

Interactive comment on “Simulated 2050 aviation radiative forcing” by C.-C. Chen and A. Gettelman

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Dear Reviewer,

We appreciate the suggestions and comments you made on our manuscript. We have modified our manuscript accordingly. Here are the response to your comments.

Major comments:

1. We have added comments in the summary section to address the uncertainties resulting from our treatment of contrails as part of the background clouds. We note that this issue has been discussed in the development of this modeling framework in earlier work (Chen et al., 2012, Chen and Gettelman, 2013 and Gettelman and Chen, 2013.) These are referenced in the text. The major advantage is a self-consistent treatment of contrail water, number concentration and

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aerosols in the model hydrologic cycle.

2. We have revised the manuscript to emphasize that the assumption made on the role aviation BC plays can significantly change the results to remind readers that the uncertainties in this regard are high and it is still an active area of research.
3. We have added comments on the sensitivities of the assumed particle size of aviation sulfate aerosols, especially with the higher emissions in 2050.

Minor comments:

1. We have eliminated the original Fig. 6. We have also modified the new Figs.6, 8, 9, 10 to only include perturbation of statistically significance.
2. We have added comments to explain why we ran CAM with specified dynamics instead of the free running mode.
3. We have modified the manuscript accordingly.
4. We have cited the work by Barrett et al. 2010.
5. We have added in the conclusion section on the forcing of aviation CO₂ by extrapolating from the 2005 level.
6. We have cited work on the the future aviation emission scenarios in the manuscript (IPCC, 1999, Gierens et al., 1999, Marquart et al., 2003.)
7. We have revised the manuscript as “Sulfate aerosols are emitted to Aitken mode, and is aged into the accumulation mode through coagulation and condensation. Within each mode aerosols are internally mixed and the optical properties reflect this.”
8. We have added explanation on why RCP8.5 and 4.5 were selected for the study.

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9. It is stated in the manuscript “Future emissions from non-aviation sources and greenhouse gas concentration are based on RCPs for the respective year of the aviation emissions for CAM5-SD simulations.” So yes: the different meteorology is taken from simulations with different emissions scenarios.
10. We have added comments to address what is causing the increase of IWP. Indeed, it is mostly due to aviation BC since SC2 shows very similar increase in IWP as in SC1 in which sulfate emission is eliminated.
11. We have acknowledged this and revised the manuscript accordingly.

Regards,

Chih-Chieh Chen and Andrew Gettelman

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