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Geoscientific Model Development Discussions

Interactive comment on "Linking hydraulic traits to tropical forest function in a size-structured and trait-driven model (TFS v.1-Hydro)" *by* Bradley O. Christoffersen et al.

Anonymous Referee #1

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This paper seems a mine of parameters for land surface process models and resources for generating the parameters. My feeling is that the author(s) made a reasonable effort for conducting this research, and further, this paper should be published in GMD as soon as possible because I believe this paper would be of extreme value for developers and users of the land surface process and terrestrial ecosystem dynamics models. However, there are some small flaws in the present manuscript, and so before this paper is accepted, the author(s) must revise the manuscript according to the followings:

When an abbreviation/a symbol appears for the first time, write it out in full spelling: What is TFS (P1L33, P6L20), WD, LMA, NL and PL (P6L21)?

I suggest in Introduction section, you should state the temporal (apparently, ∼hourly

scale) and spatial (apparently single-plot/stand scale) scale of the model. This might be "readers-friendly". Further, you elaborated a plant hydraulic submodel in this research. As you note, solving Richards Equation is tough and needs heavy computation resourse. I do not think such plant hydraulic models are suitable for large-scale and long-term vegetation dynamics models. Thus, I also suggest in the Introduction section you should explicitly state why you elaborated the hydraulic models ("because such models can describe detailed plant water relations" is not enough) and future strategy of applications of the hydraulic models.

Concerning to P3L10, you need to read: Kumagai, T., Porporato, A. (2012) Drought-induced mortality of a Bornean tropical rainforest amplified by climate change. Journal of Geophysical Research -Biogeosciences, 117, G02032, doi:10.1029/2011JG001835.

Concerning to P4L3-7, you need to mention this pioneer paper: Kumagai, T. (2001) Modeling water transportation and storage in sapwood -model development and validation. Agricultural and Forest Meteorology, 109, 105-115. And "Arbogast et al., 1993" should be inserted in the former array of references P4L6-7.

Fugure 1: Subfigures involved in Fig 1 are incomprehensible and seem unnecessary because they have no explanation. Provide them with appropriate explanations if you want them to be involved in Fig 1.

P8L18: ">=" should be "ïĆş".

P10L13: "(-)" should be omitted or changed to "(unitless)".

P10L14: "-1" should be superscripts, and "FMC" should be "FMCx".

P10L15: "1" should not be italic.

P10L23: Why is "relative to" italic?

P11L13: Remove "derive".

P14L13: Insert "statistical" between "All" and "analyses". "R" should be "R software"

and “(R core team 2015)” is not enough information.

P14L14-15: You should not state this text “In all . . .. . . ’****’.” here. You should refer to statistical significance at each figure’s caption (Figs 2-6, and 8).

3.2 Model setup: Give more detailed throughfall exclusion experiment (TFE) or remove all statements on the TFE in the manuscript (I will explain later).

P18L4: 50% reduction of what?

Captions of Figures 2 and 10: Give full spellings of the abbreviations such as LMA, WD, and so forth.

Figures 5, 6 and 8: Legends of symbols are needed.

Caption of Figure 6: Al:As needs to be italic and subscripts.

Caption of Figure 8: “ks,max,x” needs brackets.

4.2.1 Impact of plant. . .. .: Add further and more detailed explanation on why transpiration rate was higher in dry season than in wet season for both TFSs and why transpiration rate in dry season was inhibited with v.1-Hydro.

Figure 11: Mention clearly which type of TFS was used for this simulation in the caption. Further, you have to note that this analysis in Fig 11 cannot be any validation for the model because there was no difference in both observations and computations between control and 50%TFE. I recommend to omit all statements on both the TFE observations and computations (further recommendation and explanation later).

Figure 13 and 4.3.3 Fidelity of modeled. . .. .: Did you mean the simple soil bucket models of both TFSs v1 and v1-Hydro could not reproduce the temporal variation in soil moisture for the Control and the 50%TFE? If so, this is very critical problem because simulations of plant water relations such as stomatal behavior, sapflow, root water uptake and so forth must be conducted on the premises that the soil moisture environment is appropriately reproduced. In this case, I think discussion on simulation

of TFE would ruin this paper. So, in this case, I suggest omitting all statements about TFE in this paper. Note that without the TFE, the value of this paper would not change. If you are successful in reproducing soil moisture environment for both the Control and the TFE, show the time variations in modeled and simulated soil moisture and give more detailed and analytical explanation about why both TFSs v1 and v1-Hydro could not capture the observed reduction in transpiration under the TFE.

P25L24-25: How thinking plant hydraulic submodels important leads to developing ESM? Please give a concrete explanation.

P29L3: (If the models failed to reproduce the soil moisture environment) I guess “not vertically discretize the soil water or root distribution” is not big problem. This is simply problem caused by failures in mass balance equations because the models could not capture the soil moisture depletion induced from 50% rainwater reduction.

Conclusion: You should confess this paper’s current model is too complex to incorporate it to coarse-scale DGVMs.

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