

Interactive comment on “Airborne measurements of fire Emission Factors for African biomass burning sampled during the MOYA Campaign” by Patrick A. Barker et al.

Anonymous Referee #2

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The authors present results from two airborne studies performed in 2017, and 2019 over Senegal and Uganda, respectively, in order to investigate fire emission factors from African biomass burning plumes. The manuscript is well written and easy to follow. Comments above are mostly suggestions in order to improve the visualization of the graphs and present the comparisons to other studies in a clearer manner.

Comments

Line 196: Please discuss possible instrument interferences of N₂O.

Line 250: Overflowing with what? How does someone correct for humidity changes? Is there an ambient air catalyst converter for this purpose? It would be informative to

include an inlet setup for the CIMS in the SI for the reader to be able to follow the details if they feel the need to.

Line 410: It should be mentioned somewhere in the manuscript that methane was synchronized to the canister start stop times. Was it by calculating averages or medians or integrated signal?

Line 411: The lesser extent is only supported by 1 data point. Only C005 shows a consistent trend. No suggestion can be made for the other flights. Please make it clear in the text. Also, in Fig. 4 it would improve the comparison if the authors add the intercepts from previous studies to the graph as horizontal lines with their uncertainty as shaded background. This way the comparison to previous studies will be better supported.

Line 416: The authors suggest that in Uganda the Keeling plot analysis could not be used. Could the authors show a Figure of this in the SI in comparison to Senegal?

Line 421: I wouldn't consider this a forest rather than a combined forest & grassland area based on this one picture (the quality of the picture is not great). This is also mentioned by the authors later in the text. Please rephrase and consistently mention throughout the manuscript.

Line 419-440: Even if the emissions are a mixture of forest and grassland I don't understand why this wouldn't be consistent for both the isotopic analysis and the EFs. The influence of grassland burning is reflected both in the MCEs and EFs but not the isotopic ratios. What is the isotopic intercept difference of C3 forest litter and C4 tropical grasses and maize? Is the difference dramatic? I think the discussion in this section could be improved by mentioning all the parameters that can affect both the isotopic ratio and EF calculations and then conclude which one is expected to play a dominant role in the observed differences. Also, could these differences be related to different parts of the plume being sampled from the different inlets (CH4 vs Canisters) at different parts of the plain? How far away were the two instrument inlets? If the plumes are

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not dense could this become an issue?

Line 575: Visual observations don't strongly support this.

Calculation of the slope to CO based on a linear fit is how the authors determine the ERs for the far-flights. It will improve comparisons if the authors apply this approach for the other flights and determine whether they observe any substantial differences compared to equation 1.

Figure comments

Figure 3: I would recommend restructuring the Fig. in order to make it more instructive. Some suggestions below: Exclude (a) and keep only (b) this way you have a longer timeseries for the reader to look at. Split x-axis to 7 axes that are plotted against the same y-axis. Each x-axis will show an individual plume crossing (in total 7 plumes, 7 x-axes) zoomed in to the respective plume and their backgrounds. Please do the same for Fig. 5 and all the other flights in the SI.

Figure 6: It would be informative if the flight tracks are shown in one of the two maps. This graph could also be moved to the SI.

Figure 7: Would the ratio of HCN / HNCO change depending on the particle humidity and therefore the more efficient uptake to the particles of HNCO? I guess it will not be significant compared to the emission differences but maybe an interesting topic to discuss here.

Figure 10: Make the extreme markers smaller and grey.

Technical comments

Line 259: Maybe delete FIGAERO-CIMS instrument analysis software and just include the ARI Tofware version 3.1.0. Readers may be confused when reading FIGAERO and expect particle-phase measurements.

Line 297: delete "an".

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Line 301-302: How do you know if the flights display no significant plume ageing?
Please specify based on the airborne measurements.

Line 302: delete “confidently”.

Line 424: Change “Mean” to “mean”.

Line 428: Change “It” to “it”.

Line 437: Delete “.”.

Line 457: There is inconsistent use of brackets here and at other parts of the manuscript.

Line 459: Delete “.”.

Line 460: Change “,” to “.”.

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