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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tropospheric ozone radiative forcing uncertainty due to pre-industrial fire and biogenic emissions" *by* Matthew J. Rowlinson et al.

Anonymous Referee #2

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GENERAL POINTS

This is an interesting study – and makes an important point: pre-industrial emissions from fires and biogenic sources are a major source of uncertainty for ozone radiative forcing. As explained below, it could benefit from some clarifications. In particular, why are these new estimates of PI emissions better than those used by CMIP6? Some details of the modelling need to be clarified – I was baffled by the discussion of CH4 emissions for simulations where I thought CH4 concentrations were prescribed. If the points below can be cleared up, then I am happy to recommend this paper should be accepted for publication in ACP.

Printer-friendly version

Discussion paper

SPECIFIC POINTS

L25 of up to -> by up to

L56 “human impact on. . . anthropogenic emissions. . .” Reword. I think we can be fairly sure there is a human impact on anthropogenic emissions. . .

L99 State thickness (metres or hPa) of the lowest model level.

L119 Do the prescribed surface CH4 concentrations have spatial variation, or just a constant value everywhere? Given later comments about CH4 emissions, please clarify further how CH4 is handled by the model.

L146 “Total PI fire emissions. . . SIMFIRE-BLAZE. . . are 28% larger than. . . PI CMIP6”. It would be instructive to know PD fire emissions predicted by the SIMFIRE-BLAZE model. Can the model reproduce the present-day GFED distribution, or something similar? It may be that the higher PI values indicate a bias in this model towards higher values. It is hard to know how to verify or evaluate the PI fire emissions without some measure of the model’s abilities – and presumably evaluation for present-day is the best evaluation possible. If this is not the case, then at least some discussion of how much faith we should have in these PI values is required.

L155 Similarly for the LPJ-LMfire model.

Perhaps the key question here is whether the fire models used here are better than the fire models used in the CMIP6 base case. Are they clearly better, or are they just different? My non-expert reading of this is that they are just different. Please do try to convince me they are better.

Figure 1, and all the figures, are of a poor resolution. I can just about make out the necessary details, but these need to be improved for the final version.

In Figure 1c, the PD CMIP6 CH4 emissions from fire total 566.6 Tg. This sounds suspiciously high – isn’t that more like the value for the total PD CH4 emission flux?

L192 delete PI

L193 “The main driver of this increase [in fire emissions] is industrial emissions. . .” This must be wrong?

L210 I don’t understand why CH4 emissions are presented and discussed; surely if CH4 concentrations are prescribed, the CH4 emissions are irrelevant and redundant? Am I missing something?

L214 their size -> the magnitude

L218 So presumably the emission factors for different VOCs vary between the models? Please clarify.

Figure 2: are the maps emissions per 2.8 degree x 2.8 degree grid box?

Figure 3: Why show CH4 emissions?

L259 . . .when there parameters at. . . -> when these parameters are

L261 resulting -> results

Figure 4: Are the CO, NOx and VOC emissions really combined fire + biogenic + anthropogenic? Wouldn’t it be clearer to just show how the fire emissions change, separately from other categories?

L285-290 The discussion of OH trends and NH/SH ratios is interesting, but seems a bit tangential? I suggest better integrate or remove.

L327 “The decrease in OH is the most likely reason for the simulated increase in CO and O3.” This is a bit over-simplistic. BVOCs have increased. This will generate more CO and consume OH, as those extra VOCs are oxidised. Depending on the co-location of the VOCs, CO and NOx, this could either increase or decrease O3 – in this case it increases O3, indicating that the VOC and CO increases must be in areas with sufficient NOx to produce O3 (BVOC emissions in very low NOx regions can, at least

locally, decrease O3).

L340 “ice core observations” – I think these are oxygen isotope measurements from ice cores.

L344-345 0.4 +/- 0.2: the range here is a 5-95% confidence interval; 0.41 +/- 0.12: the range here is +/-1 standard deviation (i.e. encompassing 68% of the data). So these two are essentially the same, just using different range definitions. Please clarify this.

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