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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modelling the effect of denitrification on polar ozone depletion for Arctic winter/spring 2004/05" *by* W. Feng et al.

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Dear Dr. Feng,

I am very pleased to see that you are using ASUR data for studying denitrification in the Arctic winter 2004/05. As one of the originators of these data I have three short remarks:

1. Concerning the comparison of model data with ASUR data I would like to point out that ASUR data have a vertical resolution of about 5 km in the lower stratosphere. As you are comparing vortex averages rather than individual profiles and the features have a rather large vertical extent even in HNO_3 and HCl, a direct comparison is probably justified. However, features like the difference between ASUR and the model in HNO_3

around 25 km are likely related to the limited resolution of the ASUR measurement and it might be worth pointing this out. Also, the negative values in the HCl measurement are likely caused by the retrieval not quite being able to follow the steep slope from high HCl VMRs in the middle stratosphere to virtually no HCl in the lower stratosphere. This might be worth mentioning, too.

2. In extensive intercomparison studies by Kuttippurath et al. [2007] it has been established that the ASUR O_3 data product tends to be biased high by about 12%. This bias seems to be consistent over many campaigns, however, it has not been considered in data submitted to public archives. As you probably downloaded the ASUR data for your study from a public archive, I suggest to reduce the ASUR O_3 VMRs shown in your study by 12% with reference to the paper by Kuttippurath et al. [2007]. This will also bring measurements and model results into better agreement in Figs. 1-3.

3. My final remark concerns some work on denitrification I had done for the Arctic winter 1999/2000. In my paper [Kleinböhl et al., 2002] I derived denitrification inside the vortex from an NOy budget largely based on ASUR HNO_3 measurements. The results were compared to output from the Slimcat model run with the NAT equilibrium denitrification scheme (equivalent to your run "Exp A"). It was shown that the model overestimated denitrification particularly at low equivalent latitudes, close to the vortex edge. The DLAPSE scheme was not available by the time this paper was published. However, I followed up on this issue shortly after the development of DLAPSE, and performed a comparison with output from the DLAPSE microphysical model, which was not coupled to a chemistry model at that time. It turned out that the overall denitrificaion and its dependence on equivalent latitude was much better reproduced by DLAPSE than by the equilibrium model. This finding did not make it into a standalone paper, however, it was published in my PhD thesis [Kleinböhl, 2004] (which is available for purchase at the German branch of a large online book retailer, but I would also be happy to provide the relevant chapters upon request). As these results can be considered as corroborative evidence for the case you are making I think it would be

appropriate to mention them in a relevant section of your paper.

I hope you will find these comments helpful and I would appreciate if they were taken into account.

Sincerely,

Armin Kleinböhl

References:

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Kleinböhl, A. (2004), Airborne submillimeter measurements of Arctic middle atmospheric trace gases: Evidence for denitrification in the Arctic polar stratosphere, Ph.D. thesis, Logos Verlag, Berlin.

Kuttippurath, J., et al. (2007), Intercomparison of ozone profile measurements from ASUR, SCIAMACHY, MIPAS, OSIRIS, and SMR, J. Geophys. Res., 112, D09311, doi:10.1029/2006JD007830.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 3857, 2011.