This paper “Long-term measurement of ozone concentrations in semi-natural African ecosystems”, presents long-term (1995-2020) data on ozone concentrations across diverse African ecosystems. The analysis, based on passive samplers deployed at 14 sites, explores seasonal variations, long-term trends, and the influence of local factors like temperature, precipitation, and precursor emissions on ozone formation. This research fills a critical data gap for understanding ozone behavior in Africa, a region with limited such measurements. Therefore, I recommend publication after the points are considered.

Abstract

Line 25, page 1:
Atmospheric levels: could you be more precise? How do you define the atmosphere in terms of height?

Line 30, page 1:
Over the period 1995-2020, monthly ozone concentrations were measured at these sites using passive samplers
How do you get ozone levels in the atmosphere using passive samplers?

Line 32, Page 1:
Ozone levels in the wet season (in dry savanna) are higher and comparable to concentrations in the dry season (in wet savanna and forest).

I find this sentence a bit confusing. Does it compare ozone levels in dry savanna with wet savanna and forest? Does ozone levels refer to the whole troposphere?

Lines 33-34, page 1:
You mention East Africa, Southern Africa and Sahel, while before you group the sites depending on the ecosystem they belong to. How are these geographical regions defined? Does each region correspond to one ecosystem? With other words, it's not clear to me if the characteristics are due to the geographical location of the sites or because they belong to the same ecosystem.

Lines 34-39, page 1:
How do you support the dependence of ozone levels to different factors such as temperature, NOx emissions etc? How do you distinguish the effect of anthropogenic NOx emissions? Do you use any chemical transport model and sensitivity tests or these results are based on other studies?

Line 44, page 2:
The increasing trends are consistent with the increase in biogenic emissions at Zoétélé and NO2 levels at Skukuza.

The increase in biogenic emissions and NO2 levels results from this study?

Introduction

Lines 94-105, page 3:

This part could be more informative by discussing the main finding for ozone in Africa, rather than listing the previous studies.

Line 112-114, page 3:
In the first objective, we first document the long-term (1995-2020 depending on the site) monthly, seasonal and interannual variability of O3 concentrations on a regional scale at fourteen sites grouped by ecosystem (dry savannas, humid savannas, forests and agricultural/semi-arid savannas),

Grouped by ecosystem: does it mean that you merge measurements from different sites if they belong to the same ecosystem? Or do you analyse the measurements of each site separately?

Material and methods

2.1 Sampling sizes
Lines 141-143, page 4:
The abbreviations for the sites are confusing and hard to remember. It makes it hard for the reader to understand the site you are referring to.

Line 151, page 5:
Figure 1: how are the sites ordered on the map? The map would be easier to read if you order the sites by increasing longitude.

2.2 Passive sampling and chemical analysis
Table 2, page 5:
Why is the measurement altitude different for the forest sites?

In Lamto, the sampling period is 2001-2020 and the data collection efficiency is 226/240. What do the numbers mean exactly? Please clarify. The number of months of the sampling period is 228. Is it 226 monthly measurements taken into account for the period 2001-2020?

The sampling period is quite different depending on the site (e.g 2017-2020 and 1995-2020). How do you assess the statistical significance of the measurements or the trends? How do you compare trends or ozone levels while the sampling period is different depending on the site?

2.3 Meteorological parameters and leaf area index
Lines 173-184, page 6:
What difference does it make that you use different datasets for the meteorological parameters depending on the site?
Have you tried to compare data from AMMA-CATCH database/INDAAF database with the ERA5 data for the common location? What is the consistency between the different datasets?

2.4 NOX and VOC emissions
Lines 197-199, page 7:
The biogenic NO fluxes used are model outputs in reference to the work of Delon et al. (2010, 2012). They were filtered in the eastern grid from 5° S to 20° N in latitude, and 20° W

to 30° E in longitude over the period from 2002 to 2007 and cover only the Ba, Ka, Ag, La, Dj, Zo and Bo sites.

What does the phrase "*model outputs in reference to the work of Delon et al. (2010, 2012).*" mean? Please clarify.
I interpreted this phrase as you used the model output produced by Delon et al. 2010 and 2012? If yes, have you considered using more up-to-date model output and emission inventories?
Why do you use data for the period from 2002 to 2007? Why does this period not match the sampling period of the sites (Table 2)?

2.5 Statistical analysis
General comment:
The application of PCA to identify factors controlling ozone concentration raises significant concerns. PCA assumes linearity in variable relationships, which may not hold true for ozone formation processes involving precursor emissions and meteorological conditions. This raises concerns about the interpretability and validity of the results. Considering alternative methods like machine learning techniques designed to handle non-linear relationships would be more appropriate for this type of analysis. At least, it's crucial to acknowledge the limitations of PCA in establishing causal relationships between ozone and its controlling factors.

Line 221, page 7:
The use of some references (e.g. Tsuyuzaki et al., 2020) to justify PCA analysis seems outside the usual scope of atmospheric research. Considering established applications of PCA in atmospheric science for analyzing ozone surface data would be more relevant.

