

Interactive comment on “DYPTOP: a cost-efficient TOPMODEL implementation to simulate sub-grid spatio-temporal dynamics of global wetlands and peatlands” by B. D. Stocker et al.

Anonymous Referee #2

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This is an important study that represents a major advance in modeling and understanding the dynamics of wetland/peatland distributions. The authors use an implementation of TOPMODEL to simulate inundation and then define wetland and peatland extent on the basis of certain criteria, such as inundation persistency and carbon balance. Considering both wetlands and peatlands based on inundation provides a consistent framework to deal with these two related land surface features. Also, it is also very useful to explicit simulate the so-called disappeared peatlands. Now there appears to be some emergent field evidence for these disappeared peatlands, but a calibrated model would allow us to assess their importance on the global carbon cycle during the Holocene in future studies.

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The discussions about the similarities and differences between simulated results and some observational data are reasonable, such as the inundation extent and peatland carbon stocks.

The manuscript is in general clearly written and well organized.

My only major suggestion is that the authors may want to consider a more systematic sensitivity analysis for certain parameters or values used, or at least provide further discussion about why the choices of these values would not significantly affect the results/conclusions. In particular, some parameters are not well constrained by observations, such as the minimum of fraction of 0.001%, and the relative areal change rate of 1% per year. I understand some parameter values were determined based on visual comparison of simulation results with available observations, and others by using coarse-resolution model due to computational costs. In any case, some additional justification/discussion on these and other parameters would strength the manuscript.

Specific comments: Title: Change “spatio-temporal” to “spatiotemporal”?

Page 4876, line 11: Delete “Here” or change to other wordings, as you use “Here” earlier in the abstract already.

P4877, l15: change to “40-50 Tg CH₄” if that is the case, as the later part of sentence refers to C.

P4878, l11: change “area specific fluxes” to “flux rate per unit area” or “flux intensity”?

P4879, l7: define “f” here in its first use (=“inundation area fraction”) to increase readability.

L9-11: rephrase this 2 sentences, such as “Here we present an implementation of TOPMODEL by We term our module/implementation . . . DYPTOP.” The readability can be improved with rephrasing.

P4881, l20: change “sphagnum” to “Sphagnum” (also italic) L25: do you mean “decid-

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uous” by “raingreen”?

P4885, l2: change to “. . .in R (R Code Team, 2012)” (similar typo in Figure 1 caption)
L24: change “Sect.” to “Subsection”? Distinguishing Sections and Subsections in the text may help increase the clarity.

P4888, l15: minimum fraction of peat at 0.001%: How sensitive would it be if using different value other than 0.001%? What is the impact on the global C balance using different values? Is it the smallest fraction to make “peatland seeding” effective? Some discussion on how this prescribed values would affect results/conclusions may be useful.

P4889, l10-15: Again, it would be useful if additional sensitivity analysis is done to make sure that the selection of specific values for these parameters, such as 10 gC/m²/yr, 50 kg/m², or 31 years, would not affect the results/conclusions. I don't think we have empirical observations on the limits for peatland persistence, so sensitivity analysis or additional discussion would increase the readers' confidence and strengthen the manuscript.

P4890, l17-18: change to “. . .allocated to f_oldpeat, and re-expanding peatlands first expand into dolfpeat.” (add a “,” between two phrases separated by “and”).

P4896, l7: change “but are biased low. . .” to “but are underestimated. . .”

P4897, l 119-26: Good point about human modification on rice paddies. The authors may want to point out more explicitly that some rice paddies fields were constructed on the mountain slopes as terraces, so certainly topographic analysis (as modeled here) would not consider these slopes (some times quite steep) as wetlands, but satellites as in inundation dataset can still see.

P4899, l6-10: maybe reword the sentence(s) here to use either phrases or full sentences, rather than a mixture of both for items (i), (ii) and (iii). Something like: “the following three criteria/steps: (i). . .”

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P4903, l7: change to “Ringeval et al. (2012)” (misplaced “(“ L13: change to “Note, however, that M. . .” (add a “,” before “however”)

P4904, l10: change “E.g.,” to “For example,”. Similar change can be applied in several other places in the text, such as page 4907, line 14.

P4909, l10-11: any reference to the values used (for example, 1% per year)? Or further comments on the sensitivity of the simulation results/conclusions to the specific value used. See comments above on sensitivity analysis.

P4910, l17-18: maybe indicate here which three additional PFTs to represent peatland beyond boreal regions. Also, it would be useful to readers if the authors also briefly state the PFTs used for boreal peatlands in Spahni et al. (2013).

Comments on figures: Figure 1. -Figure caption about Step 3 is a little unclear. If “v, k, q and f are prescribed to LPX-Bern” (used as input as indicated on page 4885 line 9), then would it be useful to add a line/arrow in the flowchart to link “fit parameters” box with “LPX” diamond? -in figure caption, state what the brown double-lined arrow stands for “feedback of peat growth on water table”. The authors mention this in the text, but not here in figure caption.

Figure 2 -caption: change “industrial period” to “instrumental period”? -is that also for the 31-year period (1982-2012)? If so, indicate so.

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