

## ***Interactive comment on “A study of polar ozone depletion based on sequential assimilation of satellite data from the ENVISAT/MIPAS and Odin/SMR instruments” by J. D. Rösevall et al.***

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Review of "A study of polar ozone depletion based on sequential assimilation of satellite data from the ENVISAT/MIPAS and Odin/SMR instruments" by Rosevall et al., Atmos. Chem. Phys. Discuss., 6, 9967-9994, 2006

General comments:

The paper presents a study on the ozone loss in the polar lower stratosphere during the winters of Antarctic 2003 and Arctic 2002/2003 using Envisat/MIPAS and Odin/SMR data and an assimilation model. I think it is a useful paper for the scientific community since it address one of the most important topics of the atmospheric community in

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recent years. In my opinion, however, the authors should make some changes, which, although do not require a substantial effort, should put the paper in a more updated context of the state of the research in this field. Hence I suggest, before the paper being accepted for publication, the following comments to be taken into account.

1) The authors, although get important partial results on the validation of MIPAS and SMR O<sub>3</sub>, they focus on the geophysical results of O<sub>3</sub> loss in the two winters described above. A similar study about the ozone loss in the NH 2002/2003 winter has been already carried out by Konopka et al. (paper in press, not published yet). These authors actually present a more comprehensive study since it is carried in a wider altitude range, in a more prolonged period of the winter and give more insights on the problem with a full discussion of the causes of the depletion, distinguishing among halogens and NO<sub>x</sub> losses. Since that paper is not published yet, the authors do not need to mention it. However, I think, it would be better for the community, if this paper is mentioned and discussed.

It would also be very useful to discuss in the manuscript all O<sub>3</sub> losses. Although not explicitly stated, it seems the authors attribute all the O<sub>3</sub> losses to the halogens chemistry, as the reader might infer from the reading of the introduction and Sec. 2, lines 11-14. Although the halogens loss is the largest contribution to O<sub>3</sub> loss in the polar region below about ~25 km, the losses by NO<sub>x</sub> are predominant above that altitude. This has been shown clearly by Konopka et al. (2006) in the Arctic winter 2002/03 due to NO<sub>x</sub> transport from mid-latitudes (see, e.g., Fig. 1) ; and can also be important in the late winters when strong NO<sub>x</sub> descent occurs, as in the Antarctic SH 2003 winter (see Funke et al., 2005). This should be stated in the introduction and in section 2 when referring to possible chemical losses.

2) Although it is not the major aim of the paper, their findings about the validation of MIPAS O<sub>3</sub>, e.g., the good agreement between their assimilated MIPAS O<sub>3</sub> and balloon sonde measurements, is very important and timely, since the validation of those measurements have not yet been published. I would suggest to make a reference to that

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result in the abstract and in the conclusion section. A similar sentence for Odin/SMR might not be appropriate since the discrepancies are still under investigation. This is left open to the authors.

Specific comments:

As mentioned above, include sentences in the introduction and in first paragraph of Sec. 2 about the role of the NO<sub>x</sub> catalytic cycle in destroying O<sub>3</sub>.

Sec. 2. Is this manuscript the first description of the DIAMOND model? Although it is concisely and clearly described, any reference to it would be useful for the specialized readers.

P. 9971, lines 15-16. I thought (from Fig. 1) that the horizontal grid was the same everywhere. Then, I do not understand the use of a grid spacing of 167x167 km "over the pole".

P. 9976, lines 10-14. The sentence is not fully precise. The retrieval of temperature is necessary and essential for retrieving O<sub>3</sub> or any other species from MIPAS spectra. In consequence it has to be measured very precisely. MIPAS also provides information to derive species abundances more than those cited. They can be retrieved up to about 30 species (see Fischer and Oelhaf, 1996). Also, for the description the data version 4.51 it would be more appropriate the paper recently accepted for publication in ACPD by Raspollini et al (ACPD, 2006) instead of the older paper by Ridolfi et al. (2000).

P. 9988. Caption of Fig. 6. There should be a typo here. Ozone depletion in Fig. 6 should be from "Envisat/MIPAS", not from "Odin/SMR". The latter is shown in Fig. 7.

Sec. 6. Odin/SMR N<sub>2</sub>O data. Have these data been validated or published? A reference to the description of the data would be useful.

Sec. 7. A quantitative comparison with the previous work of O<sub>3</sub> loss estimation for the Arctic 2002/2003 winter by Konopka et al. (2006), mentioned above, would be very useful. Actually the agreement is quite good. Their estimation at the 475 K level is

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about 0.6 ppmv, which is close to 20%. No surprise, on the other hand, since both studies use the same MIPAS data-set.

P. 9979, l. 19-20. I suggest to use the O<sub>3</sub> loss range stated in the conclusion section, i.e., 10-20%, since the 30% change suggested by Odin/SMR is still uncertain.

#### References:

Fischer, H. and H. Oelhaf, Remote sensing of vertical profiles of atmospheric trace constituents with MIPAS limb-emission spectrometers, *Appl. Opt.*, 35, 16, 2787-2796, 1996.

Funke, B., M. Lopez-Puertas, S. Gil-Lopez, T. Clarmann, G. Stiller, S. Kellmann, H. Fischer, Downward transport of upper atmospheric NO<sub>x</sub> into the polar stratosphere and lower mesosphere during the Antarctic 2003 and Arctic 2002/2003 winters, *J. Geophys. Res.*, 110, D24308, doi 10.1029/2005JD006463, 2005.

Konopka, P., A. Engel, B. Funke, R. Muller, J.-U. Groos, G. Gunther, T. Wetter, G. Stiller, T. Clarmann, N. Glatthor, H. Oelhaf, G. Wetzzel, M. Lopez-Puertas, M. Pirre, N. Huret and M. Riese, Ozone loss driven by nitrogen oxides and triggered by stratospheric warmings may outweigh the effect of halogens, *J. Geophys. Res.*, in press, 2006.

Raspollini, P., C. Belotti, A. Burgess, B. Carli, M. Carlotti, S. Ceccherini, B. M. Dinelli, A. Dudhia, J.-M. Flaud, B. Funke, M. Hopfner, M. Lopez-Puertas, V. Payne, C. Piccolo, J.J. Remedios, M. Ridolfi, R. Spang, MIPAS level 2 operational analysis, *Atmos. Chem. Phys. Disc.*, 6, 6525-6585, 2006.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 6, 9967, 2006.