

Atmos. Chem. Phys. Discuss., referee comment RC2  
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## Comment on acp-2021-314

Anonymous Referee #2

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Referee comment on "How weather events modify aerosol particle size distributions in the Amazon boundary layer" by Luiz A. T. Machado et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-314-RC2>, 2021

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In their paper, the authors present a combination dataset in which particle size distribution data is combined and effects of lightning and weather patterns on the aerosol particle concentrations in the Amazonas.

The dataset is interesting, and the topic and data is certainly fitting to be published in ACP. However, I had some difficulty in fully understanding what the findings in the paper are. The conclusions first describe the typical diurnal behavior. Then, features for the dry and wet season are presented, and then features of lightning activity. This is then connected to aerosol concentrations, but the explanations of the connections are not very clear, except that higher lightning amounts seem to somewhat increase UFP number. Also, gravity waves are shortly discussed, but their role is not clarified at all. Then, downdrafts are discussed and it is noted that they could increase the UFP number. Overall, it is difficult to discern what the really new finding here is.

The manuscript also presents a section named conceptual model, but to me this seemed mostly to be a review of previous literature and the connection to the present dataset is not very strong. The analysis here seems to show that there are three different periods: wet season, dry season, and transitions season, during which lightning activity is strongest. Would it be possible to show a clear model, for example as a figure, that shows for each season what kind of phenomena are the most important ones affecting the PSD during each season in light of the data? This could then be discussed with the supporting data, and the open questions remaining.

Finally, the authors state that the dataset opens up new scientific questions, but they do not elaborate what these questions are. As of now, the paper reads like a report on data analysis, where interesting features are found, but the critical analysis of these features is missing.

Based on this, I would suggest a major revision of the text that clarifies the novel findings - for example, instead of weather events, why not directly discuss strong lightning events? Also, more strongly present an argument of what is happening, and how the data supports this interpretation. If new questions arise, they could be stated along with the reason why they cannot be answered with the current dataset.

Some additional comments:

- Figure 3: In my opinion, using a different plotting scheme for dry and wet season inside the same figure is highly confusing. Two similar figures make comparisons possible.

- Diurnal cycle: The figures in the appendix seem very contradictory to the presented diurnal cycle. In the conclusions, a diurnal cycle where UFP has a maximum at sunrise and Aitken and accumulation particles have a minimum is presented. However, the averaged diurnal cycles in Figs A3 and A4 are very different from this, as the maxima and minima seem to occur around 10-12 o'clock, much later than the sunrise. This should be clearly clarified, as such data interpretation seems very strange.

- Statistical testing: In many cases, the differences between cases seems to be a small signal in the number concentration data. Therefore, statistical testing is important to show that the signal is not just chance. For example, figure 5 seems bring a clear distinction to the particle concentration data, and it is also very interesting. The difference between low amount of lightning and high amount of lightning seems significant, but would it be possible to statistically test whether the shown data is also statistically significant? I assume it is, based on the high number of measurements, but it would be good to have an analysis on this. The same can be said for Fig. 6: I think here, it is essential to show via statistical testing whether there is any significant difference between the particle numbers when the GLM number changes. I think quite straightforward tests should be applicable here.