Atmos. Chem. Phys. Discuss., 4, S3476–S3478, 2004
www.atmos-chem-phys.org/acpd/4/S3476/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Column ozone and aerosol optical properties retrieved from direct solar irradiance measurements during SOLVE II" *by* W. H. Swartz et al.

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Received and published: 27 January 2005

We appreciate the thoughtful review made by Howard Roscoe and address all of his comments, as follows:

Major comment/Minor comment #1: We have added additional information to the Introduction regarding the basic historical context for the "absolute" retrieval employed in this work. We also added a new section (Sect. 2.2, Retrieval techniques) that discusses DOAS techniques specifically, which many (including Roscoe) have used quite beautifully in the retrieval of ozone from spectral flux measurements. We also draw the reader's attention to why we *did not* use DOAS for this SOLVE II analysis. As now ex-

plained more clearly in Sect. 2.2, we wished to simultaneously retrieve aerosol optical thickness along with ozone and other species. Aerosols are "smooth attenuators" with respect to wavelength and therefore do not lend themselves to retrieval using DOAS. (If it were of principal interest, $O_2 \cdot O_2$ would perhaps be more easily retrieved from its weak absorption using DOAS.)

Roscoe suggests that a benefit of the absolute (i.e., non-DOAS) retrieval approach that we have used is that "the reader might have faith in the accuracy of our aerosol retrieval, for which we have no independent validation unlike ozone." That is a good justification; however, there *is* independent validation of the aerosol optical thickness retrieval in the form of measurements by the (NASA) Ames Airborne Tracking Sunphotometer (AATS-14), which also flew on the DC-8. The favorable comparison with the AATS-14 aerosol retrieval is stated in Sect. 4.4 and 5, as well as in the cited companion paper by Phil Russell, "Aerosol optical depth measurements by airborne Sun photometer in SOLVE II: Comparisons to SAGE III, POAM III and airborne spectrometer measurements," found in this SOLVE II special issue.

Minor comment #2: We respectfully differ with Roscoe on the universality of the use of "O_4" to denote the O_2 collisional complex. Although most probably refer the complex as O_4 colloquially, the more precise "$O_2 \cdot O_2$" nomenclature is often found in the literature. To reduce potential confusion, however, we now note the use of "O_4" parenthetically in the Introduction when $O_2 \cdot O_2$ is first mentioned.

Minor comment #3: We have added to the discussion of retrieval accuracy (Sect. 4.5.2) to explain what is meant by "instrument red leak" (in the context of $>10^9$ stray light rejection), in addition to a small clarification in the DIAS instrument description (Sect. 3.1.1). We removed mention of red leak in the discussion of the sample retrieval–measurement comparison (Sect. 3.2.2), because it likely has no impact. In essence, the noted stray light rejection of $>10^9$ is a specification given by the double-pass monochromator manufacturer. In Sect. 4.5.2, we now explain that "DIAS measurement statistics were not precise enough to completely verify this level of rejection,

ACPD

4, S3476–S3478, 2004

but statistically zero signal was observed below the atmospheric UV cutoff of ∼294 nm, suggesting that red leak was negligible." In addition, we have also added a discussion of the effects of atmospheric scattering into the DIAS field of view as a possible source of contamination at the short-wavelength end of the spectrum (near 320 nm) at the largest solar zenith angles.

Minor comment #4: Roscoe rightly questions our attribution of short-wavelength model–measurement discrepancies to clouds, since clouds are largely grey scatterers (not functions of wavelength). We have therefore removed this comment. The discrepancies are likely due to the other factors noted in the Sect. 3.2.2.

Minor comment #5: The retrieval is weighted (in wavelength space) by the measurement uncertainty. At large solar zenith angles, there is almost no UV signal, due to ozone and Rayleigh extinction, and short-wavelength uncertainties become correspondingly large. As the uncertainty increases, the information content diminishes, irrespective of the size of ozone cross sections. The discussion in Sect. 3.2.2 is not connected with the statements in the first paragraph of Sect. 4, regarding the differences in the refracted light path at 320 and 600 nm (and thus the ozone column, which actually varies with wavelength due to refraction, depending precisely on the light path to which the quantity is referenced). To reduce potential confusion, however, the statements in Sect. 4 have been clarified accordingly.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 7403, 2004.