**Geoscientific
Model Development
Discussions**

Interactive comment on "Modelling sub-grid wetland in the ORCHIDEE global land surface model: evaluation against river discharges and remotely sensed data" *by* B. Ringeval et al.

Anonymous Referee #2

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Review of "Modelling sub-grid wetland in the ORCHIDEE global land surface model: evaluation against river discharges and remotely sensed data" by Ringeval, B., Decharme, B., Piao, S. L., Ciais, P., Papa, F., de Noblet-Ducoudré, N., Prigent, C., Friedlingstein, P., Gouttevin, I., Koven, C., and Ducharne, A.

In their manuscript, Ringeval et al. describe a wetland parameterisation for the OR-CHIDEE LSM, based on the TOPMODEL approach and a new parameterisation of frozen soil water. They present model validation results for streamflow and inundated area.

The manuscript generally is well written, with the exception of the model description

section, and the model extension presented is a valuable contribution, since the extent of saturated soils is an important factor for determining Methane emissions, an area where the current generation of GCMs generally is lacking.

The new parameterisation actually degrades model performance with respect to streamflow, and the determined grid cell fractions of saturated soil are far from perfect, but the authors present these shortcomings openly. Since very few approaches for determining wetland extent are published yet, the manuscript still is a valuable contribution.

I therefore recommend acceptance with revisions.

Major comments: The model description clearly is lacking. From the manuscript, it is impossible for the reader to understand, how TOPMODEl and the normal ORCHIDEE hydrology interact. The authors refer to a previous publication describing some aspects of TOPMODEL in ORCHIDEE, but even when referring to this it is very difficult for the reader to understand how model hydrology and TOPMODEL interact.

In addition, important model outputs are not documented at all. An equation for Fmax is missing completely, and how the topographic index enters the model is completely unclear. Wmax and Wmin are used in the text, but never explained. Fwet is also unclear.

Section 2.3 therefore needs to be rewritten completely so the readers can actually understand what the new scheme does. A few more equations would certainly improve the manuscript.

Minor comments:

- Page 690, line 23, and page 702, line 19: A Figure "S1" is referenced, which doesn't exist. You mean Fig. A1?

- Citations: There are numerous instances, where the brackets of citations are used in a non-optimal way. The first paragraph of Section 2.3, for example, contains numerous

cases where publications are cited (authors, year), though authors (year) would be more appropriate. Please check and correct.

- Page 696, lines 1-5: The limitation through the non-consideration of anthropogenically modified river basins: would that apply to all basins? Some basins? Where is it really important?

- Page 697, lines 9-16: Do you use a constant c for all grid cells? Since Sterling and Ducharne published a map of drained wetland areas, it might also be a spatially varying c. This issue, and especially the reasons for the choice you made, should be discussed.

- Page 701, line 16: "Yearly" should be replaced by "annual". Same goes for Fig. 5

- Page 703, line 15: Spurious "max".

- Page 704, line 12: Reference in the text is Fig. 8, should be Fig. 7

- Page 708, line 28: "wetlands extents" should be "wetland extents". There's other instances of incorrect plural "wetlands" in the text, for example "wetlands diversity" on page 713, line 24.

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