Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2015-967-RC3, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of particulate emissions from tropical biomass burning using a global aerosol model and long-term surface observations" *by* C. L. Reddington et al.

Anonymous Referee #3

Received and published: 4 March 2016

This manuscript evaluates global aerosol model simulations that have been performed with the GLOMAP model and three widely used fire emission inventories, namely GFED3, GFAS1 and FINN1. The simulations are validated thoroughly and in considerable detail with AOD and PM2.5 measurements performed in the tropics, i.e. South America, Africa and SE Asia. The study addresses the most pertinent issues recently discussed in the field of smoke aerosol modelling, i.e. the omission of small fires in burnt-area-based inventories and the need to scale up the pyrogenic aerosol flux for use in global atmospheric models. The statistical analysis is based on monthly mean values. The study is therefore very well suited as a guide on how to best select one of the fire emission inventories for use with GLOMAP, and on how accurate the simulated

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smoke AOD and PM2.5 may be. Considering the wide use of GLOMAP and of the investigated emission inventories, the study presents relevant results that are worth publication in ACP.

The study is well written and clearly presented. It adds quantitative detail to the already existing characterization of the fire emission inventories. However, this quantitative detail appears to be linked to using the GLOMAP model, and it cannot necessarily be transferred to use in other atmospheric aerosol models. The authors missed several opportunities to obtain more generally applicable new results. In particular:

- Correlations are calculated from monthly averages like so many studies have done in the past. Since emission, model and observation data are available with daily resolution, investigating this time scale would have been easily possible and and much more novel.
- The study shows that PM2.5 and AOD require different upscaling of emissions. It would have been most interesting and new to study possible reasons for this. I suspect, it points to model shortcomings, but in which part of the model?
- Likewise, it would have been of general interest to see whether any of the model configuration parameters have an impact on the amount of upscaling required for any given inventory.

I am aware that addressing one of these issues in the final manuscript will imply a major effort, which may not be justified at this stage. However, if the authors would be willing to do it, this would certainly make the results applicable for a much larger community, i.e. also those who use other models than GLOMAP or its results.

Since the manuscript is very well written, I have only very few minor comments:

SPECIFIC COMMENTS

p.11, l.1 and p.12, l.13: delete “yearly varying”

p.11, l.28: You may cite Seiler Crutzen 1980 for this formula.

p.14, l.16: Please add the definition of NMBF when first using it for the convenience of the general reader.

p.20, l.17-17: Here you first discuss the influence of the model resolution on the representativity of the station observations. This is not linked to the next sentence, which raises the question the resolution's influence on the need for scaling. This is an example for my second point made above.

Figure 9: It would help to print the scaling factor also in the graphics and you may consider merging this with Figure 3 to make the comparisons easier for the reader.

REFERENCES

W. Seiler, P. J. Crutzen. Estimates of gross and net fluxes of carbon between the biosphere and the atmosphere from biomass burning. Climatic Change, 2(3):207–247, 1980.

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