

Atmos. Chem. Phys. Discuss., referee comment RC2  
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## Comment on acp-2022-455

Anonymous Referee #2

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Referee comment on "Chemical and dynamical identification of emission outflows during the HALO campaign EMeRGe in Europe and Asia" by Eric Förster et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-455-RC2>, 2022

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Review of Chemical and dynamical identification of emission outflows during the HALO campaign EMeRGe in Europe and Asia, by Förster et al.

This manuscript details the use of observations of a few specific VOCs made during two HALO flight deployments to identify the influence of major source types by using threshold values of compounds to identify influence of biomass burning emissions, anthropogenic emissions, biogenic emissions, or combinations of the above. The authors then use back trajectory modeling to attribute and quantify these various contributions back to specific regions.

The presentation of the research is a little tedious to get through, but in general, it seems like a reasonable methodology for broadly assessing air masses sampled at varying distances from their likely sources. I have a few issues with the exact approach, however. One major issue I have is that the authors use in their back trajectory modeling to the PBL is that it discounts biomass burning injection height, and lofting due to convection, which can be significant over the Tibetan Plateau due to the Asian Monsoon. The authors should address this possible contribution and implications in their in their work.

Secondly, the authors appear to put far more emphasis on the value of the back trajectory modeling than in the VOC tracers that they are studying. Lastly, due to the nature of aircraft campaigns, there is an inherent sampling bias to air masses from specific source regions, and that should also be addressed in the paper.

Some more specific comments follow, with a large number of technical corrections below.

Line 37 – consider using "rural areas" instead of "countryside", and perhaps consider that in many countries there is a suburban interface, and identify whether that is "urban" or

"countryside/rural" in the UN statistics.

Line 75 – "(and that provides only one time information based on its lifetime..." is not communicating what the authors are trying to say.

Lines 115-116 – "some 100 km" – from what?, and on the next line, perhaps "source" instead of "target"? since the regions are where the emissions are coming from, not heading to. Also, "concept is mirrored by"... mirrored doesn't seem like the right word here. Also, one might argue that at 100 km, emissions are not exactly fresh. The other reviewer makes very good points about emissions vs. characterizing source concentrations, so I won't belabor that point, but I will echo that it needs to be addressed throughout.

Line 162 – "to the scientific needs" requires more explanation.

Table 3 – is there a reason why some columns are italicized and some aren't? This isn't clear.

Lines 223-225 – it is also not clear to me how nine consecutive 6-s measurements can be reasonably interpolated to 1-s data.

Line 251 – replace reddish colours with "red", as the high emissions are just one colour of red.

Figure 2 – these plots are very difficult to read, and are far too busy. Perhaps reduce the intensity of the background colours so that the text, flight paths, etc. can contrast against the background.

Lines 562-563 – In 19% and 34% of what are negligible contributions inferred? Be specific.

Technical corrections:

Throughout A: "air-mass" or "air-masses" should be changed to "air mass" or "air masses".

Throughout B: remove spaces before % signs (e.g., line 28: "20 %" should be "20%".)

Throughout C: refer to style guide on referencing sections, specifically "The abbreviation "Sect." should be used when it appears in running text and should be followed by a number unless it comes at the beginning of a sentence."

Throughout D: "back trajectories" doesn't have a hyphen.

Throughout E. Be consistent with "up-take" vs. "uptakes" – the latter of which is correct (e.g., Table S4)

Line 38 – "the majority of megacities are still..."

Line 39 – what is meant by "extension"? Maybe not the right word.

Line 48 – "... focused, e.g., on emissions..." (add commas)

Line 50 – there appears to be an extra space after "2008-2011"

Line 54 – "(Andrés Hernández et al., 2000 and references therein)" (remove inner parentheses)

Line 62 – "refer to Andrés Hernández et al. (2000)." (no comma)

Line 83 – "joined" should be "joint"

Line 119 – define ERA5

Line 123 – instead of “local burning”, use “local fire”.

