Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-421-AC2, 2019

Biogeosciences Discussions
Open Access
EGU

Interactive comment on "Response of Net Primary Productivity of Zambezi teak forests to climate change along a rainfall gradient in Zambia" *by* Justine Ngoma et al.

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Received and published: 23 January 2019

Thank you for your valuable comments. We incorporated suggestions from the reviewer and we also spent some time and efforts to improving the language in the revised version. We attached under Fig 1 to Fig 3 our responses to the reviewer and the changes we made to the manuscript.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2018-421, 2018.

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Discussion paper

Page 1 - Table 1: Responses to referee #2

Section of the paper	Comment from the referee #2	Author's response	Author's changes in manuscript
Title	The title could be improved again in my opinion; I found it a bit misleading as it sounds more like observational study than modelling study.	We modified the title to reflect the modelling approach.	The new title is: "Modelling the response of Net Primary Productivity of Zambezi teak forests to climate change along a rainfall gradient in Zambia"
Introduction	Page 3: The introduction doesn't describe much about the area of need for this study which I found it difficult to convince the readers the importance of this study. The authors state that Zambezi forests play a substantial role in mitigating climate change on line 24-25, but didn't elaborate further on this. I feel it is better to describe in details about the Zambezi forest in relation to NPP particularly the forest extent and carbon storage and also deficiency in the existing literature.	We acknowledge the concerns raised by the reviewer and we revised the introduction	The introduction was replaced with the new introduction. In this new introduction, we described in details about the Zambezi forests and included information on the forest extent, carbon storage, and deficiency in the existing literature.
Results	What are the uncertainties of projected changes in climate and NPP? I recommend to add error bars to the figures 2, 7 and 8.	We acknowledge the concerns raised by the reviewer and added the error bars as suggested	We added error bars to figures 2, 7 and 8 as highlighted by the reviewer. However, these figures 2, 7 and 8 in the old manuscript will be figures 2, 6 and 7 respectively in the revised manuscript
Materials and methods	Page 6, line 28: LAI is a unit less measure	We acknowledge the concerns raised by the reviewer and revised line 28	The units were removed from LAI
Materials and methods	Page 6, line 32: CAmax is not found in the listed equations	We acknowledge the concerns raised by the reviewer and we revised line 32.	CA_{max} was removed since it is not in the listed equations

Fig. 1. Page 1- Table 1 - Responses to referee #2

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Discussion paper

Page 2 - Table 1 continues

Section of the paper	Comment from the referee #2	Author's response	Author's changes in manuscript
Results	Page 10, line 8-9: The authors described how much the rainfall will increase or decrease under RCP 8.5 but not for RCP 4.5. Please also provide values or statistics for RCP 4.5.	We acknowledge the concerns raised by the reviewer and we revised line 8-9.	The values of projected rainfall changes under RCP 4.5 were provided in the revised manuscript.
Discussions	Page 16, line 23 to Page 17, line 7: I found these arguments or discussions are ambiguous and obscure. I don't understand what the authors mean by 'limited amount of soil water availability in LPJ-GUESS model'. Since the authors also discussed that the carry-over effects of rainfall on trees' productivity has been reported by other researchers, how does this be novel though?	We acknowledge the concerns raised by the reviewer and we revised this section	• The argument presented on page 16, line 23 to Page 17, line 7 has been removed from the discussion after gaining more insight from literature on how rooting depth affect water uptake by plants. Literature (For example Christoffersen et al. (2014)) indicates that water uptake by plants is dependent on different factors and rooting depth is just one them. However, there is no direct relationship between water uptake by plants and the rooting depth. So far, no study has been conducted in the Zambezi teak forests to determine the depth at which the trees take up water. The effect of rooting depth on water uptake by plants differs with locality and species (Christoffersen et al., 2014). Our previous studies (Ngoma et al., 2018a, b) reported different species composition at each of the three studied sites (Kabompo, Namwala and Sesheke), though some of them are common. Roots were only uprooted at the drier Sesheke site, indicating that the rooting depths of trees at the Kabompo and Namwala sites are not yet known. Thus, simulating tree growth using the default 1.5 m rooting depth was logical as we did not have full information on the rooting depth of trees at the other two sites (Kabompo and Namwala). However, we studied soil characteristics down to 1.5 m depth at all the three sites, giving us the needed soil information at all the sites. Thus, using the default and uniform 1.5 m rooting depth enabled us to easily compare results at the three sites. • We clarified in the revised manuscript that the clear representation of carry-over effects in LPJ-GUESS model would improve model results. We therefore removed the sentence 'This opens the novel concept to improve and validate LPJ-GUESS model' from the revised manuscript

References

Christoffersen, B. O., Restrepo-Coupe, N., Arain, M. A., Baker, I. T., Cestaro, B. P., Ciais, P., Fisher, J. B., Galbraith, D., Guan, X., Gulden, L., van den Hurk, B., Ichii, K., Imbuzeiro, H., Jain, A., Levine, N., Miguez-Macho, G., Poulter, B., Roberti, D. R., Sakaguchi, K., Sahoo, A., Schaefer, K., Shi, M., Verbeeck, H., Yang, Z.-L., Araújo, A. C., Kruijt, B., Manzi, A. O., da Rocha, H. R., von Randow, C., Muza, M. N., Borak, J., Costa, M. H., Gonçalves de Gonçalves, L. G., Zeng, X., and Saleska, S. R.: Mechanisms of water supply and vegetation demand govern the seasonality and magnitude of evapotranspiration in Amazonia and Cerrado, Agric. For. Meterol., 191, 33-50, 2014.
Ngoma, J., Moors, E., Kruijt, B., Speer, J. H., Vinya, R., Chidumayo, E. N., and Leemans, R.: Below and above-ground carbon distribution along a rainfall gradient. A case of the Zambezi teak forests, Zambia Acta Oecologica 87, 45-57, 2018a.
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Fig. 2. Page 2- Table 1 - Responses to referee #2

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Discussion paper

Page 3 - Table 1 continues

Section of the paper	Comment from the referee #2	Author's response	Author's changes in manuscript
Discussions	Page 17, line 19-20: Please fix the typing error for 'As a result: : :'.	We corrected the typing error	We removed the letter 's' from the word 'results'. The correct word was 'result'
Discussions	Page 18-19: Some acronyms are not found in Table 3 – JULES, ORCHIDEE, CEVSA, DLEM.	All acronyms that are not found in table 3 were removed	We removed JULES, ORCHIDEE, CEVSA and DLEM. from the list of acronyms
Discussions	Page 19, line 3: Please fix the typing error. : : :in there physiological properties.	The typing error was corrected	The word 'there' was replaced with the word 'their'

Fig. 3. Page 3- Table 1 - Responses to referee #2

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Discussion paper