COMMENTS RECEIVED FROM REVIEWER #1

General comments

The study under review applied in-situ instrumental data from an aircraft campaign with the aim to seperate cloud microphysical properties for conditions of clean/background air and for air polluted from anthropogenic aerosol. Therefore the aircraft measurements were taken inside and outside of a plume created from the city Manaus during the wet season over the Amazon regions. While studies for the dry period exist, the study seems to be one of the first to investigate the wet season, which has the advantage that background conditions are comparable to oceanic conditions, i.e. thermodynamic variables do not vary much with distance from the city. The study clearly outlines and justifies the methods that are applied. The results are presented in a clear way and the discussion is conclusive and supports the current understanding of aerosol-cloud interactions. The data is unique and the results should definitely be of interest for the scientific community. Therefore I would suggest to publish the manuscript after some minor corrections, which are listed in the following.

Authors answer

Dear Reviewer #1, we would like to express our gratitude for your efforts to review the submitted manuscript. We found your comments very important to improve the quality of the manuscript. Following you will find a detailed explanation of our approach regarding your questions. Your concerns are numbered and answered individually in order in the next section of this document.

Thank you and best regards,

Micael A. Cecchini and coauthors

Minor revisions:

1.

    a. **(Question)** You could consider to separate the results section into topic related subsections, as the section is quite long in general (E.g. differences in LWC for background and polluted clouds, effect of updraft speed, vertical development of clouds). This would make it easier for the reader to find the relevant information in the results.
    b. **(Answer)** We agree that it would be clearer to separate the results into subsections. We divided into two separate subsections, labeled “Bulk DSD

properties for polluted and background clouds" and "Vertical DSD development and the role of the vertical wind speed".

2.

a. **(Question)**The summary and conclusions section ends quite abrupt. Consider to add a short outlook. What are the remaining open questions? Are further field studies planned? You already mention that the effects on ice-clouds is one focus for future endeavors in the motivation.
b. **(Answer)** We added a new paragraph in the end of the "Summary and conclusions" section, which is reproduced below:

"While the effects of aerosol particles in the warm layer of the clouds is relatively straightforward, this may not be the case for the mixed and frozen portions. An aspect that was not directly addressed in this work is the impacts that warm layer characteristics have on the formation of the mixed phase (above the 0°C isotherm). Given that aerosols alter the properties of the whole warm phase, it is reasonable to assume that this would have an impact on the initial formation of the mixed layer. Such impacts can be in the form of the timing and physical characteristics of the first ice particles and the maximum altitude with supercooled droplets above the freezing level. This issue will be addressed in future studies, taking advantage of data provided by the HALO (High Altitude and Long Range Aircraft) airplane that operated in the second GoAmazon2014/5 IOP between September and October, 2014."

3.

a. **(Question)** p.4, l.13: Can you tell more about the uncertainties of the instruments? E.g. what is the accuracy of the particle concentrations from the CPC?
b. **(Answer)** We added the requested information about the accuracy of the instruments. The accuracy for the CPC is ±10%, while for the FCDP it is around 3 µm.

4.

a. **(Question)** p.6, l.27: You name one factor is commonly cited in literature but do not add any references. I suggest to add some references at this point.
b. **(Answer)** Added a citation to Abrecht's (1989) work: Albrecht, B.A.: Aerosols, cloud microphysics, and fractional cloudiness. Science 245, 1227–1230, 1989.

5.

a. **(Question)** p.7, l.18: Calculations show that… -> It would be nice if you shortly can present how you did this estimation.

b. **(Answer)** This affirmative is based on calculations of the averaged second moment in polluted and background clouds. We found that the average second moment for polluted clouds is around twice as the background one. This ratio between the second moment in the polluted/background DSDs is representative of the ratio of the overall surface areas. The text was updated to reflect this change.

