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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemical and climatic drivers of radiative forcing due to changes in stratospheric and tropospheric ozone over the 21st century" *by* Antara Banerjee et al.

Anonymous Referee #2

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General comments:

I find the paper by Banerjee et al. original, clear and very well-written, and it fits well into the scope of ACP. The paper builds on previous work in Banerjee et al. (2016), but takes it one step further by quantifying radiative forcing. Although the results are based only on a single model, the paper is original in the sense that detailed chemistry is included both for the troposphere and stratosphere, and the fact that several chemical/climatic drivers are studied. I recommend acceptance of the paper, but I also have some comments/concerns that need to be addressed first. Please see specific comments below.

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Discussion paper

Specific comments:

Page 1, line 15: Since RCP8.5 is considered rather extreme, it would be interesting, if possible, to have an estimate for O3 RF due to methane also for the RCP4.5 scenario. Do you expect the results from the methane perturbation experiment for RCP8.5 to be relatively linear, so that you can approximate the O3 RF due to RCP4.5 methane by scaling down the results from that experiment?

Page 2, line 29: For comparison, it would be useful to mention the forcing in 2000 from Stevenson et al.

Page 3, line 10-12: It is mentioned that there are previous studies on either tropospheric or stratospheric ozone RF. I would like to see some comparison in the Results section on how the results of those studies compare to the results obtained in this paper.

Page 4, line 12: Is 10 years spin-up enough for the ODS simulation, considering that the ODSs are only perturbed at the surface?

Page 5, line 3-5: I assume the tropopause height is higher in the climate perturbation experiments (especially in the RCP8.5). Perhaps I misunderstand something, but if the tropopause height is the same in all RF calculations, wouldn't that lead to a wrong split between tropospheric and stratospheric contribution to O3 RF?

Page 5, line 29: Figure 1 is not really discussed before page 9, after the discussion of Figs. 2 and 3. I suggest to change the order of the figures to reflect the order in which they are discussed.

Page 6, line 7: Not all cases show ozone RFs <0.1 W m-2. The methane case is $\sim$0.2 W m-2.

Figure 3 caption: "d.p." - I assume this means "decimal points". Is that a common abbreviation?

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Page 9, line 6-7: Could the ozone reduction in the tropical lower stratosphere be related to a higher tropopause in RCP8.5?

Page 9, line 17: On page 2, line 28 it states that Stevenson et al. got a value of -0.03 +/-0.04 W m-2 due to climate change up to 2100 under RCP8.5. Any idea why the value calculated here is so much higher (0.08 W m-2) and well outside their uncertainty range?

Page 10, line 1: Since the tropopause definition is the same in all RF calculations, wouldn't the tropospheric and stratospheric contributions be incomparable between the RCP8.5 and RCP4.5 experiments (see also earlier comment)?

Page 11, line 3: Table 2 says 0.02 and not 0.03 W m-2 DU-1.

Page 13, line 26-27: The O3 RF from the CH4 experiment is greater in JJA both in the southern and northern hemisphere. In the southern hemisphere, I would expect the photochemical ozone production to be lower during JJA than DJF?

Page 15, line 9-12: On page 6, line 8, RF values for WMGHG are 3 and 6 W m-2 for RCP4.5 and RCP8.5, respectively, and with a reference to Myhre et al. (2013). Here it is given as 2 and 6 W m-2 with a reference to van Vuuren et al. (2011). Would be good to be consistent.

Page 15, line 16-17: Is it possible to say something about how important future N2O changes may be for O3 RF, based on, if available, any estimates/indications in the literature? Would be good, if possible, to discuss the importance of this effect relative to the effects explored in the paper.

Technical corrections:

Page 1, line 12: "Wm-2" should be "W m-2". Please correct throughout the manuscript.

Figure 1 caption: Degree signs are missing from e.g., "90S-90N". Also, I cannot see that "SH" and "NH" have been defined.

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Page 10, line 25: Please fix parenthesis for the reference.

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