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

General Comments

The paper by Pletzer et al. provides a modeling study of the potential climate and ozone impacts due to emissions from Hypersonic Transport. The study is motivated by the growing contribution from aviation to climate change and also increasing desire to reduce air travel time. The present paper evaluated two hypersonic aircraft designs using two 3D chemistry-climate models, providing an assessment on climate and ozone impact for flying these aircraft. The present paper shows for the first time that a net chemical production at high altitudes leading to an increase of H2O perturbation lifetime and H2O concentration.

This is a very interesting and well-written paper that is a significant contribution that merits prompt publication. I only have a few minor suggestions for the authors to consider (below). What I find 'missing' is some contextual information. Also, I suggest that the limitations of the models need to be discussed more explicitly. I have detailed some of this below that might easily rectify this for the authors to consider.

Specific Comments

In the methods and simulations section, it is still not clear to me what nudging is applied in the models? I am assuming U wind, V wind and surface pressure? Is there anything else? Is it nudged all the way from surface to the model top? I assume the ERA-Interim meteorology fields first get interpolated to model grid (both horizontally and vertically) offline before nudged to the models? Please explain/clarify in the paper.

L151
"The respective relaxation times are listed in 1."
The respective relaxation times are listed in Table 1?

L190 and L238
Two models seem to have large difference in derived lightning NOx – 0.2 TgN/yr and 5.5 TgN/yr in EMAC and LMDZ-INCA respectively. Why is that? How do these two models derived the lightning NOx. How does this large difference can potentially influence the results here, if any? Hope the authors could elaborate more on this.

L194
What are the vertical resolutions (especially in the upper troposphere and stratosphere) in the two models? What is the vertical resolution of the HIKARI aircraft emission inventory? What is the underline assumption of the aircraft emission spread throughout the model grid? What is the role of model diffusivity in the distribution of emissions? What is the limitation? More discussion on this aspect would be helpful.

L240 to L250
The model uses the meteorology data from the time period 2000-2014 to simulate climate impact in 2050-2064. One can argue that using the meteorology fields between 2000 to 2014 doesn't account for the dynamics changes (e.g., temperature and circulation) at the upper troposphere and lower stratosphere owning to climate change. For example, previous studies have shown that the Brewer–Dobson circulation has been strengthening in response to climate change (e.g., Butchart et al., 2006; Shepherd et al., 2011). How much difference can it make to the resulting effects?

Butchart, N., Scaife, A. A., Bourqui, M., De Grandpré, J., Hare, S. H. E., Kettleborough, J., ... & Sigmond, M. (2006). Simulations of anthropogenic change in the strength of the Brewer–Dobson circulation. *Climate Dynamics*, 27(7), 727-741. DOI 10.1007/s00382-006-0162-4

Shepherd, T. G., & McLandress, C. (2011). A robust mechanism for strengthening of the Brewer–Dobson circulation in response to climate change: Critical-layer control of subtropical wave breaking. *Journal of the Atmospheric Sciences*, 68(4), 784-797. https://doi.org/10.1175/2010JAS3608.1

Figure 1 shows the vertical sum of H2O emissions over all vertical levels. How different the figure would be if one only plotted the emissions at cruise altitudes?

L295
States that "Most of the emitted trace gases are transported to tropospheric altitudes". I am curious how much emitted H2O is chemically destroyed in the stratosphere? Have the authors explored the ratio of emitted stratospheric trace gases transported to tropospheric altitudes VS chemical destruction in the stratosphere? Which is the major contributor (transport or chemistry) to the stratospheric H2O sink here? It would be very interesting to see.

Table 3
It would be interesting to see how much percentage of total H2O perturbation stay in the atmosphere (above the tropopause) when it reaches equilibrium (e.g., Perturb. LAPCAT/ total LAPCAT emission *100% in two models)

Table 4
shows that LMDZ-INCA calculates a higher ozone destruction than EMAC. The difference can be about 42% for lower flying aircraft (ZEHST). What factors can be mainly contributed to the difference derived in two models? Could the authors add a few sentences to discuss about this?

L476
"over four year"
over 5 years? 2010-2014

A recent study by Zhang et al., 2021 calculated the stratospheric adjusted radiative forcing of water vapour and ozone perturbation at difference cruise altitudes. How does the water vapor and ozone radiative forcing impact in this study compared to their study? Scaling by per unit H2O emission in $mW(m^2Tg)^{-1}$?

Zhang, J., Wuebbles, D., Kinnison, D., & Baughcum, S. L. (2021). Stratospheric ozone and climate forcing sensitivity to cruise altitudes for fleets of potential supersonic transport aircraft. *Journal of Geophysical Research: Atmospheres*, 126(16), e2021JD034971. https://doi.org/10.1029/2021JD034971

L563
"To conclude briefly, the impact on climate of aircraft emitting water vapour and flying above the tropopause increases very much with altitude." Agree with the authors: this conclusion is indeed valid for climate impact of water vapour emission with altitude; however, it might not be the case for ozone perturbation. Zhang et al study showed that there is an inflection point where the radiative forcing of ozone perturbation changes from positive to negative with increasing the flying altitude.

In Kinnison et al. 2020 study, they have showed in figure 1 that the natural stratospheric photochemical production of water vapor resulting from the oxidation of methane is 60 Tg (H2O)/year, which seems to be much higher than the value (less than 14.6 Tg/yr) presented in Figure 7 and Figure 8 in this study. Could the authors explain a little why there is such a big difference?

The simulations assume an atmosphere without volcanic eruptions, but volcanic eruptions will happen in the time frame of an employment of hypersonic transport. What are possible effects of aerosol particles and water vapour of volcanic origin? How would this effect change the picture put forward here? Perhaps nothing can be said, but then this point should be clearer as a limitation of the study.

L800
"over a time period 800 of fourteen years (2000-2014)"
over a time period 800 of fifteen years (2000-2014).

L812
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