Results and discussion

3.1 Meteorological and biophysical parameters variation
Lines 231-245, pages 7-8:
This paragraph focuses on describing the content of Figure 2. It would be more informative to analyze and explain the underlying mechanisms driving the patterns observed in Fig. 2. Several relevant studies by LAERO (e.g. Adon et al. 2010; Lannuque et al., 2021; Sauvage et al., 2005; 2007; Tsivlidou et al. 2023) explore the African meteorology (e.g. ITCZ, Harmattan, monsoon). Using these explanations, the authors could enrich the discussion and explain the seasonal variations evident in Figure 2.

Adon, M., Galy-Lacaux, C., Yoboué, V., Delon, C., Lacaux, J. P., Castera, P., Gardrat, E., Pienaar, J., Al Ourabi, H., Laouali, D., Diop, B., Sigha-Nkamdjou, L., Akpo, A., Tathy, J. P., Lavenu, F., and Mougin, E.: Long term measurements of sulfur dioxide, nitrogen dioxide, ammonia, nitric acid and ozone in Africa using passive samplers, Atmos. Chem. Phys., 10, 7467–7487, https://doi.org/10.5194/acp-10-7467-2010, 2010.

Lannuque, V., Sauvage, B., Barret, B., Clark, H., Athier, G., Boulanger, D., Cammas, J.-P., Cousin, J.-M., Fontaine, A., Le Flochmoën, E., Nédélec, P., Petetin, H., Pfaffenzeller, I., Rohs, S., Smit, H. G. J., Wolff, P., and Thouret, V.: Origins and characterization of CO and O3 in the African upper troposphere, Atmos. Chem. Phys., 21, 14535–14555, https://doi.org/10.5194/acp-21-14535-2021, 2021.

Sauvage, B., Thouret, V., Cammas, J.-P., Gheusi, F., Athier, G., and Nédélec, P.: Tropospheric ozone over Equatorial Africa: regional aspects from the MOZAIC data, Atmos. Chem. Phys., 5, 311–335, https://doi.org/10.5194/acp-5-311-2005, 2005

Sauvage, B., Gheusi, F., Thouret, V., Cammas, J.-P., Duron, J., Escobar, J., Mari, C., Mascart, P., and Pont, V.: Medium-range mid-tropospheric transport of ozone and precursors over Africa: two numerical case studies in dry and wet seasons, Atmos. Chem. Phys., 7, 5357–5370, https://doi.org/10.5194/acp-7-5357-2007, 2007.

Tsivlidou, M., Sauvage, B., Bennouna, Y., Blot, R., Boulanger, D., Clark, H., Le Flochmoën, E., Nédélec, P., Thouret, V., Wolff, P., and Barret, B.: Tropical tropospheric ozone and carbon monoxide distributions: characteristics, origins, and control factors, as seen by IAGOS and IASI, Atmos. Chem. Phys., 23, 14039–14063, https://doi.org/10.5194/acp-23-14039-2023, 2023.

Figure 2, page 9: the range of the left and right axes differ depending on the site. This makes it harder for the reader to make comparisons between the different locations**.**

Figure 3, page 10:
Too low O3 surface concentrations compared to Tsivlidou et al 2023- Sahel (their fig. S3 panel 1a). Do you have any idea why?

Table 3, page 11: What does ‘moy’ stand for?

Figure 6, page 13:
Too low concentrations compared to Tsivlidou et al., 2023- Central Africa (their fig. 3 panel 1b)? Any idea why?

Figure 9, page 15:
The location markers in Fig. 9 (especially locations 1–7) do not match the ones from fig. 1 (page 5).

3.3.1 NOx and VOC anthropogenic emissions & 3.3.2 NOx and VOC natural emissions:

To streamline the flow of the text, it might be beneficial to consider consolidating sections 3.3.1 and 3.3.2. Some of the key reasons for the ozone peaks and their seasonal patterns have already been established earlier. Merging these sections would reduce redundancy and maintain a focused narrative.

3.4.2 Characterisation of O3 precursor emission sources and studies of correlations

Similar to the previous comment above, there appears to be some repetition of explanations and citations within 3.4.2. To enhance readability, particularly given the paper's length, combining this section with other paragraphs discussing ozone features (e.g., 3.2.1, 3.3, 3.4.2) could be explored. This would allow for a more concise and focused presentation of the findings.

For improved readability and reduced redundancy, I recommend exploring the possibility of consolidating sections discussing ozone features. This could involve merging 3.2.1, 3.3, and 3.4.2 into a single, well-organized section that succinctly explains the observed phenomena.

3.5.1 Annual trends
Figure 15, page 26:
What could cause the maxima of O3 over Katibougou (a and b) and Banizoumbou (d) in 2014?

Conclusions:

Line 628, page 28:
What do you mean that the different *photochemical regimes* are discussed in the study?

Technical suggestions:

Line 76, page 2:
(Gaudel et al., 2018; Fleming et al., 2018; Mills et al., 2018) should be (Fleming et al., 2018; Gaudel et al., 2018; Mills et al., 2018)