

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.

General comments:

I find this paper interesting and I think it would be a valuable addition to the data assimilation literature. I recommend publication subject to the authors addressing one main general point and several specific points.

The main general point is that the authors fail to quantify their results in a number of

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places. The authors should refrain from making qualitative and vague points. The places in the paper where the authors should address this issue are detailed in the specific comments below.

Specific comments:

P. 9968, line 5: I think you should say: "can be built up using data assimilation"

Line 14: Remove "as expected"

Line 16: Provide a rough height for 475 K.

Line 22: "has" -> "have"

P. 9969, line 7: Remove "somehow"

Lines 9-11: I understand chemistry is excluded in this approach. If so, the authors should mention this.

Line 25: I think you should say: "can be built up using data assimilation"

Line 26: Explain what is meant by the ozone fields being less noisy than individual profiles. Do you mean less noisy when averaged over a region?

P. 9970, end of section 1: I think it would be good to comment here, and later in the paper, on how the results compare against other approaches, and how the results are validated.

Line 14: There is also heterogeneous chemistry in the lower stratosphere.

Line 23: As I understand it, the N₂O fields are used to provide an estimate of the vertical transport and, thus, errors in the approach. This should be made clearer at the beginning of section 2.

P. 9971, line 2: "dedicated" -> "designed"

P. 9972, line 5: Remove "somehow"

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Line 17: How is L tuned? This should be mentioned when first discussed.

P. 9974, line 12: What is the tuned value of the error growth rate?

Lines 14-15: For clarity, write: “in eqn (11) below”

Line 21: What is the tuned value of L?

P. 9975, line 16: “486-504 GHz and 541-558 GHz”

Line 18: “501.5 GHz and 544.9 GHz”

Lines 20-21: Do the papers mentioned discuss the evaluation of Odin/SMR data? The quality of the SMR data should be quantified.

Line 26: Comment on Fig 4: MIPAS has not been introduced. Also, in Fig. 4 there is an order of magnitude difference between the number of SMR and MIPAS measurements. Does this affect the result?

P. 9976, line 12: Another standard ESA product from MIPAS is NO₂.

End of section 4: Recently, there have been a number of papers which discuss the quality of MIPAS data. To mention three known to this reviewer:

(i) Raspollini, P., Belotti, C., Burgess, A., et al.: MIPAS level 2 operational analyses. *Atmos. Chem. Phys. Discuss.*, 6, 6525-6585, 2006.

(ii) Geer, A.J., Lahoz, W.A., Bekki, S., et al.: The ASSET intercomparison of ozone analyses: method and first results. *Atmos. Chem. Phys. Discuss.*, 6, 4495-4577, 2006.

(iii) Lahoz, W.A., Geer, A., and O'Neill, A.: Dynamical evolution of the 2003 Southern Hemisphere stratospheric winter using Envisat trace-gas observations. *Q. J. R. Meteorol. Soc.*, 132, 1985-2008, 2006.

I suggest the authors mention these papers or others if they are more relevant. The authors might have been aware of (i) and (ii); (iii) has just come out.

P. 9977, line 1: Perhaps mention that assimilating ozone data into the DIAMOND model for more than two months prior to 1 August avoids spin-up issues associated with biases between the initial conditions and the observations.

Line 11: The authors should quantify the estimates of depletion at the 425 K and 475 K levels.

Line 17: “model” -> “assimilated”

Line 22: The authors should quantify differences between the MIPAS data and the sondes.

P. 9978, title of section 6: I suggest for clarity: “in the Antarctic polar vortex”.

Line 8: What is the quality of the N₂O data from SMR?

Line 27: “decreased by ~10 K”

P. 9979, lines 1-3: Is ~10 K small with respect to the theta levels considered? Is this the argument for stating that the vertical transport is a small error? If not, please clarify, as I found the sentence: “Vertical transport (cont) less than 20%” difficult to understand.

Line 19: Figs. 11 and 12 seem to be transposed. Also check the text following (e.g. P. 9980, line 7).

Line 23: Please remind the readers of what is the pattern observed in southern hemisphere.

P. 9980, line 4: “with” -> “by”

Line 10: Is the argument that the difference between MIPAS and SMR cannot be attributed to neglecting vertical transport? If so, please make clearer.

Line 18: Remove “as expected”

Line 21: Quantify the ozone depletion.

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Line 23: “estimated” -> “estimate”

Line 25: Please explain the difference between the depletion estimated from SMR and from MIPAS.

P. 9985, Fig. 3: It would be useful to indicate the value of L derived from tuning.

P. 9987, Fig. 5: It would be useful to indicate how the location of the border of the polar vortex was calculated. Same for Fig. 12 (which according to the text should be Fig. 11).

P. 9988, Fig. 6: It would be useful to indicate the percentage formula. With respect to what is the percentage calculated? Same for Fig. 7.

P. 9990, Fig. 8: I think the NDSC is now the NDACC, Network for the Detection of Atmospheric Climate Change.

P. 9993-9994: Based on the text, I think Figs. 11 and 12 are transposed.

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

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