

Interactive comment on “3-D microphysical model studies of Arctic denitrification: comparison with observations” by S. Davies et al.

Anonymous Referee #1

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General Comments

This study is a very interesting compilation of the simulation of denitrification for different cold stratospheric winters with an update of the SLIMCAT/DLAPSE model. The simulated denitrification is compared to available observation of MLS, ILAS and MIPAS-B. In general the paper is well written and I would recommend it for publication when the few points listed below are clarified.

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Specific Comments

1. I did not realize that in the former versions of DLAPSE feedback of changed due to sedimentation is not given back to the model. This is definitely important to do. Other groups that have reproduced the idea definitely calculate this feedback [Grooß et al., ACPD, 2004]. Especially it would be interesting to see what the effect of this feedback is on the model results, especially with respect to prolonged ozone depletion. Also I would expect less particle growth in the version with feedback in denitrified areas. A comparison for one example between old and new versions of DLAPSE/SLIMCAT would be interesting.
2. Throughout the comparison with observations data are plotted together with (presumably) 12 UT model output maps. Since the observations are not made at 12 UT in general, the locations are not comparable. When comparing data with the model it should be sampled at the exact observation time to avoid mis-sampling artefacts. The authors may have done this but they should clearly state this, if so.
3. Figure 7 shows significant denitrification but very few re-nitrification. Why is this the case?
4. The comparison with MLS data (Figure 8) shows significant differences in mid-latitudes. The authors point to a likely inaccurate initialization in the outer vortex region. What is then the reason that the initialization inside the vortex is assumed to be realistic? Is it because it is scaled to MkIV observations?
5. It is not said clearly, but likely that all simulations were initialized from a SLIMCAT multi-annual run. For 1994/95 and 1999/2000, is adjusted according to observations. What about ozone and the other chemical species? Please clarify.
6. The not optimal agreement with MIPAS in winter 1994/95 was said to be overcome by an increase of the NAT nucleation rate by at least a factor of 4. Was that

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checked by a sensitivity simulation? or is this statement based on other assumptions? Only results with one nucleation rate are shown, that could rather successfully describe the denitrification in the DLAPSE model without feedback. Was the sensitivity with respect to nucleation rates tested for the updated DLAPSE model?

7. Why would a potential warm bias of 1.5K in the ECMWF data be present in the 1994/95 winter and not be present in the two other winters?

Technical Correction

Figure 13: The MIPAS curve is not dashed as said in the caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 347, 2005.

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