Line 125 – for simplicity, use “chemical age, i.e., chemically old...” rather than “that is”

Line 129 – “starting from” (not form)

Line 135 – “10-day FLEXTRA”, “back trajectories” (no hyphen).

Line 146 – remove the space before  $H_3O^+$ .

Line 151 – “vast majority of VOCs in the atmosphere are” (not is)

Line 152 – delete “further”

Line 156 – “nighttime”

Line 157 – “lifetimes”

Line 162 – “allows adaptations”

Line 164 – limit of detection = LOD, lower detection limit = LDL? Maybe use “lower limit of detection (LOD)”? Also, “in the pptV range”. (no hyphen)

Lines 168-170 – “tropospheric lifetime  $t$ ”, and again, “lower limit of detection (LOD...”  
change “and the up-to four atmospheric main sources” to “... and the up to top four main atmospheric sources.”

Line 178 – maybe “as explained below.”

Line 181 – “lifetime”

Lines 189-190 – “please see details in the supplement” – perhaps instead refer to a specific supplement

Line 205 – “... VOC tracers are...”

Line 218 – “lifetimes”

Line 225 – again, perhaps point to a specific section in the Supplement.

Line 235 – “10-day back trajectories...”

Line 236 – “the time step...” (no hyphen)

Line 251 – replace reddish colours with “red”, as the high emissions are just one colour of red.

Line 265 – delete “Earth’s” (it is redundant.) and perhaps use “trajectory air parcel” instead of air mass.

Line 266 – recommend changing to “... emissions rates at that location.”

Line 272 – replace “exemplary” with “example”

Line 276 – immerses is not the right word here. Even “dips” would be better, or “drops”, “descends”, likely best.

Line 291 – define AMTEX

Line 304 – “... values listed in Table S2).” (S indicates supplement, so “in the supplement” is unnecessary).

Line 357 – “Figures 5 and 6...”

Line 365 – “the blue dot” is very difficult to see. Again – I recommend if possible having a less intense colour scheme for the background colour bar information, so that the details on top can be seen. Same comment for Figure 6.

Line 381 – “some hot spots such as the...”, also include a comma after Madrid.

Line 385 – “More regions have likely...” – begs the question “more than what”? Be specific.

Line 397 – “Coordinates are shown in Table S3.” Is sufficient.

Line 402 – “Figures 7 and 8...”, also, Line 405 – “Figs. 7 and 8...”

Line 411 – BeNeRuhr needs to be defined. And consider whether two short forms (BNR as well) might add confusion.

The text in Figures 7 and 8 in the blue boxes is really difficult to read. Also, for both captions, “(plain) is not a great description. Perhaps use “the last row in each section”, or “the uncoloured row”.

Line 530 – “20 July 2017”.

Line 604 – “fresh biomass burning” or “fresh fires”

Supplement

Line 3 and Table S1 – “Takeoff” and “Departure” are the same thing. I think you mean Takeoff and Landing, or Departure and Arrival. Just a note, as well – this may be the convention for HALO flights, but using ICARTT nomenclature, the flight date is always the UTC departure/take-off date, regardless of how close it is to midnight, UTC.

Line 10 – “measurement noise by”

Line 17 – “4 April 2018”

Line 19 – Instead of writing “To Section 3.1.2, give the various sections in the supplement Section numbers (e.g., Sect. S1, Sect. S2.4, etc.), which will make reader navigation between the main manuscript and the supplement much more straightforward.

Line 42 – “Same applies for isoprene.” Is not a complete sentence.

Line 43 – “This assumption...” or “These assumptions...”

Line 45 – “as an additional tracer...”

Line 48 – this is far too much prose for a Table title. Move most of this to a text paragraph or to table footnotes. Also, the last line “This figure is a supplement...” This isn’t a figure - it’s a table. Also, I recommend only putting “Table X” or “Figure X” in bold, and not the entire title or caption.

Line 58 – “MPCs (in italics) with coordinates...” or “MPCs (italicized) with coordinates...”

Lines 64 and 66 – delete “... in the main document.” (it is unneeded, as sections and tables that don’t begin with S are by definition in the main documents.