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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Assessment of fire emissions inventories during the South American Biomass Burning Analysis (SAMBBA) experiment" *by* G. Pereira et al.

Anonymous Referee #2

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The study by Pereira compares CO emissions from four different biomass burning emission inventories (spatially and temporally) over South America during the SAMBBA field campaign. The study also makes an attempt to evaluate these emissions in two chemistry transport models against MODIS AOT. The concept of the study is well within the scope of ACP and will be very useful to users of these emissions, particularly atmospheric chemistry and aerosol modellers. The results of the study are generally well described and summarised. However, I think there can be some improvements made in the layout of the manuscript (text, figures and tables) and the clarity of the text. I recommend publication in ACP once the following general and specific comments have been addressed.

General comments

1. To compare the emission inventories, the authors rely on the use of correlation between the different datasets. Correlation is a useful metric, but the authors need to be clearer in the manuscript what type of correlation they have calculated or between what data points i.e. state whether the correlation is temporal or spatial. This needs to be improved both in the text (abstract, Sect. 3, conclusions. . .) and in the captions for Table 2 and Figure 4. Also, it would be useful if the correlation values were accompanied with an estimate of bias (absolute or percentage etc.) so that the reader can judge how the magnitudes of the emissions compare quantitatively.

2. I believe the most important and useful part of the manuscript is the evaluation of the emissions against observations. This section has the potential to inform the reader of the most appropriate emission inventory to use for this region/time period. However, this section falls slightly short. Firstly, the description of the models and the emissions they use is too brief. What is the spatial resolution of the models? Are the fire emissions scaled at all? What version of GFAS is used in MACC? Are the emissions injected all at the surface in the models? Secondly, no statistics are computed to compare the model and observations. It would be useful to have correlation and/or bias values calculated to quantify the agreement (as for the comparison of emission inventories). It would also be useful to see the difference between model and observations mapped as in Fig 5. Finally, what is the reason for the underestimation of AOT in Grid 5? Would 3BEM-FRP emissions perform better here?

3. The results and discussion section should be broken down into sub-sections to improve readability of the text. I suggest separate sections on: i) comparing emission inventories spatially; ii) comparing emissions temporally; iii) evaluating the emissions against observations. The figures and tables should be re-arranged accordingly. Also, make sure it is clear which values in the text are shown in which figure/table, this is not always the case (see specific comments below).

4. There are several typos, grammar mistakes, naming inconsistencies and missing words in the text that at times distracted me from the science content of the paper. There were too many errors to point out individually in the specific comments below so the authors should thoroughly proofread the revised manuscript and make the necessary corrections prior to re-submission.

Specific comments

1. Abstract, L26-33: Please state clearly what the under/overestimations of the emissions are relative to i.e. to the other inventories NOT observations. Also, there is no mention of the results of the comparison to observed AOT.

2. Introduction (or Sect. 2.1): The positives, negatives and key uncertainties in the biomass burning emission estimation methods should be discussed and compared either in the introduction or later in Sect. 2.1 (some points for burnt area given i.e. not near real time, but more could be added). Also, I'm also surprised that GFED emissions are not mentioned in the text, since these emissions are widely used in models.

3. Sect. 2.1.1: How is cloud cover dealt with in the 3BEM and 3BEM-FRP inventories? Are any corrections made for missed detections due to cloud (or smoke) cover? Apologies if I missed this information.

4. Sect. 3, P7, L19-24: Can you suggest any reasons for the large differences between emissions in grid 5? In particular, why are FINN emissions so low relative to the other emissions? There must be active fire detections here for the FRP-based inventories to predict emissions? Could the assumed fire size be too small in FINN? (Although this seems unlikely if fires in this region are mainly agricultural).

5. Sect. 3, P7, L25...: Is this the correlation between the spatial patterns of the emissions (see general comment 1)? Please clarify in the text.

6. Sect. 3, P8, L1...: It's confusing to start referring to the emission inventories as models here. I suggest sticking to "emission inventory" so as not to confuse it with

the term "models" used when discussing chemistry transport models in the final few paragraphs of this section.

7. Sect. 3, P8, L1 onwards: (As for general comment 1) what are these correlations calculated between? Is it the spatial correlation being discussed? What figure table do these correlation values link to?

8. Sect 3., P8, L2: From Table 3 it looks like total CO emissions from FINN are lower than 3BEM in 4 out of 8 grids, so this statement doesn't seem to follow. Which figure/table are you referring to here? Please clarify. (Cannot tell from Fig 4 because there are no values on the axes).

9. Sect. 3, P8, L11: Table 3 shows total CO emissions from GFAS are lower than 3BEM in grid 2. Do you mean grid 8?

10. Sect., P9, L18-19: How is this agreement "good", please quantify or explain. Some peaks in CO emission and AOT look anti-correlated on a few of the days. In what way would you expect CO emissions to agree with retrieved AOT?

11. Conclusions, P11, L4: "...where 3BEM_FRP and GFAS deliver a better accuracy". How do you show that 3BEM_FRP and GFAS emissions deliver a better accuracy? Is this surmised from the comparison between MACC+GFAS and MODIS AOT?

12. Conclusions: Perhaps I have misunderstood something but the final two sentences do not seem to follow on from the previous sentence.

13. Figure 4: This figure is difficult to interpret and needs a clearer/more detailed caption. What does each data point represent? What do the grey bars represent? Axes labels and values would aid interpretation.

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