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Interactive Comment

Interactive comment on "Ozone mixing ratios inside tropical deep convective clouds from OMI satellite measurements" *by* J. R. Ziemke et al.

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This paper describes satellite ozone measurements inside tropical deep convection clouds by applying the cloud slicing techniques to column measurements from OMI. This is an extension of earlier works by the same author on tropospheric ozone derived from column measurements. The cloud slicing technique has been first reported by Ziemke et al. (2001) and is particularly suited to determine upper tropospheric ozone. In Ziemke's paper from 2001, cloud information from an infrared radiometer (THIR) were combined with TOMS ozone data. In this paper they derive the cloud information directly from OMI using rotational Raman scattering. One important result from this paper is that the effective (Lambertian) cloud tops derived in the UV spectral range are considerably lower than IR cloud tops, the latter are closer to the "visible" (physical)

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cloud top. This means that the cloud slicing technique can retrieve upper tropospheric ozone beneath the top of convective clouds in the tropics.

The second major results are the findings of near zero upper tropospheric ozone in regions of high convective clouds above the Pacific tropical regions, confirming results from other studies. Origin of the very low ozone assumed to originate from the marine boundary layer are qualitatively discussed. The near zero upper tropospheric ozone provides a justification of the CCD method that obtains tropospheric columns by subtracting from clear-sky total columns, stratospheric columns measured above Pacific high clouds.

This paper is well written and should be published after responding to some issues related to Section 4 (Sensitivity of UV to O3 inside deep convective clouds) that in my opinion is somewhat superficial. The authors here evaluate errors and sensitivity in retrieved tropospheric ozone vmrs when assuming Lambertian clouds instead of the more accurate cloud extinction profile from CLOUDSAT/MODIS. Despite an error of 10% in the radiances at 323 nm, they claim that the derived ozone vmr will not differ assuming a well mixed troposphere (constant vmr in the troposphere). This seems to me a very handwaving argument and this point should be elucidated in more detail. Since most cloud retrievals in the UV/visible are based upon the assumption of a Lambertian reflecting surface this becomes a very important issue. The true error with respect to a use of a correct cloud extinction profiles is not really shown here, but should be given here.

It is conceivable that a constant bias in the "Lambertian" cloud-top pressure (UV cloud parameter) from an IR derived cloud top (as used in Ziemke et al. 2001) would provide identical results, since the slope (as shown in Fig. 4) is not affected by s ahift in the pressure-axis. Some discussions should be provided here if cloud slicing results are different by using IR derived cloud top heights as in their past work in order to document the improvement achieved by using the "centroid" cloud-top pressure derived from UV spectral observations.

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Minor issues:

p. 16385, l. 2: "UV-2" probably meant "UV". The spectral range of OMI is not divided in channels (CCD imaging technique), so suggest to simply say "UV and visible spectral region".

p. 16385, last paragraph: It is important here to mention that all satellite DOAS techniques as applied to GOME, SCIAMACHY, OMI, and GOME2 satellite data derive total column amounts using cloud parameters retrieved with the same instrument. Conversely, it seems surprising that TOMS V8 seemed to work so well using only a cloud climatology. I suggest to mention the use of retrieved cloud parameters in the total column DOAS retrieval by referencing to relevant papers (e.g. Roozendael et al. 2006, Coldewey-Egbers et al. 2005, Eskes et al., 2005, Kroon et al., 2008).

p. 16392, l. 8: I would call a comparison given for two months (October 2005 and October 2006) not really a "validation", but rather call it "verification". Validation would require a more comprehensive comparisons covering more months and other seasons from the four year data available from AURA.

Figure 2. Is the IR cloud top correct here (the same as in Fig. 1?), it seems to be well above the physical cloud top? Please explain.

References:

Coldewey-Egbers, M., Weber, M., Lamsal, L. N., de Beek, R., Buchwitz, M., and Burrows, J. P.: Total ozone retrieval from GOME UV spectral data using the weighting function DOAS approach, Atmos. Chem. Phys., 5, 1015-1025, 2005.

Eskes, H.J., van der A, R.J., Brinksma, E.J., Veefkind, J.P., de Haan, J.F., and Valks, P.J.M.: Retrieval and validation of ozone columns derived from measurements of SCIAMACHY on Envisat, Atmos. Chem. Phys. Discuss., 5, 4429-4475, 2005.

van Roozendael, M., Loyola, D., Spurr, R., Balis, D., Lambert, J.-C., Livschitz, Y., Valks, P., Ruppert, T., Kenter, P., Fayt, C., and Zehner, C.: Ten years of GOME/ERS-2 total

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ozone data. The new GOME data processor (GDP) version 4: 1. Algorithm description, J. Geophys. Res., 111, D14311, doi:10.1029/2005JD006375, 2006.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 16381, 2008.