Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-1215-RC2, 2021

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Pollution trace gases C_2H_6, C_2H_2, HCOOH, and PAN in the North Atlantic UTLS: observations and simulations" *by* Gerald Wetzel et al.

Anonymous Referee #2

Received and published: 8 February 2021

Review of Pollution trace gases C2H6 , C2H2 , HCOOH, and PAN in the North Atlantic UTLS: observations and simulations

by Wetzel and colleagues

—- General comments

This is a nice paper that showcases measurements of upper troposphere and lower stratosphere composition by the relatively new airborne remote sensing "GLORIA" instrument. The paper does a nice job of describing these observations and using state-of-the-art models and analysis techniques to explore the likely origins of and explanations for the observed abundances.

Printer-friendly version

Discussion paper

Overall, I think this paper is a nice addition to the field, and provides a nice example of the GLORIA capabilities. I fully expect that it will be ready for publication once my comments below (and those from any other reviewers) have been attended to.

My only general comment is that it would have been good to include some discussion of how these observations compare to past observations of these species. Currently this is limited to comparisons to limited-resolution spaceborne remote sounding observations (e.g., the many citations to the Rinsland, Glatthor and Wiegele papers in the manuscript). However, there are a wealth of airborne in-situ observations of many these species in past campaigns (for example the NASA ATOM campaign, among many others from the US, Europe and Asia). Given that GLORIA is a relatively new (but very welcome) addition to the worldwide portfolio of airborne instruments measuring atmospheric composition, and that it is one of the few employing remote-sounding (particularly for such a wide range of species), and further, given the general skepticism some in the community have toward remote sounding observations, some additional statements as to how the GLORIA findings compare to available in situ observations of the same species at similar altitudes/latitudes/seasons, etc. would help cement the value of the GLORIA dataset in the community mind set.

—- Specific comments

Sentence spanning lines 24/25: Reword to "Elevated quantities of PAN were measured even in the lowermost stratosphere (locally up to 14 km), likely reflecting the fact that this molecule has the longest lifetime of the four species discussed herein."

Sentence spanning lines 43-46: Better to split into two sentences along the lines of "... conditions. In particular, rapid vertical transport by deep convection followed by strong horizontal transport associated with the upper troposphere subtropical jet stream ([citations]) is a particularly efficient means by which surface pollutants can be transported long distances.

Line 47: Think that the "that" would be better as ", which" in this case.

Line 56: "such that C2H6 may be" -> "enabling it to be"

Line 64: "are important <contributors to the tropospheric abundances of this molecule>" or something similar.

Line 66: "like" -> "such as the"

Line 105: "using" -> "observing" (to avoid having "using" twice in quick succession)

Line 154: I think something like "Test retrievals were used to identify microwindows that combine limited overlap of spectral signatures of disturbing gases with a high sensitivity to changes in the abundance of target gases." would be better wording.

Line 252: comma needed after "that"

Lines 257-287: As discussed above, it would be good to compare a small number of the wealth finding from airborne in-situ observations of these species.

Line 262: "stronger enhanced" -> "strong enhancements of"

Line 263: "what" -> ", which"

Line 265: "picture" -> "behavior"

Line 291: "with respect to" -> "given the", also "in" -> "of"

Line 292: "Concerning" -> "For"

Line 293: "principally" -> "generally"

Line 302: "The comparison of" -> "Comparisons for"

Line 311: "For C2H2 we note that EMAC predicts elevated concentrations in much the same region where GLORIA reports enhancements (see ...)"

Line 311-317: Again, this would be a good place to mention in situ comparisons.

Line 430-434: The sentence "However, the real...". I'm afraid I don't understand what

this sentence is trying to say. Does CLAMS not have emissions for these specific species on some kind of fine spatial resolution (EDGAR, MEGAN, etc.?) Please clarify what is meant by " the real regions".

Line 461: Remove "(primarily CAMS)" and add ", particularly for CAMS" at the end of the sentence.

Line 525: Some weird cut and paste typo in citation

Line 679: Extra space between "O" and "3" in citation

Line 746: "n/a-n/a" in citation.

Figures 2-5 are nicely put together.

Figure 6 (and 7): The grey line is hard to see, make it thicker. The dashed magenta line is very hard to see. I suggest you make it white and thicker (and possibly not dashed?). "...mark regions with enhanced VMR levels" - not for O3, perhaps clarify "primary pollutant VMRs" or something like that?

Figure 9: This is very hard to see given the colored continents/oceans. As pretty as they are I'd suggest a grey-scale version of the background image, or ideally just white oceans and very pale grey continents (single color, no mountains or things like that).

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1215, 2020.

Printer-friendly version

Discussion paper