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Biogeosciences Discussions

Interactive comment on "Modelling burned area in Africa" *by* V. Lehsten et al.

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Dear Referee of Biogeosciences, thanks for reviewing our manuscript and giving us the opportunity to improve it.

As requested by both reviewers, I added two new figures (10 11) displaying the spatial pattern of the changes in the driving data for the future simulations as well as the simulated changes in burned area. All requested changes are commented below. We have incorporated all of the reviewer's comments related to spelling and readability of the text, and revised the manuscript's language carefully throughout, including a tightening-up to shorten some sections. The following point by point response does not contain comments relating to readability if they are incorporated in the manuscript as suggested. Statements in *italics* indicate our responses to the comments.

Referee 3 The authors present two models for parameterizing burned area in Africa in

a manner suitable for dynamic vegetation and other global models. The subject matter is appropriate for Biogeosciences and will be of interest to readers. While I have no major issues with the modelling aspect of the paper (but see minor issues below), I believe there are potentially several significant problems regarding the manner in which the authors used the MODIS MCD45A1 burned area product. Details are provided below. *We hope that we clarified the misunderstanding by explaining the procedure to calculate the burned area fraction in more detail on page 5, lines 28 to 32.*

Page 4390, line 16 - "All pixels classified as 1 'unsuitable' in the MODIS product were discarded." Please clarify how such pixels were identified in the MCD45A1 monthly product. Based on my experience using the product and consulting the Collection 5 MODIS Burned Area Product User's Guide, I can find no such classification. Are you determining this from the QA layer? If so, a value of 1 does not mean "unsuitable". *We considered all pixel flagged as 'not enough data to perform the inversion throughout the period' according to a value of 10000 in the "Burndate" array field as unsuitable. Since this might also be unclear for other users, we extended the sentence. P5L28*

Page 4390, line 21 - "We calculated an annual 'burn ratio'... by calculating the ratio between the number of pixels classified as 'burned' over the 12-month period and the total number of valid pixels within the same grid cell." Please clarify what you mean by valid pixels. *All pixels that were not flagged with a 10000 value, see above.*

Page 4390, line 24 - "We thereby assumed indirectly that the pixels that were not classified in the MODIS product experience the same fire frequency as the classified pixel." Surely this assumption must break down during the wet season. In west Africa the majority of 500-m pixels in MCD45A1 product are unclassified during the wet season due to persistent cloud cover. Based on your assumption this suggests that you will be incorrectly boosting the annual area burned in each grid cell by a factor of roughly 1 + 3/12 = 1.25 (assuming a three month wet season). Please clarify. *You are right that we probably overestimate the burned area, however we think the effect is smaller than expected according to your calculation, since we only account for a burn event once*

a year. All pixels that ever burned during the year are considered valid. On the other hand, many fires especially, in western Africa are not detected by the MODIS product due to persistent cloud cover during the burn time and due to the very fast re-growth of the vegetation. Because the study by Roy et al (2008) also concludes that the product underestimates the real burned area and that the R2 value for correlation of the product with the 'evaluation data' is estimated to be 0.75, with a slope of 0.75 we consider this still a valid approach within the accuracy of the original product. This underestimation of ca. 25 We added a sentence pointing the reader to this fact however. P6L5-10

Page 4393, line 19 - Which TRMM precipitation data set was this (e.g., 3B43)? *Yes it is 3B43, we added this information.P8L28*

Pages 4405-4406 - The decreasing trend in area burned you found for Africa is very interesting. As the total precipitation did not change, you attribute this result to the GCM assuming the spatial distribution of something changing. Are you referring to the spatial distribution of precipitation? I'm curious as to how much responsibility the monotonically increasing population projections have for the decreasing burned area trend, if any. This is especially so for the northern hemisphere, where you show the population tripling by 2060. *The main driver of the changes are precipitation change and population increase. Please see the added text in the results and Discussion sections, as well as the added figures 11 and 12.*

Page 4406, line 20 - Re. the apparent shrinking of the climatic range susceptible to fires, it would probably be good to illustrate this over the continent with a map as in Figure 4 showing, e.g., the change in burned area from 1980 to 2060. *We included such a map and discussed it.*

Interactive comment on Biogeosciences Discuss., 7, 4385, 2010.