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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effective Radiative forcing from emissions of reactive gases and aerosols – a multimodel comparison" *by* Gillian D. Thornhill et al.

Anonymous Referee #1

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This paper examines the effective radiative forcing (ERF) of reactive gases (e.g., CH4, NOx, VOC, O3, N2O, HC, NH3) and aerosols (e.g., BC, OC, SO2) to the climate system using multi-model output from the AerChemMIP experiments of the CMIP6 project. The contribution of each species to the total ERF is decomposed, and the differences of the calculated ERFs by various models are discussed. The paper is overall well written and easy to follow. I have some minor comments for the authors to consider before publication:

1. It is not clear how many ensemble members are used for each model. Can you please clarify this?

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Discussion paper

2. Fixed SST and sea ice are used in the ERF simulations. Is it the climatological SST of the 1850s?

3. The description of Eq. 5 is a bit vague. You may want to add “ERFaci” to line 240 after “The effect of the aerosol on cloud radiative forcing”.

4. “A_trop” is used in text while “RA Trop” is used in Fig. 1. It’s better to be consistent.

5. Line 373, “Fig. 6”→ “Fig. 5”. And can you explain a bit more about how the total AOD is used to calculate the sum of the scaled ERFs?

6. Table 6, second row, “Nox”→ “NOx”

7. Line 465, please remove the brackets around “O’Connorl F. M. 2019”

8. Error bars are used in Fig. 9-10 to quantify the uncertainties due to interannual variability of model diagnostics. Is it possible to apply similar approach (error bars) to other figures where data are available?

9. Line 507, “RFs”→ “ERFs”

10. Line 525, “+/-“→ “$\pm$”, please also add explanation about the numbers follow the sign, for instance, is it a standard deviation of multi-model output?

11. Lines 541-542, the overall aerosol ERFari from AR5 (-1.5 $\sim$ 0.4 Wm-2) is much larger than values reported here (-0.16 $\sim$ 0.03 Wm-2). Can you add some discussion about the differences?

12. Lines 546-550, redundant

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