

## ***Interactive comment on “Intercomparison of O<sub>3</sub> profiles observed by SCIAMACHY, ground based microwave and FTIR instruments” by M. Palm et al.***

**Anonymous Referee #2**

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The manuscript describes a comparison of ozone profiles measured by three ground-based instruments with SCIAMACHY data. The three ground-based instruments are the millimetre wave radiometer RAM in Ny-Ålesund, Spitsbergen, and BreRAM in Bremen, Germany and the FTIR in Ny-Ålesund, Spitsbergen. An excursion into the theory of inversion is followed by the description of straight forward comparison of the profiles of interest. In order to reduce the expected variances in the profile differences the authors choose to smooth the SCIAMACHY profiles with the lower vertical resolution and sensitivity of the ground-based instruments. The collocation criteria and the comparison process is described briefly before the results are presented.

This short manuscript is an interesting although not new attempt to the necessary

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comparison of satellite data with ground-based data. The paper in general is well structured and the intercomparison approach is described in details. Although the number of collocations for the comparison is somewhat small I recommend the manuscript for publication in ACP after my comments have been taken into account either in the final version of the manuscript or in the discussion.

Here are my specific comments:

1. To pick the right coincidence criteria for comparison with satellite data is always a tough job. In this paper the authors have described a number of them. Unfortunately the authors did not explain on what grounds they chose the values for each of them.
2. It seems to me that the size of the SCIAMACHY pixel with 1000 km x 400 km is already quite a large area to average about when comparing to a 100 km x 100 km. Why is it necessary to increase this area by 500 km (in all directions?). If the reason for this is that the number of coincidences is too small one should have increased the time period. In contrast to this the temporal coincidence criteria is rather strict. Except from measurements at the terminator the ozone values should not vary that much within a quite larger time span.
3. The threshold for the mean ozone column density  $m_0$  and the variability  $d_0$  of the ozone value within a SCIA pixel is not sufficiently clear to me. Especially the choice of the  $m_0$  value seems to me like a pretty strong bias for the degree of agreement in the comparison result.
4. The much larger values for  $m_0$  and  $d_0$  in case of the FTIR/SCIA comparison which still only lead to 21 measurements, all from one day except for one leave me with the feeling that the paper would do better without the FTIR/SCIA comparison until the number of coincident measurements is large enough for real statistical treatment.
5. The potential vorticity is used with fixed limits for outer and inner edge of the vortex. It might be worth trying to use the 'equivalent latitude method' in order to have a more

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precise tool for identification of the vortex edge. This might add some more data points to the comparison. I suggest the authors present a table with the dates of the collocations in order to see how widely spread the collocations were during that period August 2002 and August 2003.

6. The authors claim that the retrieved ozone maximum of the compared profiles being at the same altitude is a sensitive measure of the differences in the a priori profile and the differences in the height resolution. This is hard to understand if considering that the altitude of the ozone maximum still is a regime where the a priori should not have a strong influence at all due to the high instrument sensitivity. Since this is a central part of the paper I suggest the authors spend a few words of explanation on this issue at the end of paragraph 4.1.

7. Although the SCIAMACHY data altitude range is 15 to 40 km (paragraph 2.1) all the figures cover a altitude range of 10 to 60 km and the SCIAMACHY profile goes up to 60 km. I assume that the profile above 40 km consists mostly of the a priori. It would be an important piece of information to see the averaging kernels or the sensitivity of SCIAMACHY (if not of all the instruments) at different altitudes.

8. For curiosity reasons: With an AOS and 1.3 MHz resolution why is the height resolution only 15 km at its best? Other millimeter wave instruments with similar spectrometer give a height resolution of 7 or 8 km at its best.

9. Why is there no reference to figures 6-9 in the text?

10. I assume that it is just by coincidence that the a priori profile for SCIAMACHY in figures 2 and 5 are so close to the RAM and BreRAM retrieval, respectively?!

11. In the description of the processes of the retrieved profiles I had some trouble understanding the third point (page 920). The authors might consider expressing the word simulation by what is done to the SCIA profile.

As a suggestion: 'SCIAMACHY retrieved profiles are then transformed to the sensitivity

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and vertical resolution of the respective ground-based instrument by'

Some technical comments

12. As a general comment: The paper clearly has a non-native English but there is definitely no problem at all to read the manuscript. However, proof-reading by a native speaker could be an option if the authors want to do something about it.

Some typographical errors have been removed in the online version since submission of the manuscript but some have survived: page 912 line 5 ground-based line 7 Ny-Ålesund line 9 conclusive line 13 greenhouse page 914 line 15 an effective line 17 every half hour page 915 line 17 chosen page 916 line 16 an ozone page 919 line 4 instead of options it should probably be called constraints?! page 921 line 5 immediately page 922 line 5 differ Fig. 1. Standard deviation In the figure legends Apriori is used instead of A priori and the y-axis title changes between Altitude and height.

13. In figures 3, 5 and 8 the legend is easy to misunderstand. I suggest that the SCIA-MACHY profile that has been smoothed with the height resolution of the respective ground-based instrument is still called after the instrument it stems from, for instance 'SCIA smoothed' instead of 'RAM simulated'.

14. Index 2 in Eq. 11 is missing.

15. The PV of 30 and 40 PVU, respectively, refers to the potential temperature of 475 K. This should be mentioned.

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Interactive comment on Atmos. Chem. Phys. Discuss., 5, 911, 2005.

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