suppose that this paragraph should appear beforehand; here is a possible order to follow that seems to be more logical.
i- you should listed all the studies showing model-data mismatch,
ii- then you should mention the fact that the issue is due to the fact that data synthesis assume synchronous changes and that is an issue because other studies show that the peak warmth likely occurs at different time across the globe;
iii- you should then explain that the difficulty on producing more than one snapshot on maximum warmth is due to the fact that it is hard to define robust age models and thus robust chronologies for multiple archives;
iv- finally you should present the latest synthesis that able to solve this issue for the high latitudes.
Line 7: replace "of" by "on".

P6: "The latter simulation ... model-data agreement": which model-data agreement? when? Please clarify this new sentence.

P9:
Line 23: "the data….": this sentence is very confusing; please reformulate as such: "The high latitude climate synthesis by Capron et al. (2014) provides temporal air and sea surface temperature reconstructions based on ice core and marine records respectively, across the interval 115 to 130 ka. They also propose snapshots of surface temperature anomalies and associated quantitative uncertainties at 115, 120, 125 and 130 ka.
Line 25: maybe the sentence starting with "this…" is not necessary anymore if you mention this already in the introduction.

P10
Line 24: please refer to Table 2 for this paragraph. It will be most helpful for the reader.

P11:
Line 26: please remove the sentence starting with "the TS anomalies..." I find this very confusing since after that, you come back to the other simulation you want to focus one. You already mention that you focus on this specific one.

Line 30: what do you consider "high latitudes" , 60-90degres of latitudes ? please clarify.

P12:
Line 14: "considering Table 2" : please be more specific than that.

P14:
Section 3.4 is still far too long and needs to be shortened with a text written in a more concise way and that also be going straight to the most important observations and patterns

P16:
Line 24: explicitly mention at the beginning of this paragraph that you use the Turney and Jones data synthesis.

P19:
Line 14: "...is used FOR A model-data…"
Line 17: be careful to not create misunderstanding: CCSM3 is FORCED with higher GHG concentrations, it does not simulate GHG, they are prescribed.
You should mention the bipolar seesaw pattern!
Line 14-26: this is some discussions, not really a result, please move this paragraph to the discussion section. I'm actually surprised you don't mention here and in the discussion more explicitly the fact that your model does not reproduce the bipolar seesaw pattern observed in the 130 ka data based timeslices.

Results Section: I still find it still long and hard to read.

P20:
Typo in the title of Section 4.1. (insolation)
Line 24: Check typo at the end of the sentence.

P23:
The section on model-data comparison is very long, you should consider writing it much more to the point. However, I think that here you should add a few sentences of discussion regarding the model-data comparison with the new 130 ka data based time-slice and the fact that your new simulation do not reproduced the bipolar seesaw and possible explanation for that.

P24:
Line 31: you need to refer to NEEM c.m 2013 instead of the two references that you propose.

P25:
Line 1: please use the NEEM ice core site rather than the Renland and the NGRIP sites site as a reference site in Greenland having some LIG quantitative temperature reconstruction. Be careful please also when using the NGRIP ice core for the LIG: the record stops at about 123 ka and it very likely doesn't record the LIG maximum warmth; NEEM is the only Greenland ice core providing a quantitative estimate of surface temperature change of 8±4°C.
Line 10: this sentence needs to be rewritten, it is not correct to say that the reconstructions overestimate the simulated temperature, but you can say that the reconstructions suggest stronger warming than the one simulated.

P28:
Section 4.4. You need to be careful here as there is a lot of slightly inexact information that are given in this section:
Line 8: For over a decade, paleoceanographers mostly use the benthic d18O stack from Lisieki and Raymo 2005 rather than the SPECMAP curve; you should refer to this curve as well and maybe be more general in your statement:
"the dating of …by lining up their benthic d18O signal to a dated benthic d18O stack…"
I can refer you to the Govin et al. 2015 paper, it explains this in details.
As a consequence, you need to remove "which is tuned…".
Line 13: "A relatively…" this is the wrong reference, the method we used in Capron et al. 2014 was originally developed by Govin et al. CP 2012; Also the rest of the sentence is

very unprecise. Also, you should rather talk about “an alternative” method, rather than “new”
- The next sentence “….allowing for consideration of dating uncertainties”: this is an incorrect formulation: the method doesn’t not allow use to estimate uncertainties more than another alignment strategies. This is only that we made the decision to provide such a quantitative estimate, which was not something done previously. Please rephrase.
Line 21: from the sentence starting with “furthermore” until the end of the section: this should greatly be shortened: you are repeating information that you already describe in the introduction. Also, since you now consider a time-evolving data synthesis, your statements are not always relevant
You should instead discuss whether by comparing with the Capron et al synthesis, there is an improvement in the model data comparison (or not) compared to when you do the comparison with climate synthesis that give a unique time slice.

P29:
Line 6: replace “proxy reconstruction” by “LIG climate data synthesis”
Line 7: remove “a compilation of synchronised records by”.

Typographic comments:
P4, line 29: missing space between two sentences.
P6, line 21: missing space between two sentences.
P9, line 1: missing space between two sentences.
P11, line 24: missing space between simulation and (.
P29, line 13: double space before the start of the sentence I think.
Line 29: a “.” is missing between “considered” and “At”.
P20: line 10: I don’t understand this sentence, it needs to be re-written or removed.

Figure 10: Please indicate clearly which time slice from Capron et al. you are using in the caption (130 ka).

References:

Bakker, P. and Renssen, H. (2014). Last Interglacial model–data mismatch of thermal maximum temperatures partially explained, Clim. Past, 9, 1633–1644, doi:10.5194/cpd-10-739-2014, 2014.

Capron et al. (2014). Temporal and spatial structure of multi-millennial temperature changes at high latitudes during the Last Interglacial, Quaternary Science Reviews, 103, 116-133.

Govin et al. (2012). Persistent influence of ice sheet melting on high northern latitude climate during the early Last Interglacial, Climate of the Past, 8, 483-507.

Govin et al. (2015) Sequence of events from the onset to the demise of the Last Interglacial: evaluating strengths and limitations of chronologies used in climatic archives. QSR, 129, 1-36.

Dutton et al. (2015) Sea-level rise due to polar ice sheet mass loss during past warm periods, Science, 349, no. 6244 *DOI:* 10.1126/science.aaa4019

NEEM community members (2012). Eemian interglacial reconstructed from a Greenland folded ice core, Nature, 493, 498-494.