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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Direct observation of molecular clusters and nucleation mode particles in the Amazon" *by* Daniela Wimmer et al.

Anonymous Referee #2

Received and published: 24 October 2017

This work presents ground-based particle ion and number concentration measurements from the Amazon. The results are interesting and useful, but the paper needs to be carefully edited before it can be considered for publication in ACP. Also, as discussed in comment 18 below, I think the authors need to consider an additional explanation for their below vs above canopy rain-induced example that is illustrated in Figure 7.

Specific comments:

1) Title: "Direct" seems unnecessary. Perhaps better replaced by "Ground-based"? Also, "molecular clusters" seems inappropriate. Perhaps "particle ions"?

2) Line 38 – "Pristine" is used here and in a few other places. It needs to be defined.

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3) Lines 40-42 - Define the sites as locations relative to Manaus, much as you did on lines 80-83. You can't expect all readers to identify with T0t and T3.

4) Lines 43-44 – "T0t is reached by the pollution about 1 day in 7, where the T3 site is about 15% of the time affected by Manaus." The statement implies a difference between T0t and T3, but 1 in 7 is 14%, which is not different from 15%. What are you trying to say here?

5) Lines 59-60 – This sentence is not useful. Also, you state in the paper that the back trajectories in both cases pass over Manaus. Does not the source strength of Manaus even out other differences in the trajectories? Your last sentence of the conclusions is that "Most likely, during the dry season the condensation sink is too high for new particle formation." That appears to be the main factor that differentiates between the NPF and non-NPF days. Why is that not mentioned in the abstract?

6) Lines 221-222 – You say "The vertical mixing can be enhanced during the wet season due to convective clouds." Are you saying that convective clouds lift the mixed layer or that convective clouds lift particles out of the mixed layer or something else? Clouds formed at the top of a mixed layer will tend to cool below, which does not help the development of a mixed layer.

7) Lines 275-279 – This may be true for inside the canopy, but not for outside the canopy. Please clarify. Also, why would the pattern outside of the canopy not reflect biomass burning and wet deposition more than that inside the canopy?

8) Lines 281-282 - That appears to be true for the wet season, but the factor is less than 2 during the dry season. Did you mean "up to a factor of 3"?

9) Lines 287-288 – The 4-20 nm ions are not shown in the Figure 2 I have.

10) Line 301 – "Oct-Dec for both seasons"? Oct-Dec is a season (fall). Specify wet and dry seasons.

11) Line 305 – On line 214 the dry and transition season is April to September, whereas

here it is Apr-Oct. Please correct.

12) Line 311-312 – Cluster ions are not shown in Figure 3. Where are we supposed to view this?

13) Lines 321-323 – Again, 4-20 nm ions are not shown in Figure 2.

14) Line 358 – What do you mean when you say that “negative ions are smaller than positive ions”? Do you mean fewer in number?

15) Lines 374-376 and figure 6 – For the ions in the 0.8-2 nm particles, it looks like they simply turn on at rain intensities above 1.

16) Figure 7 – Indicate which axis corresponds with which particle size class in Panel B; presumably, the LH axis is 6-10 nm.

17) Line 379 – “followed by a second one at about 11:00”. Here, indicate the relative difference in rain intensity.

18) Figure 7 and lines 385-395 – This is a very interesting set of observations. If particles descending with the rain were responsible for the increase in 6-10 nm particles above the canopy, how do you explain the apparent evolution of 6-10 nm particles to 10-20 nm over a few hours? Given the roughly 3 orders of magnitude difference in particle number concentrations from ground to above canopy and the potential canopy filtering you mention, why instead is it not possible that the few 6-20 nm particles above the canopy were due to the rain-induced particles mixing and filtering upwards?

19) Table 3 and lines 404-406 - Table 3 shows 65 and 49 for a total of 114, while you state 64 and 46 and 113. Please correct.

20) Figure 9 – On either side, you show four panels. The top two are labelled ions and the bottom two are labelled total particles, which is consistent with the text. In the caption, we are led to believe that the top three are ions. Please correct.

21) The RH side of Table 5 is cut off in my copy.

22) Line 520 – Should be Jan-March for wet season?

23) A couple of more general comments: Is there some sort of summary connecting the ion concentrations with NPF that can be drawn? The rain-induced events are prominent, but we are not given any sense of how important these might be. For example, is there any evidence that a significant number of rain-induced particles survive to become CCN size, or is Figure 7 the best example of their potential longevity?

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