

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2021-139

Anonymous Referee #1

Referee comment on "The Cretaceous physiological adaptation of angiosperms to a declining $p\text{CO}_2$: a modeling approach emulating paleo-traits" by Julia Bres et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-139-RC1>, 2021

General Comments:

I found this paper to be very interesting and a good first step in estimating the impact of the evolution of angiosperms. Though there are limitations to this study, I think that they were very nicely and plainly listed and acknowledged as such. This study will an important contribution to the continuing attempts to better represent paleo vegetation in climate modeling.

I think the paper could use some work with the grammar. There are a lot of sentences that are missing needed commas or need be rearranged for clarity. I have attempted to point these out when possible.

I think this paper fits well within the scope of Biogeosciences and would recommend its publication pending minor to moderate revisions.

Specific Comments:

Abstract:

- Line 14 and 15: "Stage"? Maybe "state" would be better.
- Line 15: Irrigated? That sounds off. Maybe say that the leaves are kept more flush with water?d

Introduction:

- Line 54: Not sure if this falls into "specific" or "technical", but surely there a better phrase than "a lot"?

Methods:

- Lines 98-104: This sentence is very hard to comprehend. Way too much information in one sentence. I recommend splitting it up. Also, should "a day respiration" be "daily respiration"?
- Lines 106-108: Again, this sentence is hard to comprehend. Suggest changing "leaves morphologic and physiologic traits" to "the morphologic and physiologic traits of leaves" for clarity. Otherwise, this sentence should be split for clarity.
- Lines 118-132: This section is much more clear and should be a model for sentences listed above.
- Line 171: This sentence is awkward and should be changes to "A lower value for γ indicates a lower stomata-to-vein distance and a higher...." Or something similar.
- Line 187: Why was solar radiation set at 99%? For instance, in the Late Paleozoic, solar radiation is thought to be 3% lower based on the modeling of Crowley and Baum 1992. Is there similar modeling evidence for the Cretaceous. If so, it should be cited. If not, it should be justified.
- Line 201: I'm not sure I agree with the 5-fold lower photosynthetic and hydraulic capabilities of pre-angiosperms because it is based on the notion that vein density trumps all other physiological attributes, but for the purpose of a sensitivity analysis and your paper, it is appropriate and important. Carry on.

Results:

- Line 219: "3-fold" instead of "3-time".
- Line 223-224: The fact that gymnosperm function was not accessed is a problem for me. Yes, without a doubt, angiosperms have displaced gymnosperms as the dominant plant through time, but they still, to this day, occupy vast and important parts of the Earth's surface. Understanding their response in terms of a global climate model is important for the whole story of the increase in angiosperm dominance across the earth surface. Ultimately, judging the effect of angiosperms in the face of no change in gymnosperms seems to be missing a large part of the story. However, given your stated purpose, and the fact that needleleaf gymnosperms are not widespread in your paleovegetation distribution map, it is appropriate.
- Line 255-257: Doesn't this show the importance of highlighting the modeled change in angiosperms vs. gymnosperms? Gymnosperms are showing the resilience of coming to dominance during the low CO₂ of the Late Paleozoic Ice Age.
- Line 263-264: Soil water is always the limiting factor, especially in the tropics.
- Line 271-276: Indeed. Leaves do not function in a vacuum. Without accessing the

whole canopy, we cannot truly trust the implications.

Discussion:

- Line 478: I do not understand this sentence. Are you saying vein density is stomatal size and density? Or are you saying that vein density and stomatal size and density need to be accounted for? Clarify.

Technical corrections:

Introduction:

- Line 34: Should there be a space between "95" and "%"? I was under the impression that there should not.
- Line 35: Change "at the expanse" to "at the expense".
- Line 42: This sentence would be clearer with "i.e., stomata" was parenthetical.
- Line 61: "of H₂O", not "to H₂O"
- Line 63: seems as though "simulation design" would be better than "choices made"?

Methods:

- Lines 98-104: In line with my earlier comment on this sentence: To improve this sentence, or sentences after editing, I suggest placing the abbreviation for parameters inside the parentheses with the units.
- Line 182: Need comma after "both".
- Figure 3 caption: Should this read "fixed through time"?