

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
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Review on hess-2020-671

Anonymous Referee #2

Referee comment on "Plant hydraulic transport controls transpiration sensitivity to soil water stress" by Brandon P. Sloan et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-671-RC2>, 2021

The study analysed the impact of heuristic β -type water stress formulations, commonly adopted to many land-surface schemes in terrestrial biosphere models and identifies when such a formulation diverges for more detailed models that include explicit formulation of plant hydraulics. Additionally, it proposed a new dynamic β -type formulation that "emulates" with a very reduced complexity the limitations that originate from plant hydraulics. The study is focused and very well written, and clearly within the scope of HESS. I found particularly insightful the analysis with the simple plant hydraulic model that clearly shows when plant hydraulics are expected to play a major role, and the dynamic β model which can be easily adopted by existing TBMs. I can suggest the manuscript for publication after the following comments have been addressed:

Specific comments:

- I believe that information from S4 should move to the main manuscript. While reading the manuscript I was confused whether soil moisture dynamics were simulated, or if soil moisture and soil water potential were set to the observed values at the site. I could also not tell what ψ_s corresponds to (i.e. root zone average potential? potential of root average soil moisture?). I appreciate that the authors like to present a focused manuscript, but bringing this information in the main article will improve its readability.

- Regarding the calibration of the dynamic $\delta \square \square^{1/2}$ model, to my understanding, the results from the full complexity PHM was used to derive the dependence of the stress factor to T_{ww} and ψ_s . As this would not be the case with existing TBMs, can the authors suggest a general procedure on how a generic calibration could be achieved for a "general-purpose" dynamic β model?

- One aspect worth discussing is the use of capacitance within a plant hydraulic model. I would encourage the authors to expand their discussion regarding this point, as several TBMs now adopt a resistor/capacitor approximation when formulating their plant hydraulic modules.

- I agree with reviewer 1 regarding the interpretation of the results. The behaviour of β models limiting particularly photosynthetic rates (or in some cases V_{cmax}), might have a different behaviour that the reported. That would be worth discussing further.

Minor comments:

- Line 101, 98: has instead of is?
- Line 133: Neutral atmosphere, instead of "negligible atmospheric stability"
- Line 137: "and codes will be made available online with acceptance of this manuscript". Not a necessary statement in the manuscript. The code will appear upon acceptance.
- It would be nice to keep consistent units for transpiration and conductance terms throughout the manuscript.