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Interactive comment on "Surface pressure retrieval from SCIAMACHY measurements in the O_2 A Band: validation of the measurements and sensitivity on aerosols" *by* B. van Diedenhoven et al.

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First, we would like to thank the referee for the useful comments. Here, we reply to all comments addressed by the referee.

The referee addressed that the 1% continuum correction appears very empirical. This is correct; the method to derive the offset is empirical. In order to further substantiate the empirically determined offset we will introduce the following procedure: First, GOME observations are selected with co-located SCIAMACHY observations. Then

surface pressures and albedos are retrieved from these GOME and SCIAMACHY data. Additionally, surface pressures and albedos are retrieved from SCIAMACHY data on which several offsets are applied, i.e. 0.5%, 1%, 1.5%, 2% of the continuum reflectance. Then, the mean difference between surface pressures retrieved by GOME and SCIAMACHY and their standard variations can be shown as a function of the corrective offset. This provides a systematic method to determine the required correction to the SCIAMACHY data to agree with GOME retrievals.
Furthermore, for this study we will extend our dataset to all measurements from four orbits obtained on August 2002 and January 2003 around Northern and Southern Europe and Africa. This analysis confirms the conclusions drawn in the case study as already presented in the paper. Therefore, we recommend to apply this determined offset for any further analysis using SCIAMACHY data in this wavelength region.

As suggested, the study using synthetic measurements as presented in Fig. 2 will be extended with a discussion on the dependence of solar/viewing geometry. The sensitivity of the surface pressure on aerosols depend on solar angle, viewing angle and relative azimuth angle. Therefore, it is impossible to show the dependence of the retrieval shown in Fig. 2 for all geometries. We choose to include a figure showing the dependence on solar angle with a nadir geometry and a figure including the range of geometries present in the measurements as shown in Fig. 7 and 9. The referee states that the aerosol layer would lengthen the atmospheric path for low sun/viewing angles and the opposite is true for high sun/viewing angle. However, in fact a maximum in path lengthening, i.e. a maximum in retrieved surface pressure, appears at solar angles of 40–50 degrees. This is due to the fact that an increase in geometrical path can cause an enhanced optical path due to multiple scattering but also a decrease in optical path due to increased extinction due to aerosols. This will be explained in the paper as well.

The referee suggests a more quantitative analysis with the MISR data, using a

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scatter-plot of retrieved ΔP against against MISR optical thickness or a comparison of retrieved ΔP with simulated ΔP using MISR optical thickness. However, a problem with both options is that ΔP is strongly dependent on surface albedo, which is a poorly known quantity. An additional problem with a more quantitative analysis is that the overlap of MISR and SCIAMACHY is poor. Therefore, we believe that a qualitative analysis is the best option. We believe Fig. 10 is informative, because it allows the mean optical depths at different locations to be estimated. Furthermore, it shows that the optical thickness chosen in Fig. 9 and Fig. 11 qualitatively agree with those observed by MISR.

The referee inquires about the physical cause for the derived offset ("1% continuum corrections"). As stated in our paper "this offset is probably related to the inaccuracies in the reflection calibration" (section 4.2). The inaccuracies in the reflectance are estimated to be about 20 % (Acaretta et al. 2004, Noel 2004), implying a serious problem with the calibration. For further discussion of the SCIAMACHY calibration, we refer to the paper –G. Lichtenberg, and The SCIAMACHY Calibration Team, SCIAMACHY Level1 data: Calibration concept and in-flight calibration– appearing in this special issue of ACPD. We will include this reference in the revised paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 1469, 2005.