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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 #1

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In this study, the authors use a chemistry transport and different inventories of preindustrial fire and biogenic emissions to argue that the uncertainty range of ozone radiative forcing has been overestimated in past multi-model studies and assessments. The paper is the ozone counterpart to Hamilton et al. (2018), which made a similar point about biomass-burning aerosols.

The paper is very well written and structured in a straightforward way. The changes in simulated tropospheric ozone are well understood from differences in precursor emissions, so the question is whether the alternative sets of preindustrial emissions are a good guide to the overall uncertainty. This is where my concerns are, as detailed be-

low. Addressing my comments may involve new simulations, so may represent major revisions.

1 Main comments

- My main concern with the study is that the PD/PI pairs used to estimate radiative forcing are not consistent. There is only one PD simulation, using the CMIP6 inventory. But shouldn't the SIMFIRE-BLAZE PI simulation be coupled with a SIMFIRE-BLAZE PD simulation? Shouldn't the LMfire PI simulation be coupled with an LMfire PD simulation? If the PD simulations differ from CMIP6 in the same way as the PI simulations, then the impact on radiative forcing would be small. I acknowledge that fire models (including those used to provide the CMIP6 inventory) are typically overfitted to present-day observations, so their PD simulations should share common patterns, but at least the PD and PI distributions would always be consistent in terms of the internal physics of the fire emissions.
- In a related concern, I note that section 2.6 implies that CCMI is a reasonable biogenic emission inventory for present-day because it compares well to flux measurements and other models. Then LPJ-GUESS is said to be similar to CCMI for present-day, implying it is also a reasonable inventory. Those are weak arguments, but there is at least an attempt at looking at performance of inventories. In contrast, section 2.4 on fire emission inventories does not discuss present-day performance. This is a problem because if SIMFIRE-BLAZE and/or LPJ-LMfire happen to be biased in an era where they can be constrained by observations, then the authors overstate the case for preindustrial emission uncertainty.

2 Other comments

- Line 158: “within the quantifiable uncertainty of fire emissions (Lee et al., 2013)”. What do the authors mean here? For present-day or preindustrial? And is Lee et al. the correct reference? That paper does not mention LMFire at all.
- Figure 1a: LMfire has large CO emissions between 25 and 50S. What is burning there? Australia? Argentina?
- Figures 2a,b,c: What are those black lines in South America and Africa? In the difference maps, they seem to correspond to a brutal change in emissions, with differences between datasets switching sign suddenly.

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