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Discussions

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Interactive comment on "Peatland area and carbon over the past 21 000 years – a global process based model investigation" *by* Jurek Müller and Fortunat Joos

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In their manuscript, Müller and Joos explain the integration of peatland carbon cycle dynamics into the LPX DGVM and investigate how peatlands changed (in their model) over the time between the Last Glacial Maximum and today. They investigate the influence of climate forcing on the LGM peatland distribution, compare the present-day model results against observations, and describe the changes in peatland extent and carbon storage over time from the LGM to the present. Their manuscript makes fascinating reading, as the picture they draw on the temporal development of peatlands is much more detailed than the usual assumption of a more or less linear growth of

C1

peatlands.

The manuscript is very well written and is a major advance on the previous state. I recommend publication with minor changes.

I only have one major issue with the manuscript by Müller and Joos, and that is the fact that I didn't write it. I wish I had written such a comprehensive description of peatland development since the LGM. However, this rather obviously is not the author's fault, but my own.

There are, however, a few minor things that might improve the manuscript, and I very much hope that the authors will agree to that.

1) The TraCE21k forcing data is rather unusual in that it is what one might call a "guided" climate model experiment, in the sense that the modelling team at various points in the climate evolution performed perturbation and/or sensitivity experiments in order to make the climate model conform more closely to the observational record. This makes the data set especially valuable as a forcing data set, but it is quite different from the usual experiment setup, where one sets initial and boundary conditions, and then gets some climate evolution which may – or may not – be similar to what can be reconstructed. A few explanatory sentences in section two would lessen the need of unintiated readers to refer to the original papers.

2) Personally I prefer SI units, so I would use PgC instead of GtC. Also, I may have overlooked it, but I did not see an explanation of Mkm2 – a definition would clarify things for readers unfamiliar with this unit.

3) Page 4, line 19: ...with a rate of 0.01 per year. Is this a fraction of the grid cell, or a fraction of the difference between potential and actual area? Please clarify.

4) Section 2.3, also 3.1.1 – PEATMAP is partially based on Gumbricht, if I remember correctly (unfortunately the original manuscripts and data sets are on a disk in my office, which I haven't been able to visit since March). I also seem to recall that South

America is more or less exclusively based on Gumbricht. However, the manuscript seems to say that extent in South America is similar to Gumbricht, but larger than Peatmap? Please clarify in the manuscript, where PEATMAP and Gumbricht are identical, and where they differ.

5) Section 2.2 (Page 6, lines 7-14) please list the models considered in sensitivity experiments, otherwise readers need to refer to original PMIP papers.

6) Figure 1 – I am wondering whether it is better to show PEATMAP on the 0.5° resolution, or whether it might be better to show it on the LPX model grid. Please check.

7) Figure 5, bottom-left corner: What's G-IG supposed to mean? Either clarify or remove.

8) Figures 6, 7, 8 – Figure caption refers to letter a,b,c, but subfigures not labelled accordingly.

9) Page 21, line 2: "with an inconsistent temporal evolution" Inconsistent how? Please clarify.

10) Figures A1 & A2 (d): Please correct spelling of "Afrika" from German to English spelling (Africa). Similarly, I seem to recall that it's the "Congo", not "Kongo", as on page 7, line 19.

11) Figures 7, 8, A1, A2: Background colour coding unclear from caption – I suggest to insert reference to Fig. 4, where it is explained.

12) Figure 2, caption: Explanation of (b) could be clearer ("...how many timeslice simulations with climate forcing from different models show...")

13) What happens to shelf C after shelf flooding? Did I miss that or is it missing in the model description?

I am also adding an annotated version of the authors' original pdf with some wording / spelling suggestions.

Please also note the supplement to this comment: https://www.biogeosciences-discuss.net/bg-2020-110/bg-2020-110-RC1-supplement.pdf

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-110, 2020.