Authors Response

Dear Reviewer,

we would like to thank you very much for your additional comments. Our answers are given in *blue and italic* below each comment.

Yours sincerely,

Johannes Pletzer

Review of "The Climate Impact of Hypersonic Transport"
by Pletzer et al.

authors have presentd a comprehensive study about the climatic impacts of air pollution from hypersonic aircrafts. Authors have covereddetailed explanation about the two set of emissions, two numerical models and the climatic impact. The reviewer 1 made very specifc and accurate observations and I agree that this manuscript may needs minor modification.

Thank you very much for your positive feedback.

In particular:

On line 131, authors states: "A comparison with satellite data shows that over the annual cycle ozone volume mixing ratios are well reproduced in the stratosphere, apart from southern polar regions and with larger differences at tropospheric altitud". Can you comment about these differences?

1. The stratospheric southern polar bias is larger in free running EMAC simulations and especially low in simulations with specified dynamics (without mean temperature nudging). Hence, our chosen EMAC model setup is especially well suited for our application of modelling stratospheric ozone.
2. The troposphere bias is reduced in simulations with specified dynamics, where mean temperature nudging is included. According to Joeckel et al (2016), this originates from the complex relation of reduced vertical convective activity, shift in tropopause height, reduced lightning NOx and eventually increased NOx emission from soil.

The whole topic is described extensively in Jöckel et al (2016), sections 4.7 and 5. We added the additional information on bullet point 1 in the publication.

Include color legend for figure 1 and 2.

The reason, why the colormap was omitted, is stated in the figure caption.

Suggestion: It is better to communicate the results with bar plots and not pie charts.

Generally, we agree. However, in this specific case, we decided to use a pie chart, first, simply not to use bar plots twice and, second, the two absolute values of the pie chart (4.7 Tg, 14.6 Tg) do not have to be normalized to be able to compare the reactions ratio with one look.

Lines 419-421. Is EMAC better? I believe the author plays with the ideia without explicitly

stating.

Both models are well validated within the Coupled Model Intercomparison Project (CMIP). It is a huge advantage to be able to use two climate models. With results from two models, we can compare the results, validate trends and reduce the error of our estimates. We do not agree and do not want to transport the view that EMAC or LMDZ-INCA is better. If you do have a proposition on how to change the text, we would gladly welcome it, since it is not our intention to rank the models. Nonetheless, we rephrased the passage, hoping to address the issue.

Old: "To conclude, in the EMAC results, either the uncertainties due to annual variability is larger compared to LMDZ-INCA for 420 both O3 and NOx or the perturbation to background ratio is larger. Additionally, the larger vertical resolution in EMAC could explain the different uncertainty value ($p < 0.05$ for EMAC, $p < 0.001$ for LMDZ-INCA)"

New: "To conclude, the uncertainties due to the annual variability are lower in LMDZ-INCA compared to EMAC for both \chem{O_3} and \chem{NO_x}, highlighting the significance of LMDZ-INCA results. The larger vertical resolution in EMAC could explain the different uncertainty value ($p < 0.05$ for EMAC, $p < 0.001$ for LMDZ-INCA), since it allows more detailed perturbation patterns, which is not model-specific, but resolution-specific."

Line 486: The author mention WACCM used by another author without define it.

We define the model (Line 474), but do not compare the specific model setup to our model setups. We added additional information for the readers (underlined text).

"[…] using the coupled chemistry-climate model WACCM (Whole Atmosphere Community Climate Model). <u>Similar to our model setups, WACCM simulates atmospheric chemistry and dynamics. For more detailed information, please refer to their publication."</u>

There are some paragraphs consisting in less than 2 phrases. Each paragrah should have at least thee phrases, intro, body and conclusion.

Thank you very much for the suggestion. We have changed the composition of the paragraphs to reduce the occurrence of very short text passages.

The manucrsipt has an excessive number of tables and figures. Consider moving some into supplementary material

We are strongly convinced that especially figures are helpful in understanding and comparing the main text. Therefore, we prefer to keep the figures and moved Table 7 (RF including upper tropospheric perturbation) to the appendix.