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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Glyoxal vertical columns from GOME-2 backscattered light measurements and comparisons with a global model" *by* C. Lerot et al.

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Page 21157, line 5: "The systematic errors on the slant column densities (_S,syst) mainly originate from uncertainties in the reference cross-section data sets and their cross-correlations. The systematic errors due to the glyoxal cross-sections have been estimated at 13%, which is the mean relative difference between the cross-sections of Volkamer et al. (2005a) and those measured by Horowitz et al. (2001) with a lower spectral resolution."

It would be helpful if the authors could separate more clearly the effect of (1) uncertainties in the reference cross-section data and (2) cross-correlations. Notably, in recording

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their cross section, Horowitz et al., (2001) observed deviations from Lambert-Beer's Law of up to 15%. An explanation was provided by means of high-resolution cross-section modeling (Volkamer et al., 2005a) that demonstrated this non-linear behavior is caused by the considerable ro-vibronic structure, which, when observed at low spectral resolution, results in the apparent absorption to become dependent on the column density of glyoxal. As recognized by the JPL evaluation panel 'The UV spectrum reported by Volkamer et al. is further consistent with IR spectral parameters, for which glyoxal photolysis is not a problem, and which were obtained by simultaneous recording of UV and IR spectra in identical glyoxal fillings of the absorption cell.' Notably, the UV spectrum agrees within 5% with several IR spectra, better in instances. The discussion of systematic error sources currently ignores this knowledge, which might alter the magnitude and apportionment of uncertainty.

Page 21158, line 19; also Fig. 7: The authors discuss the effect of cloud factions on the AMF for "two opposite glyoxal profiles: one peaking at the surface and the other being constant in the troposphere", but remain rather vague in terms of the actual profile shape used in these calculations (Table 2). From Figure 7, however, it appears that for both profiles most glyoxal is taken to reside above the cloud layer (top height 2km). Else, how can the authors explain that the AMF is independent of the cloud fraction? Can the authors make a more explicit case that the assumed vertical distributions are indeed 'opposed' in terms of conservatively bracketing uncertainty? How would the AMF sensitivity, and the error apportionment change if all glyoxal was indeed located in the MBL (<700m according to the authors)?

Page 21162, line 28: "Assuming a uniform glyoxal concentration in the marine boundary layer (z<700 m, based on ECMWF analyses), the vertical column densities corresponding to these ship measurements reach 3×1014 molec/cm2, consistent with our glyoxal observations from GOME-2 and those from SCIAMACHY (Vrekoussis et al., 2009)."

How is a boundary layer profile (up to 700m, according to the authors) consistent with

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Figure 7? Some explanation would be helpful how the argument about vertical glyoxal distributions, and apparent agreement with the MBL profile supported by the ship measurements are internally consistent. Wouldn't a MBL profile of glyoxal be shielded for the view from space at the higher cloud fractions? It would help if the authors could include a figure that shows the vertical distributions assumed in their retrievals (substitute for Table 2), and bind uncertainty in terms of unmeasured vertical distributions in a consistent and conservative error analysis that reflects our current knowledge, or - unless supported by measurements - lack thereof.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 21147, 2010.