General comments:

The manuscript tests and compares various empirical correction functions (β) of stomatal closure under soil-moisture limitations to more advanced plant hydraulics models. The authors explain the source of the differences between the β and mechanistic plant hydraulics approaches, leading to the development of a new dynamic β model that compares well to mechanistic plant hydraulic schemes, but with half the parameters. The authors are clearly well aware of the issues within terrestrial biosphere models. This is a nice manuscript. The supplementary information is particularly clear and thorough.

Major comments:

(1) A key strength of the manuscript is that it proposes a new dynamic β scheme which has half the parameters as the full plant hydraulics scheme. This is mentioned in the main text beginning at line 306 and more fully discussed in the SI (lines 40-44). The simplicity of the parameterization should be more fully discussed in the main text, considering its importance and since it seems to have at least partially motivated the study (as discussed in introduction; lines 49-54). The parametric benefits of the new scheme should be brought out more in the title (which is appropriate, but does not reflect this strength – if anything, the current title evokes an obvious statement), the abstract (which mentions the scheme being generally parsimonious but without being exact), and the end the introduction (near lines 58-59).

(2) It should be made clear that the results and their interpretation reflect β functions when formulated as a function of soil water potential (or soil moisture content by extension). The choice of soil water potential as the explaining variable is explained in lines 158-164, but should be discussed elsewhere for emphasis. It is not clear if the manuscript's conclusions would be the same had the authors formulated β as a function of leaf water potential, which is recognized as an alternative model scheme in line 159. I expect that the conclusions would be different had β been defined as a function of leaf water potential, considering that the finite plant conductance is explained here as a controlling variable for the response (lines 211, 252-257, 290), and the conductance would be reflected in the resulting leaf water potential. Whether or not the conclusions would be different for a leaf potential formulation, at the very least, these concepts should be explained in the text. Nonetheless, regardless of the alternative formulations for β and their implications, the study is still highly meaningful to terrestrial biosphere models, considering most terrestrial biosphere models apply β as a function of soil water potential or moisture – another point that can be further brought out in the text (or a Table could summarize existing schemes in terrestrial biosphere models).

Minor comments:

(1) Line 17: "water use" is a broad term that can mean many things besides transpiration. To be more exact, change "water use" to "transpiration."

(2) Eq. 3 + 8: These formulations are reasonable enough for the purposes of the study; however, limitations of these formulations should be explained. Eq. 3 is flawed in the sense that there is no unique stomatal conductance response for a given leaf water potential (recently discussed by Anderegg & Ventuas, 2020; "*Plant hydraulics play a critical role in Earth system fluxes*"). Similar logic applies to Eq.

8. The formulation for stomatal conductance as calculated by Eq. 8-9 is a little funny, considering at least two things. First, Eq. 8-9 causes the minimum stomatal conductance to decline with leaf water potentials. And second, g_1 in Eq. 9 is considered a constant, even though it reflects the marginal water use efficiency (which is recognized by the authors in the SI; lines 325-326), which can be further considered a function of leaf water potential (e.g. Manzoni et al., 2011; "*Optimizing stomatal conductance for maximum carbon …*"; Wolf et al., 2016; "*Optimal stomatal behavior with competition for water and risk of hydraulic impairment*"). I do not expect these equations to change with revision, but the formulations should be justified in the text or SI.

(3) Lines 154-156: This sentence is vague, and the intent is unclear. In particular, "tested against the selection of different soil moisture depths to represent plant water availability" suggests to me something about parameterized rooting depths and/or soil properties, but again, it is unclear. If it concerns rooting depth, refer to the SI (either generally to section S6.5.3 or specifically to Eq. 84). However, the rooting depth appears to have been set as a constant based on literature review (Table S7) and not a calibrated value. As a side note, the rooting depth of 0.1 m seems very shallow for an 18 m tall pine tree.

(4) Line 169: Refer to Figure S2 here. Figure S2 helps explain the linear functions used by the dynamic β scheme.