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Interactive comment on "Climate change will cause non-analogue vegetation states in Africa and commit vegetation to long-term change" *by* Mirjam Pfeiffer et al.

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Author responses to comments of anonymous referee 2.
Responses are highlighted in bold font.

The authors present a theoretical study on possible vegetation changes in Africa for two scenarios of global warming and climate change. They use the sophisticated and well documented aDGVM, a dynamic (but not global) vegetation model that has been developed specifically for grass-tree interaction in tropical ecosystems. The authors convincingly demonstrate that in a global warming scenario, the vegetation

composition in Africa will likely change and increasingly deviate from its equilibrium composition, i.e., its composition that is attained, if vegetation would instantaneously follow the changing climate. In this sense, the transient future vegetation state in Africa is supposed to move into 'non-analogue states'. In conclusion, this is a well written, interesting study. The method is clearly outlined. The results are thoroughly and convincingly discussed. The topic is highly relevant. I am happy to recommend its publication in Biogeosciences in its present form subject to a few small, editorial changes.

Thank you for taking the time and making the effort to read and evaluate our manuscript. We are happy that you found it interesting and worthwhile for publication in Biogeosciences.

Minor items: Line 234: Fire 'consistently' enlarges. . . ok, but what about statistical significance? I assume the scatter is just too large to talk about statistical significance. This is more a comment, which the authors might consider, not a critical remark.

We intentionally wrote "consistently" instead of "significantly" because we did not test for statistical significance when aggregating data for Figure 2. The scatter is indeed very large, as indicated by the plotted standard deviations of the spatial means in Fig. 2. This wide scatter is a consequence of the distinct spatial patterning of Euclidean distance emerging over time that can be seen in Fig. 3 and Fig. S2. It is likely that the difference in Euclidean distance between fire and no-fire scenarios is significant for specific regions where fire strongly drives vegetation dynamics, and this then reflects in the consistent difference of the continental-scale mean, which in itself may not be significant. We will add a brief explanation on this topic when presenting the results of Fig. 2 and 3, and can conduct a test for significant difference of continental-scale mean values

between fire and no-fire scenarios.

Lines 249 to 252: I had to read these sentences at least twice to fully understand their content. Which variables refer to which percentage? Perhaps a slight re-arrangement of the sentence starting with 28% will cure the problem. It slightly enhances understanding, if the authors more specifically refer to Fig. S3a, instead of Fig. S3 (and if the 'Fig. S3a' were put in closed brackets).

Thank you for pointing out your difficulties with these sentences, as well as the formatting issue with the brackets. We will rephrase these sentences to communicate our point more clearly. As an alternative way of phrasing, we suggest the following: ***"In RCP8.5" with fire, for 28% of vegetated African area savanna tree cover was the variable that had the largest influence on dissimilarity between SDPs in the 2010s (Fig. 4). Ranking of variables based on their impact on the full Euclidean distance between SDPs revealed that the variable with the strongest impact in average contributed ca. 40% to the full Euclidean distance, whereas the variable with the second-strongest impact in average only contributed approx. 10% (Fig. S3a). The strength of impact varied between variables and was highest where mean tree height was identified as most influential variable (ca. 65% contribution), and lowest where forest tree cover was the most influential variable (ca. 18% contribution). This general pattern was similar for all four scenarios (Fig. S3a, b, c, d)."***

Line 363: What are these unpublished studies by the co-authors (Kumar and Martens)? Grey literature, PhD theses, to be submitted, or just personal communication?

The study of Kumar et al. is meanwhile published as a discussion article (Kumar,

D., Pfeiffer, M., Gaillard, C., Langan, L., and Scheiter, S.: Climate change and elevated CO2 favor forest over savanna under different future scenarios in South Asia, Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-169, in review, 2020.), and the study of Martens et al. is currently under review with Global Change Biology. We will update the references accordingly.

Figures: The figure captions should be self-explaining as much as possible. Therefore, please, explain the acronyms (SDP in Fig.2, 3, 4 and CDP in Fig. 5, 6, 7 and the figures in the Supplement)

We will update the figure captions according to your suggestion to make them self-explanatory.