

Interactive comment on “Airborne observations of newly formed boundary layer aerosol particles under cloudy conditions” by Barbara Altstädter et al.

Anonymous Referee #2

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In summary this paper presents observations of non-surface layer new particle formation under cloudy conditions and near surface vertical transport of newly formed particles. Observations in the vertical were made using the UAS system ALADINA in the region of the TROPOS research site near Melpitz: TROPOS facilities providing surface observations. 53 hours of flight data was available spanning a period 23 days between October 2013 and July 2015. Of the available data two periods were selected as case studies.

Although the paper is well structured and presented the quality of the English is poor making for a difficult read and confusion as to what point the author is trying to convey

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– there are far too many corrections to list here. There is also a tendency for the author to use emotive\subjective phrases for example: "All in all, the research site Melpitz of TROPOS offers a great potential for observing NPF within the ABL and inter-comparison of airborne data with monitoring at ground." These are major failings and ones that need to be addressed: if the author is not a native English speaker it is recommended that they find somebody who is to assist in editing.

The work presented is unique and will be of great interest to the community but there needs to be a substantial "tightening up". The paper gives the impression of slackness and carelessness in experimental techniques, discussion of relevant processes, and how conclusions have been arrived at. At this stage and in this form I would not recommend publication but I would encourage the authors to re-submit after revision.

Some suggested areas to revisit. 1. The authors cite a number of papers concerning the experimental set up at both the field site and for the UAS. It would be expected for a basic discussion of both these setups to be included in the paper and a discussion of the various factors that will effect measurement uncertainty and what has been done to mitigate them. This is very important when it comes to the particulate measurement as inlet losses and transmission losses can seriously bias a measurement: for example is the fact that you are not seeing particles above a certain size because they are not there in the first place or because they have all been lost before reaching the sensors. Basically have you characterised both the ground and UAS sampling and measuring systems. If you have then discuss it and the implications. If this has not been done you would be advised to do so.

2. There is also the point regarding humidity and this applies to both the ground and UAS measurements. You are measuring the humidity of the ambient air sample upstream of your sensors. If that air mass is warmed (resulting in its RH reducing) or purposefully dried then this will impact on particle size. There is a need to be exact as to what the conditions are at the point of measurement and to indicate what effect this might have.

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3. The need to be exact also extends to terms you are using. You refer to size but what do you actually mean: radius, diameter, and are these optical, mobility or aerodynamic equivalent values. This needed to be exact also extends to the gas phase measurements: are the concentration in ambient air or dry air? What are the uncertainties in these measurements?

4. With regard to your CPCs. In the first instance you are using two units: one with a lower cut of 5nm (diameter?) and one with a lower cut off of 10nm (diameter?) while in the second you are using two units: one with a lower cut off of 7nm (diameter?) and one with a lower cut off of 12nm (diameter?) and on page 4 lines 1 – 6 this is clear. Lines 10 – 14 on page 7 this is not the impression the text gives. This is what you say: "total aerosol particle number concentration measured with two CPCs in the particle diameter of 5 nm (red line) and 10 nm (blue line),". What I think you are talking about is the total aerosol concentration measured by the two cpc: red line cpc with 5nm lower cut off, blue line the cpc with a 10nm lower cut off. On line 12 of the same page you say: "OPC in the particle diameter of 390 nm (pink line), 500 nm (green line) and 700 nm (turquoise line)". An OPC has specific measurement bins that will have a centre value of particle diameter and a specified width – you need to add the width of the bin to this kind of statement and state explicitly that you are using the bin centre value.

5. Your figures show no error bars nor is there any reference in the captions: this needs to be addressed. On the subject of figures, although I am not colour blind many of your readers may be. It is good practice to choose colour schemes that those who are colour blind can interpret.

6. In your discussion of the use of the LES you use the term "closure": however what you are actually doing is using the model output to substitute for missing observations. Again the need for exactness but there is also the question of the validity of this approach. What evidence can you present that would indicate that the LES has accurately representing the conditions at the site. Presenting a comparison the model data with flights where you have full observations would be advised.

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7. Lidar and ceilometer. You put a deal of emphasis on the importance of these observations without the necessary explanation and discussion of the observation themselves. What are you actually looking at what is the implication to the interpretation arising from the change of laser wavelength?

8. In your paper introduction you introduce many concepts and make many statements backed up by a paper reference – you could really do with expanding this by adding brief textual explanations.

9. You introduce “gravity waves” but do not provide an explanation as to why this is relevant and the process that are at play.

10. Use of the term inter-comparison. This is a tautology and a very common mistake – simply use the term comparison.

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