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

W. H. Swartz et al.

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We appreciate the thoughtful review made by anonymous referee #1 and address all of his/her comments, as follows:

Introduction: We have enhanced our parenthetical statement regarding the potential use of proxy maps in the Introduction, including specific mention of ozone and a reference to Cora Randall et al.'s work, they being the source of the proxy maps used in our on-going investigation (see Footnote 1 in the manuscript). We would prefer not going into greater detail here, simply because we do not want to distract the reader from the main purpose of the current paper.

Sect. 2.1 (higher-order Rayleigh effects): The Referee has made an excellent point about potential effects from Rayleigh scattering *into* the DIAS field of view. The instrument of course accepts not only the direct attenuated solar flux (L°) but also a contribution from atmospheric scattering (L^*), which effectively increases the apparent transmission of the direct solar beam.

In order to explain this thoroughly, we have extended Sect. 2.1 (also adding Eq. (4)), including a discussion of the theoretical basis for the higher-order Rayleigh effects, clearly defining the terms L° and L^*. We clarified why a 3.6° DIAS field of view was used, in Sect. 3.1.1. We also added another paragraph to Sect. 3.2 (Retrieval implementation) explaining the higher-order effect and when it is important, based on radiative transfer modeling, and the rationale behind our choice of a minimum wavelength of 320 nm in the retrieval. In Sect. 3.2.2 (Sample retrieval and comparison with measured spectra), we have added the comment that some of the retrieval–DIAS discrepancy at large SZAs and at short wavelengths (see Fig. 3b) may in fact be the result of this scattering contamination. And finally, we added a paragraph to Sect. 4.5.2 (Retrieval accuracy) discussing when the effect may not be entirely negligible, what the impact would be, and why the overall impact on this analysis is small.

Sect. 2.1 (iteration of LOS composition profiles in minimization): The line-of-sight composition profiles were not iterated. This is now stated in Sect 3.2 (Retrieval implementation).

Sect. 2.1 and 3.1.1 (typographical suggestions): Both have been adopted, as suggested.

Sect. 3.1.1: The laboratory calibrations of DIAS were performed at NCAR. This is now explicitly stated.

"Sect. 3.2 and Figure 3": The discussion in the first paragraph of Sect. 4 led to a misunderstanding for both referees. When we stated that the difference between the ozone column density at 320 and 600 nm was less than 1%, we meant that the *actual,*

ACPD

4, S3479–S3481, 2004

true column density, although a function of wavelength (because refraction causes the LOS to be slightly different, as a function of wavelength), was less than 1% different at 320 nm as compared to 600 nm. The retrieval used in this paper simultaneously utilized both the Huggins and Chappuis bands. The wording of this paragraph has been changed to make the point more clear. Retrievals based solely on the UV and visible parts of the spectrum (not shown) do not generally agree to within 1%.

The Chappuis cross sections are from a measurement compilation by Shettle and Anderson (1995), based on the work of Burkholder and Talukdar and Anderson et al. This has been added to the table.

Figure 6: The Referee suggests that the AATS-14 and DIAS results in Fig. 6 are not sufficiently visible. Although it is difficult to discern the symbols, we feel that the coloring makes the figure very legible. (Perhaps we misunderstand the referee comment.) Please let us know if a change is desired.

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