

Interactive comment on “Implementing northern peatlands in a global land surface model: description and evaluation in the ORCHIDEE high latitude version model (ORC-HL-PEAT)” by Chloé Largeron et al.

Anonymous Referee #2

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Thank you for the opportunity to review the paper by Largeron et al.

I believe the paper is worthy of publication once all the referee comments have been addressed to the satisfaction of the Editor.

Largeron et al. added a fixed gridcell fraction to represent northern peatlands to ORCHIDEE. They then evaluated the impact of this new set of processes at site and regional scale.

In general, the arguments are quite convincing, but I feel they could be made much

C1

more solid with the addition of some extra information (detailed below), and a little extra analysis. For I feel that this lack of detail in certain key places is the main drawback of the paper.

I have chosen to divide my comments into General and Specific categories in the following. The comments below refer, where possible, to specific pages and lines or ranges of lines.

I'm looking forward to reading a revised version.

General Comments and Questions

1. The problems with the treatment of snow sublimation, mentioned in many places throughout the text, is vital to be able to understand and trust the results shown here. Please provide more detail.
2. How are the peatland fractions of the cells parameterized? You mention that they have a texture, but is this the same as the remaining fraction of the cell, i.e. more representative of mineral soils? What is the porosity? What is the depth of the bucket? How is evaporation treated?
3. For the FLUXNET site evaluation: how was the WFDEI forcing combined with the climate at the site? What were the other components of the C flux, e.g. GPP, and do they compare to site observations?
4. Maps: Can you provide a map of your peatland fractions, described in Sec 2.3.1, or combine it with Fig 4? Can you highlight the Ob catchment on Fig. 4?
5. Productivity and decomposition: you reduce V_{cmax} based on Degerö observations, but how is the regional GPP affected by this change? Was the ORCHIDEE decomposition changed too? A lot of effort is put into a study of the effects on the regional water balance, but how do these peatland changes alter the regional C balance and fluxes?

C2

How does the peatland vegetation behave, e.g. in terms of LAI, NPP, biomass etc.?

6. Little mention is made of the effect of the soil freezing and thawing processes. E.g. I suspect that the active layer depth is greater in your peatland cells than in reality, if the texture you use corresponds to mineral soils.

7. Section 3.2. Did you force the model with precip and NO runoff first in order to identify bogs and fens? After that, runoff transfer is switched off in cells with bogs? Please clarify.

8. Discussion. Can this approach be used to represent tropical wetlands? What is needed to do so? How about seasonally inundated wetlands? Will you add a CH4 submodel?

9. Language: Finally, please consider getting a native English speaker to go through your paper before it is published. The language is mostly fine, but there are quite a few places where the readability and grammar could be improved. I have identified some, but not all, below.

Specific Comments —————

Page 1: Line 3. The sentence "These are considered..." doesn't make sense. "These" are peatlands. Line 9. "at" or "for" instead of "according to"

P2: L3. Sentence "Moreover, ..." is too general, and anyway seems out of place here. L11. Same thing for "Peatlands..." L15. Remove "a large" L30. "peatland density"

P3: L4. "MICT" ??? L5. "latitude" L30. "as" to "to"

P4: L6. I suggest: "... with site measurements from the FLUXNET ..." L18. "shallow vegetation? Do you mean low? L21. Västerbotten L28. remove final "of"

P5: L23: I suggest "in reasonable agreement with" instead L30-32: Mention that some models do have this stress, e.g. LPJ-WHyMe

C3

P7: L4-7: I'm confused, was a simple bucket approach used, or did the infiltration etc follow STD ORCHIDEE? Eqns. 1 & 2. Do the Beta factors depend on vegetation type/PFT?

P8: - In general, I'd recommend you use "soil moisture" instead of "humidity" in the text. - R is described as a resistance and a reduction. - Eqn 3: so does this mean that when $f_{peat} = 1$, $R = 1$, so there is NO evaporation from the peatland? Is that justified? L10-12. show the improved latent heat flux!

P9: Fig.2 - is PFT grass simply the same simulation without the V_{cmax} reduction? L14. "snowfall and rainfall"

P10: L1. evidence for "may"? L1-2. unclear what's meant here. L3-5. But didn't you force Fayemyr with observed precipitation? If so, the WTP reduction on Feb/Mar should also be seen in the observations. Is the problem frozen soil? If so, where is the soil water coming from in reality? Is there justification for the sensitivity test described in Lines 9-10?

P11: Fig 5. Describe the zoomed section in caption.

P12: L1-2. Obvious? Sec. 3.3.1 - please identify the Ob basin in a Figure.

P13: Fig 7. There is no "center". Please identify with a, b and c, as in Fig 8. L8. "first show" - but both are in Fig 7!

P15: L10. "reduction" instead of "difference" L24. RE snow - more detail needed.

P16: L4. "top panel" - use (a) instead.

P17: L4. RE snow - more detail needed. L6 & L11. Fig 8a L14-17 - remove/move this paragraph? L22. Why north of 40N? I thought you ran the model for north of 45N. L18-29. This whole section is unclear.

P19: L1. ice on the observed or modelled soil? L12. Could also mention the discrepancy near Finland. L28-30. Not sure what this sentence means.

C4

P20: L6. "methane emissions to hydrological variations", perhaps?

P21: L17. meteorological L31-32. Unclear "34% in average" of what?

P22: L8. Which Fig 8 - a, b or c? L14. underestimated

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2017-141>, 2017.