

Interactive comment on “Profiling of formaldehyde, glyoxal, methylglyoxal, and CO over the Amazon: Normalised excess mixing ratios and related emission factors in biomass burning plumes” by Flora Kluge et al.

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The reviewers comments are written in **bold**, our responses are marked with AC (authors comments).

We are very grateful to the reviewer for his comments and overall very positive assessment of our manuscript, to which we react in the following way.

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Comments:

Lines 172-182: The writing in this paragraph is somewhat confusing. The statement of UV/vis limb measurements dividing the atmosphere in to three parts (a, b, and c) applies not only to O₄ absorption but also to the absorption of the targeted species. But here the authors only discussed the implication for O₄ absorption (i.e., b-c dominates, which is also true for the targeted species here). What are the implications for the retrievals of the targeted species?

AC: In order to clarify this, we added in lines 182-184 and 190-192: “In the following, we discuss the significance of the different contributions exemplarily for O₄. Evidently, the same tri-partitioning applies for all other gases of interest, however differently weighted as expressed by the respective alpha-factors.”

“Figure 2 illustrates the contributions to OD_{meas} at 343.7 nm (panel 1a) and 477.3 nm (panel 2a) for O₄ as a function of the flight time for Sept. 16, 2014.”

Lines 194-197: “From the above discussion, ... volume.”: Can the authors say something about the estimated size and orientation of this averaging volume?

AC: Lines 203-206 have been changed to: “From the above discussion, it also becomes clear that our air-borne UV/vis limb measurements average over some atmospheric volume, which is determined by the viewing angle of the telescope lenses (0.3°), the light path length, and the aircraft displacement during the time of measurement, both of which are in the order of several kilometers (for details see sect. 3, and fig. 6). This large sampling volume precludes direct comparisons with in situ measured quantities on spatial scales smaller than the current averaging volume.”

Other minor comments:

Line 13: “applaying” should be “applying”

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AC: The typo has been corrected accordingly.

Line 31: Extra “is” after C3H4O2*. Please remove.

AC: The extra ‘is’ has been erased.

Line 52-69: Missing key reference for the global budget of glyoxal: Myriokefalitakis et al. (2008) Myriokefalitakis, F., M. Vrekoussis, K. Tsigaridis, F. Wittrock, A. Richter, C. Brühl, R. Volkamer, J.P. Burrows, and M. Kanakidou, 2008: The influence of natural and anthropogenic secondary sources on the glyoxal global distribution. Atmos. Chem. Phys.,8,4965-4981, doi:10.5194/acp-8-4965-2008.

AC: The missing reference has been added in line 64-65: “Satellite observations have shown strongly enhanced vertical column densities of atmospheric glyoxal above this region (e.g., Myriokefalitakis et al., 2008).”

Lines 85-87: “In comparison to satellite. . . biogenic precursors.” This statement is missing references.

AC: The sentence has been changed in lines 88-90 to: “In comparison to satellite measurements from SCIAMACHY and GOME-2, several studies have found evidence that the models underestimate global glyoxal emissions, when not considering additional biogenic sources (Myriokefalitakis et al., 2008, Stavrou et al., 2009b, Lerot et al., 2010).” Accordingly, the following references have been added:

Myriokefalitakis, S., et al. "The influence of natural and anthropogenic secondary sources on the glyoxal global distribution." (2008).

Stavrou, T., et al. "The continental source of glyoxal estimated by the synergistic use of spaceborne measurements and inverse modelling." (2009).

Lerot, C., et al. "Glyoxal vertical columns from GOME-2 backscattered light measurements and comparisons with a global model." Atmos. Chem. Phys. 10.24 (2010): 12-059.

Line 241: Remove “either of”

AC: The text has been rephrased accordingly.

Line 250: “several 100m” should be “several hundred meters”

AC: The text has been rephrased accordingly.

Figure 8 caption: “The colour coding in panels (e)), and (g)” should be “(e) and (f)”

AC: The text has been rephrased accordingly.

Line 368: Extra “)” after (Fu et al., 2008). Also, there was no budget analysis for formaldehyde in Fu et al. (2008). Please cite a relevant reference.

AC: The additional “)” refers to line 383-385: “(mostly...Fu (2008)).” The sentence has been changed to: “Besides their common dominant precursor, additional sources of the gases differently influence their local distribution (mostly combustion processes and oxidation of other biogenic/anthropogenic hydrocarbons in the case of formaldehyde (Lee et al., 1998, Liu et al., 2007, Fortems et al., 2012), oxidation of acetylene in the case of glyoxal, and oxidation of acetone in the case of methylglyoxal (Fu et al., 2008)), and might therefore differently contribute to our measurements. A recent study additionally discussed the oxidation of aromatics as possible relevant source of atmospheric glyoxal and methylglyoxal (Taraborrelli et al., 2020).” These additional references for the budget analysis of formaldehyde are now included:

Lee, Y-N., et al. "Atmospheric chemistry and distribution of formaldehyde and several multioxygenated carbonyl compounds during the 1995 Nashville/Middle Tennessee Ozone Study." *Journal of Geophysical Research: Atmospheres* 103.D17 (1998): 22449-22462.

Fortems-Cheiney, A., et al. "The formaldehyde budget as seen by a global-scale multi-

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constraint and multi-species inversion system." Atmospheric Chemistry & Physics Discussions 12.3 (2012).

Liu, L., et al. "Photochemical modelling in the Po basin with focus on formaldehyde and ozone." (2007).

Line 733: Capitalize "C" in Nature "communications".

AC: Communications has been capitalized.