Geoscientific
Model Development
Discussions

Interactive comment on "ORCHIDEE-PEAT (revision 4596), a model for northern peatland CO$_2$, water and energy fluxes on daily to annual scales" *by* Chunjing Qiu et al.

Anonymous Referee #2

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The authors present a new peatland model as part of the ORCHIDEE land-surface model. The manuscript is well written and does a nice job of describing recent advances in peatland modeling and identifying the need for the model developments reported here. Specifically, the model simulates water table by prescribing peat-specific hydraulic properties across the 11 soil-profile layers. Water table is then used to determine decomposition rates in in the near-surface acrotelm and deeper, saturated catotelm. The model is evaluated using eddy covariance measurements from 30 sites across northern hemisphere (bog, fen, and tundra). In general, I think the manuscript is in good shape, and I have a few relatively minor comments:

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1. Would it be possible for the authors to evaluate model performance of heterotrophic respiration or ER vs. observed values?

2. Line 132 – Should be permafrost "thaw", not "melt

3. Lines 231-232 – While incorporating a peatland-specific PFT is a step in the right direction, I was surprised the authors did not develop a bryophyte or shrub PFT for application in this study, particularly given the range of peatlands used for model comparison. It seems like at the very least, the authors should acknowledge this as a cause of discrepancies between model output and observations.

4. Line 321-324 – Please clarify how the CENTURY-type model of the standard ORCHIDEE is incorporated in the new decomposition parameterizations for the peatland version. As is, it's not clear how the three-pool set-up relates to these equations.

5. Line 566-567 – The model does incorporate hydraulic properties of peat soils. It seems like it would have been relatively straightforward to also incorporate thermal properties of peats to improve soil temperature performance and its effects on respiration.

6. The authors point toward possible causes of the poor model performance with respect to water table in the Discussion. It would be helpful if they could lay out some practical future steps to improve model performance, particularly given the importance of WT on below-ground C cycling parameters.