

Central role of nitric oxide in ozone production in the upper tropical troposphere over the Atlantic Ocean and West Africa, I. Tadic et al., ACPD, 2021

General Description:

The authors use aircraft observations of ozone and NO to estimate net ozone production rates in the upper troposphere over the Atlantic Ocean and West Africa. They determine that ozone production is NO_x-limited. My recommendation is substantial changes to the manuscript before this should be considered for publication in ACP. These are detailed below.

General Comments:

The introduction does not provide the reader with context for what's known about the region and the time period sampled. The introduction details well-established ozone chemistry, rather than referring to prior publications that focus on ozone chemistry in the region. These include, but are not be limited to, publications that make use of observations from previous and ongoing flight campaigns in West Africa and over the Atlantic (AMMA, DACCWA, MOZAIC, IAGOS, CARABIC, ATom). URLs to some relevant publications are provided in the References section of this review. An introduction specific to the target region would clarify whether the finding in this study is in dispute, known already, or contrary to what's been found before.

Similarly, the results section should be compared to results published in the literature from previously published research.

The measurement techniques the researchers use are established techniques, so instead dedicate the methods section to describing the aspects of these that are unique and relevant to your study.

Avoid unfamiliar and unnecessary acronyms when there are mathematical symbols or familiar letters that would be easier for the reader to follow. NOPR, RMU, and TMU are not universally familiar. For NOPR, for example, consider rather using P(O₃)_{net}. P(O₃)_{gross} could then be used to distinguish the two. Many acronyms in the paragraph starting on line 111 seem unnecessary and make it a challenge to read.

Specific Comments:

Line 118: How does the flight ceiling compare to the tropopause height during the flight campaign?

Figure 1 caption: Provide dates instead of flight numbers. The former are more meaningful.

Line 190: What domain does the model simulate? Global?

Section 2.4: Are soil NO_x emissions in the model? If so, give the name and reference of the inventory. If not, would this contribute to the model-measurement discrepancy in NO in the lower troposphere?

Line 198: What is “tg”? Do you mean “Tg”?

Line 211: Format of the in-text citation of Tadic et al. is incorrect.

Line 213: What does “Therewith” mean? Is it necessary?

Lines 217-221: This is a very lengthy sentence that makes for challenging reading.

Lines 219: Tell the reader what “PSS” is.

Lines 225-226: The dominant loss pathway for HCHO leading to the formation of HO₂ is photolysis. If this loss pathway is also taking into account, is HO₂ production from HCHO still negligible?

Equation (6): Is the righthand side of this equation just “P(O₃)_{gross} – L(O₃)”? If so, consider rewriting it to this so that it is clearer that this relates to what’s given in equations (2) and (5).

Line 231: It’s not clear whether the quoted values are calculated in this work or are from a previous study. Reword for clarity.

Figure 2: Considering the simulated NO variability extends into the negative, provide the min and max values of the modelled and observed NO.

Lines 252-253: Why would there be influence from the stratosphere if this has been removed using an ozone concentration threshold?

Line 309: Avoid subjective words like “Interestingly”.

Line 433: Change “Please note that there ...” to “There ...”.

Line 432: Was there any doubt or contention that the upper troposphere is NO_x-limited over this region?

Figure 7: Give the number of data points in each NO concentration bin.

Line 445: Should “tropical troposphere” be “upper troposphere in the tropics”, as this is the focus of the study according to the title.

References:

A sample of a few publications relevant to ozone formation in West Africa. There are more.

<https://acp.copernicus.org/articles/9/6135/2009/>

<https://acp.copernicus.org/articles/20/10611/2020/acp-20-10611-2020.pdf>

<https://science.sciencemag.org/content/304/5676/1483>

<https://acp.copernicus.org/articles/19/3257/2019/acp-19-3257-2019.pdf>

<https://hal.archives-ouvertes.fr/hal-00569542/document>

<https://acp.copernicus.org/articles/7/1193/2007/acp-7-1193-2007.pdf>