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Interactive comment on "Impact of aircraft NO_x emissions on the atmosphere – tradeoffs to reduce the impact" *by* M. Gauss et al.

M. Gauss et al.

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Once again we would like to thank reviewers for their valuable comments. A revised manuscript has been submitted to ACP taking into account all reviewer comments and suggestions.

Below are our answers to the comments of reviewer #3. We first quote the reviewer. Our answers are marked by >> <<

Anonymous Referee #3 Received and published: 18 January 2006

First, both in the abstract and in the main paper, there is inadequate discussion of the baseline reference scenario and what it represents.

>> The reference case (now labeled 'ref') includes military aircraft, while the 'base'

case does not. This is now explicitly stated several times in the paper (first two sentences of section 4.1, first two sentences of section 4.2, and Table 1). This is the only difference. The reference case ('ref') accounting for both civil and military aircraft was included in order to compare with previous studies, which also included all (both civil and military) aircraft. <<

In particular, there needs to be more discussion of the basis for the reference scenario and the methodology used (referring to the Gardner et al. report which does not appear in the peer-reviewed literature is inadequate).

>> Regarding the detailed methodology, the first version of the peer-reviewed publication of the ANCAT inventory

Gardner R. M., Adams K., Cook T., Ernedal S., Falk R., Fleuti E., Herms E., Johnson C. E., Lecht M., Lee D. S., Leech M., Lister D., Massé B., Metcalfe M., Newton P., Schmitt A., Vandenbergh C. and van Drimmelen R.ň (1997) The ANCAT/EC global inventory of NOx emissions from aircraft, Atmospheric Environment, 31, 1751-1766, 1997

has now been added to the manuscript. The methodology used there was similar, although not identical. The Gardner et al. (*1998*) report on the ANCAT/EC2 scenario is thus kept, but supplemented with a reference to Henderson et al. (1999), which appears in the peer-reviewed literature and reviews the Gardner et al. (1998) emissions. <<

It would also be useful to compare this reference database with previously published emissions databases.

>> To our knowledge no other inventory for 2000 has appeared in the peer-reviewed literature yet. However, the recently developed scenarios FAST-2000 and AERO2K are now mentioned in the text. Up to now they have appeared in the grey literature only, but Aero2k is publicly available on the web (http://www.cate.mmu.ac.uk/aero2k.asp) and is being used by the European FP6 project QUANTIFY. The 'base' case dataset used in

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this study compares very well with 'FAST-2000' (152 Tg(fuel)/year and 0.618(N)/year for 2000) and the AERO2K inventory (156 Tg(fuel)/year and 0.627 Tg(N)/year for 2002), as is now mentioned in the manuscript. <<

On pages 5 and 6, I remain concerned about the coarse resolution of the CTM-2 model, and would like to see further discussion on its adequacy for the studies addressed here, perhaps through further comparisons with observations or pointing at previous papers that have discussed this issue.

>> We admit that running the model in T42 resolution would be desirable. However, in view of the large number of scenarios (many of which are not included in the paper) and the strict requirement on spin-up length for studies including stratospheric perturbations we were forced to confine ourselves to T21 resolution during TRADEOFF. Yet, we consider the vertical resolution as more important for the type of study presented here, and the 800 m - 1200 m resolution of the CTM2 as being adequate. More importantly, as we use the expensive Second Order Moment Scheme of Prather (1986) taking into account 1st and 2nd order moments, i.e. variations of chemical species within a grid box, the effective resolution is actually higher than the nominal T21 resolution. We are not aware of any publication that has addressed the effect of different horizontal resolutions on calculated aircraft impact, but have referred in more detail to the Brunner et al. papers (following a suggestion of reviewer 1) where the T21 version of the model has been evaluated extensively at typical flight altitudes. <<

On page 7, explain FESG. Could also reference to IPCC (1999).

>> Done. The abbreviation FESG is now explained in the text: Forecasting and Economic Support Group. The reference to IPCC (1999) is added in the same sentence (Penner et al.). <<

On pages 9-12, it would be useful to give further analysis relative to previous studies for similar reference scenarios to be clearer on what is similar and what is new in the studies done here.

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>> We agree that more comparison with previous studies is needed, and the main reason for including the reference case ('ref') was to allow for such a comparison and to demonstrate that the model is capable of calculating aircraft-induced perturbations. In addition to the comparison with Kentarchos and Roelofs (2002) regarding NOx we have now added a comparison with the multi-model assessment in the IPCC special report (1999) regarding both NOx and ozone. (see end of section 4.1). The new aspect here is that stratospheric chemistry is included in addition to tropospheric chemistry. A short discussion has been added. <<

The sensitivity studies are quite interesting, but it would be useful again to put these into perspective relative to prior studies.

>> We are not aware of any peer-reviewed previous study looking at polar routes or changed flight altitudes for subsonic aircraft, apart from Grewe et al. (2002b). A detailed comparison with this study is difficult, because the assumptions made were very different. Anyway we refer to it in section 4.3 (4th paragraph) trying to relate our results to their results. We believe that further publications using the TRADEOFF lower and higher altitude scenarios are in preparation, so that a comparison with other models will become possible. <<

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 12255, 2005.