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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Climate impact of supersonic air traffic: an approach to optimize a potential future supersonic fleet – results from the EU-project SCENIC" *by* V. Grewe et al.

Anonymous Referee #1

Received and published: 27 June 2007

The manuscript addresses the climatic impacts of a theorised replacement of subsonic aircraft by a fleet of supersonic aircraft by 2050. The manuscript explains the effects on stratospheric chemistry and on near-surface temperature change, and clearly lays out the methodology used to do this. I do have one or two concerns concerning the methodology used and the focus of the conclusions. If the authors can address these questions, I recommend publication.

Major Comments:

On p.6154 and Figure 2, the authors show the CO2 emission (Fig 2a) and concentration scenarios (Fig 2b). It looks to me that the integrated emission between 1990 and

2050 is 8-9 ppmv from Figure 2(a) and the concentration at 2050 is 7-8 ppmv from Figure 2(b). I'm a bit confused by this- I thought that the airborne fraction (fraction of emitted CO2 that stays in the atmosphere) has been observed to be ˜0.4 during the 20th century. Given that these emissions are small, shouldn't the concentration at 2050 also reflect the airborne fraction of ˜0.4? The reasoning scales to Figures 2(d) and 2(e) as well. have the authors overestimated the total CO2 concentration change from the aircraft fleet? This will affect their total radiative forcing too.

The authors concentrate on globally averaged radiative forcing and near-surface temperature change, but I would like to see more details on the stratospheric/chemical effects; particularly, what is the stratospheric temperature and circulation change in the models given the decrease in O3 and increase in stratospheric H2O? Both of these changes cool the lower stratosphere in the northern hemisphere. Might the circulation change induced by the O3 and H2O changes cause a circulation change in the troposphere too, causing some regional climate change at the surface?

Is there any seasonal variation in the stratospheric water vapour loss given its proximity to the tropopause? Also, given stratospheric cooling and extra water vapour, might there not be added chemical effects due to more frequent occurrence of polar stratospheric clouds for instance?

The final RF values given in the abstract seem very small (˜0.02 W/m2). What is the estimated RF change from aviation as a whole between 1990 and 2050? I assumed it was significant ($>$0.1 W/m2). The authors need to state the RF change estimated from subsonic aircraft in 2050 in the conclusions (they already state the 2000 value) so that a reader can place the 9-29 mW/m2 estimated from supersonic replacement in context.

Other comments:

P.6147 line 15: can the authors provide a publication rather than a personal communication?

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P.6150 line 25: why are the methane boundary conditions fixed? I don't understand this. Does the factor of 1.4 come from IPCC (1999)?

P.6156, lines 5-8. Why is there an ozone increase below the domain of ozone depletion?

P.6156, line 18: emission spelt wrongly.

P.6156, liune 23: "extend" should be "extent"

P.6157, line 5: "less" should be "smallest"

P.6157, line 20: "lifetime" should be "lifetime by"

P.6158, line 10: Is a reduction of 1.6% in contrails statistically significant? Also, one surely cannot quote these values to 4 significant figures

P.6160, lines 12-14: Since the contrail changes are very small, and contrail effects are very uncertain, I'd either remove this, or quantify it more.

P.6161, line 9: "since transport of water vapour is nearly a linear process in the stratosphere". Could this be explained more clearly please?

P6163, lines 15-17: No discussion of UV changes actually takes place as far as I can see. Please either remove this bit, or if UV changes are significant, please state them.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 6143, 2007.