6.

a. **(Question)** p.8.,l. 21: While your statement seems to be true for the background clouds, especially for the polluted clouds there seems to be an increase in the last LWC bin. Also the spread is increased. Can the latter be explained by a larger LWC bin size?

b. **(Answer)** Added the sentence at the end of the paragraph: "This effect is clearer in background clouds given the limited aerosol availability". This should make the matter clearer. We believe that the LWC bin size should not have as big of an impact here. Under polluted conditions, new droplets may form even if the LWC is big.

7.

a. **(Question)** Table 2: Add the definition of bottom, mid and top layer to the Table caption.

b. **(Answer)** Added the requested information.

8.

a. **(Question)** Figure 2: This figure looks a bit clumsy. My suggestion would be to create a plot with subfigures with the individual flight plans and add the estimated plume area and the average wind direction for each flight.

b. **(Answer)** We tried several approaches to improve this figure, taking into account the clumsiness and the message we want to get through. The most important thing to show with this figure is that most of the flights had a similar trajectory, which enables the plume classification. The updated figure separates each flight in a subplot, with the plume angular section. We changed the text in order to describe this figure. The last 5 lines of the second paragraph of section 2 is now:

"Figure 2 shows the trajectories for all flights, where the dashed grey lines represent the plume angular section considered from the airplane data. Note that the plume usually disperses from Manaus to the T3 site, with relatively small variations on the direction based on the wind field.

Two flights (4 and 6) had low sampling on the plume given the trajectories and the grey lines may not represent the overall region of the plume. However, the directions identified presented higher CN concentrations than the other ones".

Phrasing / spelling corrections:

All phrasing and spelling corrections were addressed. Thank you for taking the time to highlight these issues. The specific corrections you suggested are listed below.

p.1, l.11: in terms *of* aerosol conditions

p.1, l.17: split the sentence after the brackets -> The cloud droplets observed are in the range…

p.1, l.24: correct the superscript of km-1

p.1, l.25: Why you use e.g. for the definition of larger droplets? In my opinion, you can just omit this.

p.1, l.25: to the cloud base

p.1., l.26: change sentence structure to: The overall shape of the droplet size distribution (DSD) does not appear to be : : :

p.1, l.31: initiation of the collision-coalescence

p.2, l.4: maintains

p.2, l.8: for the Amazon by Martin et al.

p.2, l.11: that a city like Manaus has on atmospheric conditions

p.2, l.22: Amazonian cloud properties

p.3, l.7: suggests -> suggest

p.3, l.8: over the Manaus area

p.3, l.9: stronger wind component -> dominant wind component

p.3, l.20: clouds microphysical properties -> cloud microphysical properties

p.3, l.25: add comma after background air reference

p.4, l.1: consider to change pollution-aerosols to anthropogenic aerosols

p.4, l.2: are almost only urban, while biomass-burning contribution is very exceptional

p.4, l.6: omit numbered before chronologically

p.4, l.29: what is meant by true airspeed? I guess you mean the speed of the aircraft?

p.6, l.22: by effective size you refer to effective diameter D_e?

p.7, l.29: omit *profiles*

p.7, l.30: updraft speeds levels -> updraft speed levels

p.8, l.18: relationships De x LWC and DNC x LWC -> relationships of De and LWC, and of DNC and LWC

p.8, l.20: omit e.g.

p. 9, l.4: omit brackets. Instead write: for each layer, as there are more measurements for lower levels.

p.9, l.14: its mass -> their mass

p.9, l.19: omit e.g.

p.9, l.32: and l.33: once you write plume and once polluted. Try to be consistent.

p.10, l.10: justifies -> explains

p.10, l.10: vertical velocities region -> vertical velocity region

p.10, l.25: the updraft regions DSD -> DSDs in the updraft region

p.11, l.6: Polluted clouds had 10

p.11, l.16: omit e.g.

p.11, l.17: bi-modality *favors* the efficiency

p. 11, l.20: aerosols conditions -> aerosol conditions

Figure 5 caption: affected or not -> affected and unaffected

Figure 5 caption: units of LWC should be gm^{-3}

Figure 6 caption: add the information that this is for clouds lower than 1000 m only.