

Interactive comment on “Detection of Outflow of Formaldehyde and Glyoxal from the African continent to the Atlantic Ocean with a MAX-DOAS Instrument” by Lisa K. Behrens et al.

Anonymous Referee #1

Received and published: 4 February 2019

This study presents first MAX-DOAS observations of formaldehyde and glyoxal in the Atlantic Ocean caused by transport of air masses coming from Africa. The paper is well written and the results appropriately discussed, with sufficient evidence to demonstrate that the observed signals of HCHO and CHOCHO are real and that their origin is relatively well understood. This is a valuable contribution to the understanding of VOC concentration levels that can be observed remotely from their known sources. A mechanism explaining how the HCHO/CHOCHO precursors could be transported so far away from their sources is proposed in the discussion, which would require further investigation but is beyond the scope of this work. This work is well suited for publication in ACP. I have only a few comments, which I ask to be considered before the

C1

publication.

Comments:

- Page 15; line 29: The MAX-DOAS measurements do not show strongly enhanced values on 14th October, on contrary to MOZART-4 data. Please clarify and discuss this. It is also interesting to see that MOZART shows elevated values for that day for HCHO but not for glyoxal. Do you have any explanation for this?
- Page 16; lines 17-19: I don't find the explanation to rule out the AMF as potential source of the differences very convincing. If I understood well, profile shapes from MOZART are used for the slant to vertical column conversion in the MAX-DOAS analysis. Are those profiles also used for the satellite retrievals? Please mention which a priori profiles are used in the satellite retrievals. Because of the different observation geometries, an error in the a priori profile shape would impact differently the satellite and MAX-DOAS retrievals. Also, from Figs. 13 and 14, one can clearly see that the MOZART profile shapes change in time/latitude. So the argument that an error caused by the AMF would be constant in time doesn't seem valid to me. Could you add a figure showing the MAX-DOAS and satellite AMFs as a function of time/latitude so that we can better see what are their respective time/latitude variability's?

Technical comments:

- Page 9; line 12: remove either "several" or "different"
- Page 9; line 14-15: "In this study... satellite measurements." Phrase unclear. Please rephrase.
- Captions 4-5-6: replace "Example for" by "Example of"
- Eq. (7): replace "SDC_ref" by "SCD_ref"

C2

- Page 11; line 6: replace "sensitivity for" by "sensitivity to"
- Page 11; line 19: replace "of degree of 5" by "of degree 5"
- Page 11; line 30: replace "lower SZA" by "larger SZA"
- Caption 7: replace "an linear" by "a linear"; add "than" in "smaller than 92°".
- Page 14; lines 2-3: remove "from Fig. 7" and "shown in Fig. 8"
- Page 14; line 5: add "the" in "related to the degradation"
- Figure 8 and following ones: I would suggest to mention in the caption that the latitudes are plotted from North to South, which is unusual.
- Page 18; line 10: Clarify why enhanced columns indicate that the satellite data are close to the detection limit. Having satellite columns higher than MAX-DOAS data might also be caused by non-zero glyoxal concentrations in the free troposphere (where the MAX-DOAS is not sensitive) or simply by artifacts in the satellite data. Could you add a sentence on this?
- Figures 13-14: I suggest adding altitude information along the y-axis to facilitate the link with the discussion.
- Caption figure 16: This figure refers to 14 October and not 13 I believe (2nd line)
- Caption figure 17: This figure refers to 17 October and not 13 I believe (2nd line)
- Page 23; line 6: Could you add information on the distance from the continent your cruise track was (more specifically for the days of the HCHO/glyoxal) hot spots.

C3

- Page 23; line 32: For Fig 17, the number of fires seems rather limited in the source regions. For that particular case, the precursors are most likely from biogenic origin.
- Page 25; line 27: "these" instead of "this". Please make clear that the presented transport process in this paragraph is a potential explanation as there is no evidence presented in this study supporting particularly this.
- Page 23; line 18: "On 3 respectively 2 days" - Please rephrase.
- Page 23; line 33: See comment above - the number of fires in the source region is quite limited for 17th October.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-1286>, 2019.

C4