

## **Response to Referee Comment C8172–C8173.**

*General: Well written. Pleasure to read. Useful work. Publish after minor revisions.*

We thank the reviewer for his positive comments on our manuscript.

*Specific:*

*1) p. 18910, line 29: change "plant" to "plants"*

Response:

We will change the phrasing.

*2) Section 2.4: Advantage of running coupled? I could see simulations 1, 2, and 3 in offline mode to remove feedbacks with climate. Then repeat the 3rd simulation in coupled mode to permit the feedbacks.*

Response:

For our research question, we needed to run the models coupled. If climate would be forced, as in offline simulations, climate would affect traits but no modification of climate via changes in traits would be possible, and one of our aims was to implement additional vegetation-climate feedbacks via trait variation. Without such feedbacks between traits and climate we cannot perceive the full effects of trait variation on vegetation shifts and fluxes. Coupled simulations are necessary for this.

We acknowledge additional offline simulations might help to disentangle the effects of climate on traits alone and the interaction effects between these two. However, such simulations were not feasible, as the offline version of JSBACH with dynamic vegetation is not working properly yet.

*3) Section 3.2, you say "for each grid cell, only trait values of the dominant pfts are selected..." Maybe I misunderstood, but why not weight the values according to each pft's weight in the grid cell, instead of using the values of the dominant?*

Response:

In figure 2, we plotted trait values per PFT. Consequently, we couldn't weigh the traits according to each PFT in every grid cell, as this would mean all PFTs would have been combined into a single box plot. If we would not only show trait values of a PFT where it is dominant, but also include trait values of other grid cells where the PFT was not dominant, this would obscure which trait values (per PFT) have the strongest impact on ecosystems. This motivation is also given in section 3.2 of the manuscript.

*4) Sections 3.2-3.5: Do you isolate which results are due to climate changes? This may be my greatest concern, because it may require offline simulations to be addressed.*

Response:

Because the simulations were coupled, it is indeed not possible to relate changes in productivity or vegetation distribution with certainty to specific changes in climate. Our main aim however, was to improve the way vegetation is represented in DGVMs and allowing for climate feedbacks. So, we were more interested in whether and to what extent trait variation alters model performance, than to know the exact pathways, as we acknowledged in advance this is difficult with a coupled model setup.

However, we agree offline simulations will reduce the number of possible variables causing the changes and may clarify some patterns, although even in that case it will still not be possible to directly relate changes in climate with certainty to changes in model output, as there are still other interactions possible between e.g. traits and vegetation distribution or productivity. Unfortunately, as mentioned earlier at comment 2, we could not perform such analyses as the offline JSBACH version with dynamic vegetation is not running yet.

5) p. 18926, lines 7-8: not clear as written. In the next sentence, you say "limited and mainly based on soil N". Is this what you mean in the prev. sentence when you say "cannot be separated from nutrient effects"?

Response:

With the nutrient effects we indeed mean the effect of soil N on traits. We agree with the reviewer these two sentences should be clarified, and we will do this in the revised manuscript.

6) p. 18927, line 9: not clear as written and possibly wrong usage of these words. Does "modeled" refer to "default" and "natural" to "observed"?

Response:

We contrasted the fixed trait values from the default simulation to the fixed trait values used in the observed traits simulation, where the fixed values are the PFT-specific global means of observed traits values. We agree this sentence in the manuscript is not that clear and we will rewrite this in the revised manuscript.

7) p. 18927, line 26: does "indirect" mean from changes in climate?

Response:

Indirect effects indeed include changes via feedbacks with climate, but also other indirect changes, e.g. through changes in vegetation distribution or dominance. We will make this clearer in the revised manuscript.