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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sensitivity of tropospheric loads and lifetimes of short lived pollutants to fire emissions" *by* N. Daskalakis et al.

Anonymous Referee #1

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General comments.

The authors perform sensitivity studies using 3 biomass burning emission inventories, and a study on the height distribution of these emissions. The results are reasonably well presented and discussed. However, I am missing an in-depth discussion on the model dependency of the results (what did other studies find?), and how that together with the uncertainty in inventories would translate in overall uncertainties. The authors should think about their scoping: what they want to evaluate and why? Biomass burning versus fossil fuel? Human controlled versus wildfires? What would the consequence of this work for more impact related work; e.g. climate modeling as was performed in ACCMIP. What are the lesson to be learned?

While surface measurements are explored, I wonder why no similar attempt has been made to compare to satellite observations (CO, aerosol, perhaps O3), which could at least give information on spatial extents of biomass burning plumes. Finally, I thought the isoprene-biomass burning relation is interesting and could be explored a bit deeper. I give some suggestion in the detailed comments.

Despite my criticism, I think this work deserves to be published in ACP as a welcome addition to the literature.

Detailed comments

22640 l 10 to be able to introduce=>to lead to

22640 l 12 lifetimes, I think one could also express this a load- or is there a specific reason why in l. 10 loads and l. 12 lifetimes are discussed?

22640 l 13 it would be interesting to evaluate and discuss which component are specifically responsible for 'transferring' the changes in oxidant concentrations from biomass burning regions to the much larger regions that have isoprene emissions.

22640 l 19 this is an interesting finding, which was probably present in all models, but not as such analysed. What would be the enhanced factor of biomass burning aerosol emissions, but inducing larger isoprene-aerosol yields? Could you define a feedback factor (see below).

22640 l 4-l 6 the sentence on function of biomass burning is overcomplete when referring to atmospheric chemistry, and not very comprehensive when discussing overall issue.

22641 l 24 biomass burning 'emissions'?

22642 l 29. Probably refer to some newer references, as source of both anthropogenic and biomass burning emissions have been changing a lot in the last 25 years, and the views have been changing from CH4 only chemistry to more comprehensive VOCs.

22643 l 9-13 check grammar.

22643 l 14 Pacic Northwest USA?

22643 l. 22 compared to a standard inventory?

22643 l. 27 can help in reducing uncertainties?

22644 meteo data: any particular year or years was considered?

22644 Describe the vertical resolution of the model in the boundary layer, as important for the experiments.

22645 l. 11 this sentence reminds that it is not entirely clear what is actually evaluated, and why? If the purpose is to evaluate only naturally occurring fires, the authors may run in problems, because there is a human influence in many types of fires. The double counting issue is tricky- as there are many small scale waste burning activities that may not be picked up by burnt areas from satellite, while in that same region also large scale burning could be detected. Finally, the AWB sector is arguably one of the most uncertain ones. Some uncertainly analysis is warranted: how do the assumptions on correcting for AWB affect the final answer.

l. 22646 l.2 Describe where the ACCMIP biomass burning emissions are coming from. If I remember well it was GFED2 for the year 2000. Do all emission datasets refer to the same year or years?

22646 l. 7 what assumptions are made in the Dentener 2006 paper? I am wondering if no 'newer' studies are available.

22646 l. 12 What can lead to different seasonality across components?

22646 l. 16 In line with earlier remarks; why removed AWB from one inventory and not from others?

22647 l. 20 What is the criterion to qualify as 'characteristic': more specific.

22648 l 15 . . . Tsigaridis. What was the outcome of this discussion, and to what extent contradicting or confirming discussion here. What is the difference of that paper and this one?

22649 The conclusion is that the sparse observation of CO and Particulate do not constrain the inventories. This is perhaps not a really novel conclusion.

22650 l 1 There must be more studies on biomass burning source contributions. I recall the work of Marufu et al, there must be more. An adequate literature survey is relevant in view of evaluating the models sensitivity to biomass burning emissions in general and the effect of using different inventory assumptions. The two together can give some uncertainty range.

22650 l 26 result in or lead to.

22651 section 4.2.3 is an important section, which could be explored somewhat better, since it is perhaps the most novel analysis of this paper. Specifically I would suggest to analyse what is know in the literature (measurements) about co-occurance of biomass burning and isoprene emissions- the role of grid resolution. Is it possible to analyse a feedback factor (i.e. with and without the feedback process included).

22651 As I understand it, aerosol yields from isoprene are still quite uncertain. Can the authors discuss an uncertainty range- and how this sensitive to biomass burning emissions. Where are the regions where these isoprene aerosols are becoming relevant (there will be a lot of direct biomass burning aerosol).

Tables 22662 There are a couple of combinations of inventories/components standing out as 'unusual'. E.g. FINN BC/OC 5 to 8 lower than others, GFED-ECLIPSE NMVOC. It would be good to repeat discuss the reasons for such different estimates, as they will determine much of the answer.

22663 see discussion before. I do not understand why NMVOC fraction attributed is so much higher than for other components? A bug?

22664 Table would read easier when just having two columns for varying and surface.

22669/70 Figure 3 and 4 Obviously these are a snap shot of available CO and O3 measurements. How was the selection made?

22672 The color scheme of the figures is not very helpful.

22673 The numbers below colorbar are not sufficiently describing the scale. Only one plot would be sufficient- they are almost the same.

22674 Figure 8 In the main text should be some summary of what are the current insights in the ageing of OC and BC; the changes in lifetime displayed here are of course a function of these assumption- which are too my knowledge rather uncertain. Is lifetime applying to the column/burden?

22675 how is lifetime defined in Figure 9/10; tropospheric column?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 22639, 2014.