Interactive comment on "Aviation 2006 NO_x-induced effects on atmospheric ozone and HO_x in Community Earth System Model (CESM)" *by* A. Khodayari et al.

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Response to referee #1:

The authors have addressed most of the comments from my previous review. It would have been nice to have more quantitative insight into the link between aerosol representation and the response to aviation NOx, but I appreciate that this would require a large amount of extra work. Perhaps it could be mentioned in the conclusions that this could be the subject of future work. I think the manuscript is ready to be published, following a few very minor revisions suggested below.

We thank the reviewer for the comments.

We agree that a more quantitative analyses of the linkage between aerosol representation and the response to aviation NOx could be a subject of future study and this is stated in the last sentence of the conclusion section:

"More detailed analyses are required to explore the impact of the differences in the representation of the background atmosphere and treatment of aerosols processes on aviation NOx-induced effects to a greater extent."

- Paragraph starting "Cloud microphysical processes" in Sect. 2 is enormous, and should be split.

Done.

- In the last paragraph of Sect.2, it is mentioned that "clouds may also contribute to some degree". Could you please briefly mention in the text what might be the difference in clouds between the two models that has implications for the aviation NOx effects? Since this aspect is not explored at all, it would be good to at least give an idea to the reader regarding the Direction of the potential effect (as for the aerosols).

The following sentence was added to elaborate on this:

"It is noted that the differences in clouds caused by the differences in aerosol-cloud microphysical interactions between the two models may also contribute to differences in the chemistry of aviation NOx-induced effects to some degree as it affects the radiation budget and therefore, the photolysis."

- There is still no mention in the text on how photolysis is treated.

The sentence at page 5 line 19 was modified to the following sentence to mention the treatment of photolysis in both models:

"Both models use the same photolysis scheme as described in Lamarque et al., 2012 and …"

- In Fig. 2, it should be explained in the caption what the underscores mean in the legend.

Done. The following sentence was added to the caption of Figure 2.

*"*_p and *_c refer to the perturbed and control simulations, respectively."*

Response to the editor comments:

I would also like to mention the comments by David Stevenson, and my own related comments on the first draft ACPD paper. The revisions made in response to Dr. Stevenson's comments were very short, whereas I thought that a broader discussion of your estimated short-term O3 forcing with respect to other studies would be valuable, as well as putting that short-term O3 forcing into context relative to the magnitude of other forcings from other papers. For example, based on other studies, do we expect that the short-term O3 forcing that you estimate is a major or minor component of the overall forcing from aircraft?

We thank the editor for the comments.

The following sentence was added to the first paragraph of Section 4.5 to elaborate on the short-term O_3 response with respect to other aviation induced effects:

"The short-term O_3 forcing is one of the major contributors to the overall aviation forcing and dominates the net O_3 forcing (Lee et al., 2009; Holmes et al., 2011)."

Secondly, I thought that the explanation for why the two versions of CAM4 vs CAM5 differ was not very strong, and a short summary explanation would merit inclusion in the abstract or conclusions sections.

The differences between the two models were discussed in the abstract and in the model description section, but not directly in the conclusion section. As such the following sentences were added to the first paragraph of the conclusion section to elaborate on the reason for the differences between the two models:

"Aviation NOx-induced effects on ozone and the oxidative capacity were evaluated using two different atmospheric components of CESM, namely CAM4 and CAM5. This study is the first evaluation of aviation NOx effects in CAM5 which simulates the size distribution of aerosols, both internal and external mixing of aerosols, chemical and optical properties of aerosols. The differences between the aviation NOx-induced effects presented here are mainly caused by the different treatments of aerosols between the two models."