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# *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 #2**

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This paper presents a plant hydraulic model and the parameterization of this model with plant traits of tropical forest trees. The study is interesting and in the scope of the journal Geoscientific Model Development. The hydraulic model itself is based on the model proposed by Sperry et al. (1998). But the parameterization with plant traits is comprehensive and valuable for model development, especially for modeling tropical forests. The equations in Supplement S1 have well explained the formulations of the model. And the figures and the equations in Table 2 are presenting the results well.

I have to say that I had a hard time reading this paper. I went through this paper many time in the past weeks and still didn't well get it. Fortunately, the equations in Supplemental material and Table 2 are clear and the figures of results are readable. I



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can see it is a good work. But the writing of this paper should be substantially improved in its revised version.

Another concern is the interactions between the hydraulics model and the host model TFS. The authors only show that the hydraulics model makes the hourly predictions of water dynamics better (e.g., transpiration, water potential, etc.) at given forest structure in their results. But, how the hydraulics model affects the long-term predictions of TFS (decades to a century)? I ask this question because a plant hydraulics model may change the behavior of trees in competition and therefore change the long-term predictions of forest dynamics. I want to know to what extent it changes the host model (i.e., TFS).

Minor suggestions:

1. The section of "introduction" : I didn't get it why it is necessary to build this model and why this way works here from this section. I hope the authors can write a better introduction to make it easier to understand in a revised version.

2. In page 4, lines 3∼6 "Other models treat the plant continuum as a porous medium with constitutive equations defining water retention properties (the relationship between water potential and water content) and xylem PLC, using Darcy's law to incorporate fluxes 5 within the Richards' mass balance equation". I think this sentence is important because it describes what other models do. But please make this sentence clear.

3. Pages 4∼5, from line 10 in page 4 to line 30 in page 5: These two big paragraphs have a lot of facts and arguments. But they are too messy. I have read through them many times, trying to figure out the messages that the authors want to deliver. But, I still do not get them.

4. Page 7, lines 9∼10 ". . . the model developed by J.S. Sperry and described in Sperry et al. (1998)" can be shortened as " . . . the model developed by Sperry et al. (1998)".

5. Page 7, line 21 "we modified S98 in three important ways . . .". I prefer to say "we

modified S98 in three ways . . .” by crossing out “important”. I understand that these modifications are important. But here it’s a description of the model and you don’t have to evaluate your works here.

6. Page 8 lines 1∼12: This paragraph should be a summary of the model, not just what have been described in Supplement S1. The authors should expect the readers to get a picture of the model by their descriptions without reading S1.

7. Page 8, lines 22∼23: It took me a while to think what the authors want to tell in this sentence. If the authors just want to talk about “capillary water”, I prefer a sentence like “sapwood also stores capillary water in its void spaces and embolized conduits”. Then, I don’t have to think about “tension theory”.

8. Page 8 lines 23∼30: These arguments are not necessary because this section is to describe the model. And, the sentences in lines 14∼23 can be reorganized so that it’s easier for readers to understand Eqn 1.

9. Page 9, line 6: “RWC” is not explained.

10. Page 10, line 13 “(-)”: Does it mean ax is negative? If yes, I prefer to use “-ax” in the equation.

11. Page 11, lines 2∼13: This paragraph is supposed to describe some “first principles” of the size effect of trees on plant hydraulics according to the second paragraph, but where are they? I saw “two main mechanisms”. The second one describes two possibilities. Which one should be the “first principle” in the model?

12. Page 11, line 10: “because of the Hagen-Poiseuille law”. It’s a phenomenon of the Hagen-Poiseuille law, not because of it.

13. Page 12, lines 20∼23: I think the sentence “FMCgs . . . is the only variable passed from the hydraulics module to the host model” is the message of this paragraph and therefore should be the first sentence.





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14. Lines 23∼26 in Pages 12 and lines 1∼5 in page 13: These sentences can be moved to discussion. This section is to describe the model, it's not necessary to argue these issues here.

15. Page 13, line 28: Please also cite Strigul et al. 2008 for PPA.

16. Page 16, line 15: "Idealized model experiments". I would use "Model experiments" because any model experiments are always "idealized" somehow.

17. Page 17, lines 13∼14 "We matched simulated trees . . ." It would be clearer if there is a table to show the settings of trees.

18. Figures 11 and 13: explain "50% TFE" in legends.

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