Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2015-1049-RC2, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impacts of the Manaus pollution plume on the microphysical properties of Amazonian warm-phase clouds in the wet season" *by* Micael A. Cecchini et al.

Anonymous Referee #2

Received and published: 10 March 2016

The manuscript describes unique aircraft measurements of polluted and pristine clouds over the Amazon region during the wet season of 2014. The results are of potential interest not only for those involved in the GoAmazon experiment but to the general ACP audience.

However, the manuscript is poorly written and needs substantial revision to meet ACP standards. Part of the methodology should be better explained and some of the results needs further investigation. Moreover, I have serious concerns about some methods and the interpretation of results. Hence, I cannot recommend its publication without a major revision.

I have annotated the author's PDF file with many comments and questions to the au-

thors, which I hope will help to improve the manuscript. Here, I only list my major concerns.

1) Introduction needs to be throughly revised. Lines discussing this work are mixed with paragraphs discussing the current state of the art, making it hard to follow for those not part of GoAmazon.

2) Session about the instrumentation should explain what corrections or data processing were performed for the different instruments / probes used. Alternatively, other papers describing that should be cited.

3) Authors used CN to identify if clouds probed under each circunstance were or were not beeing affected by the plume of pollution.

I beleive CCN would be better to indicate the influence of the plume on the clouds for 2 reasons. Firstly, because most of the initial pollution particles emitted will be too small to become CCN, hence the initial plume will not affect much the cloud formation. Secondly, as the plume is chemically and physically transformed downwind of Manaus, the extra aerosols will grow, be oxidized, and thus will interfere more and more with the CCN population. See for instance previous results from Kuhn et al (2010). Hence, as the G1 flight legs are at different distances from Manaus, CCN would be a better indicator than CN.

4) For selecting the in-plume events, the authors defined a cone where the plume was most likely to be found.

This cone was centered at the airport as if the pollution plume were being dispersed from that single position. While this approch might work for larger distances, for the short distances from Manaus (closer legs) the airport-angle will not confine the plume.

5) The authors based their whole analyses on a bold hypothesis:

Given the nature of the meteorology in the Amazonian wet season, i.e. (...) horizontal homogeneity, there is no significant difference between the thermodynamic conditions

inside and outside the plume region (...).

This would be true only for Amazon regions with an uniform vegetation cover, which is not the case at all for the region of Manaus. The Manaus plume goes towards T3, which is the direction of the Solimoes river. Hence, the in-plume cases studied are mostly over or close to the river. On the other hand, the out-plume clouds are far away from the plume and hence from the river. Therefore, as we know from previous studies that the river breeze is significant, one cannot assume that the thermodynamics are the same (over the river and far away)!

To assess the validity of their hypothesis, the authors could, for instance:

- use radiosondes close and away from the river

- look at the specific humidity around the clouds (polluted vs pristine)

- verify the average time of day when polluted vs pristine clouds were sampled

- verify the location (lat/lon) where the polluted vs pristine clouds were sampled

- etc...

6) When authors look at DSD from different altitudes, they divide the vertical from LCL (0%) to freezing level (100%). Then they made averages for relative altitude ranges of 0-20, 20-50 and >50%.

There are two things going on. Firstly, the G1 samples are not well distributed in the vertical, hence the authors had to choose uneven limits to get the same number of samples in each. However, not all shallow clouds will develop as high as the freezing level.

Therefore, the average for the bottom layer includes some clouds that did not extend at altitudes >20% and more clouds that did not develop > 50%. On the contrary, samples for the top layer are, by definition, all from clouds that extended from the LCL up to > 50%.

Hence, this introduces a large bias. It is mixing clouds of different total vertical development, in different amounts, in each of the three categories. Hence one could not compare DSD from different altitudes, just DSDs from the same altitude for polluted/pristine cases.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/acp-2015-1049/acp-2015-1049-RC2-supplement.pdf

---

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2015-1049, 2016.