

## ***Interactive comment on “Global impact of contemporary smoke aerosols from landscape fires on climate and the Hadley circulation” by M. G. Tosca et al.***

**Anonymous Referee #1**

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### GENERAL COMMENTS

The manuscript presents a model-based evidence that biomass burning (BB) aerosol emissions are among important factors that determine patterns of climate variables (such as precipitation, air temperature, and radiative fluxes) and are related to general atmospheric circulation, especially in the tropics. The study is timely in light of increasing knowledge about biomass burning, and the efforts to understand the effects of different ecosystem components on climate and the effects of changing climate on Earth components. Earth system models are necessary tools for investigating these effects.

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The paper is fairly well organized and written and the presented evidence is reasonable. I recommend it for publication in ACP with some changes.

### SPECIFIC COMMENTS

As far as I understand, the objective of the study is to demonstrate the effect of BB aerosol emissions on the strength of Hadley cell and climate-related variables. Including the word “contemporary” in the title of the paper left me waiting for some time to see some comparison with the “historic” BB emissions or such a discussion. I now realize that you are indeed looking at contemporary (last 13 years or so) BB aerosol, but such specifics in the title brings confusion. I suggest removing the word “contemporary” from the title or rephrasing

Page 28071 line 25 (from now on notation is as follows: 28071\_25) You use Tg everywhere else in the manuscript. Converting Pg to Tg will read better. Also, how big is this number, 0.6 Pg C yr<sup>-1</sup>? Is this a small fraction of all BB emissions, comparable to boreal BB emissions, to other burning in the tropics? The number is used here to demonstrate some point, so to impress the reader with it, need to put it in context.

28072\_10 list of references here should be either (e.g., Hansen...) or expanded to include more publications. Two articles poorly demonstrate decades of work on a subject. Consider Penner et al. 1992 which you reference later, Chylek&Wong-GRL-1995, Kaufman&Fraser&Mahoney-JClim-1991 etc ...

28076\_14 A&M emission factors are updated annually? If so, where can these updates be accessed?

28076\_7-24 This paragraph describes methodology and datasets for emissions adjustment, but also mentions datasets used to validate the model output. Split these into separate paragraphs

28077\_5 How high is your lowermost model layer? Does your model end up with the BB aerosol well-mixed within the BL with this injection at the surface? Would it

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matter for the result if you distributed injection within the height of the PBL? Have you checked?

28077\_19-29 Why no Boreal North American region in Figures 1 & 2? If no AERONET there, say so, but still include the box in Fig. 1 so that we can relate when you further mention this region in your analysis.

28078\_27-28 How do you account for large-scale transport and deposition differences between the model and obs. in this analysis?

28079\_26 Why 52 years? Could the same analysis be done with only one cycle through the GFEDv3 dataset?

28079\_26 What do you mean by “ensemble” here?

28080\_1 The use of phrase “increase in fire aerosol emissions” echoed with the confusion discussed in my comment to the “current” in the title. I assume you mean either “...presence of BB aerosol emissions in the FIRE case...” or “...increase in aerosol loading/emissions in the FIRE compared to NOFIRE case...”

28082\_18 comment similar to the one above. Replace “... increased fire aerosol loading...” with “... increased aerosol loading...” or “... Presence of fire aerosol...”

28085\_1-4 Are these numbers ( $5 \times 10^8$  kg/s-1, 9%) based on an additional model run that you performed but have not presented here? Or how did you arrive at them?

28085\_19-20 regarding the “10%” see previous comment

Table 4. Why are stats only for two (SA and SAF) regions presented in the table out of four regions you introduced before (also Eq. Asia and Bor. NA)? Is there a reason to not include these in the table?

Figures 4-6. What is the time period for data averaging? Are these differences of averages over entire 52-yr run?

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TECHNICAL CORRECTIONS 28071\_20 “..between climate and fireS..”

28072\_16-17 Put the sentence in present tense (...we investigate..., ... model that includes...) for consistency, and it reads better when you talk about current research presented in the paper in present tense and save past tense for previous relevant studies.

28085\_13 seems to be missing a word between “tribute a...” and “...between 0.3-1.0”

Figure 7b and Figure 8b Replace “wFIRE” with “FIRE”

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 28069, 2012.

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