

Interactive comment on “Intercomparison of O₃ profiles observed by SCIAMACHY, ground based microwave and FTIR instruments” by M. Palm et al.

M. Palm et al.

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I would like to thank the reviewer for the comments made on the paper. More detailed explanations of the points 1, 2, 5, 6, 7, will be included into the revised publication. The points 11, 13 are described in detail in the publication of Rodgers and Connor (2003). The hints given in point 9, 12, 14 and 15 will taken into account when revising the publication.

1., 3. The referee asks how the coincidence criteria are chosen. The SCIAMACHY instrument as well as the RAM-instruments integrate over their respective measurement window. Because for a linear forward model we find that

$$\langle \vec{y} \rangle = \langle \mathbf{K} \vec{x} \rangle = \mathbf{K} \langle \vec{x} \rangle . \quad (1)$$

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Hence integrating spectra corresponds to integrating the retrievals.

The ozone column can be used as a parametrization for the ozone profile. Lamsal et.al. used a binning of 30 DU which corresponds to ca 8-10 % of the ozone column typically observed. The profiles shown by Lamsal et.al. vary less than ca. 5 % per bin. Because this is less than the error expected by the standard deviation of the comparison (see green line in figure 1) a value of 5% for m_0 is a reasonable compromise between the number of coincidences and quality of the comparison.

The restriction for d_0 has been taken out, because the retrieval of SCIAMACHY is linear (see also eq. 1).

2. **The referee asks why the time criterion is rather strict compared with the spatial criterion.** The time criterion is 2 hours. The ENVISAT satellite always flies over a given location at 10 o'clock local time. In spring this is already close to the terminator especially when taking into account that the air parcels may travel fast in the upper stratosphere. We also chose to have common criteria for all coincidences and the time criterion symmetric to the overfly time.
4. **The referee feels that the FTIR/SCIAMACHY comparison should be left out.** The comparison with the FTIR instrument will be taken out again.
5. **The referee suggests a more exact criterion for the vortex.** There were no cases where there was any question about a measurement being near the boundary of the vortex. Because not one coincidence was dismissed because of being on different side of the vortex boundary, no more coincidences could be gained. The criterion is somewhat superfluous but we felt it has to be checked for completeness.
6. **The referee wonders why the altitude of the maximum vmr is a criterion for the quality of the retrieval.** For a satellite based instrument measuring in limb

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geometry it is very crucial that the exact tangent altitude is known. In order to check it's correctness some feature has to be found which is sensitive to the tangent altitude information. We decided to use the altitude of the maximum vmr.

7. The referee asks why the SCIAMACHY profiles go up to 60 km. The SCIAMACHY profiles had to be appended with the a priori used for the SCIAMACHY retrieval up to 100 km. Because the RAM's are sensitive in a greater range this had to be done in order to make them comparable. From about 55 km, there is little information from below 40 km in the RAM-retrieval, hence, only the a priori will be retrieved. Therefore and for better readability the figures have been cut at 60 km.

8. The referee wonders why the altitude resolution of the microwave radiometers is only 15 km.

1. The most important quantity for the altitude resolution is the signal to noise ratio. A long integration time yields a high signal to noise ratio which in turn improves the altitude resolution. In the instruments considered a high time resolution was favored on the cost of altitude resolution. It is also not trivial to integrate over long periods of time because the tropospheric water vapor background can change quite fast. The resolution of the spectrometer is more important for the maximum altitude information can be retrieved from.
2. Because of the radiative transfer the water vapor found in the troposphere attenuates the signal and leads to a loss in information. Both radiometers are only slightly above sea level, so that the conditions for high altitude resolution measurements are not ideal.
3. A conservative resolution measure has been used (Backhaus-Naur). Other measures may yield a better altitude resolution because they disregard the negative lobes, which almost all averaging kernels show.

- 10. The referee wonders if the a priory is are so close to the retrievals by coincidence.** The a priory profiles of SCIAMACHY are monthly and zonal means and therefore expected to be close to the measured profiles. Because of the low altitude resolution of the radiometers small deviations in the profiles are not readily seen.
- 11. The referee suggested to describe the procedure more detailed.** Because the procedure lined out in this work follows closely the path laid out in Rodger and Conner (2003) we also chose to use their terminology. We also refer the interested reader to this work for a detailed analysis and discussion.
- 13. The referee finds the legends of figures 3,5,8 easy to misunderstand...** See the answer to point 11.

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

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