

Interactive comment on “Vertical profiles of sub-3 nm particles over the boreal forest” by Katri Leino et al.

Anonymous Referee #1

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This paper presents airborne observations of sub-3 nm particles in the lower troposphere over the boreal forest of Finland. The results show that the number concentration of sub-3 nm particles was highest near the forest canopy top indicating the key role of the precursor vapors emitted by the forest during new particle formation (NPF). Case study shows the number concentrations of sub-3 nm particles are influenced by the evolving of boundary layer during the NPF. Overall, this study presents interesting results regarding the vertical profile of new particle formation. The manuscript is concisely organized and well written. Therefore, I suggest that this manuscript can be considered for publication after following comments are well addressed:

Specific comments:

1. As only three flights were analyzed in this study, case studies should be done for

all the three flights. In the manuscript, only 13th of August 2015 was chosen for case study. What the aerosol size distributions on ground and what the values on the aircraft were related to the values on the ground during undefine day and non-event day are also interesting to be known. Is it possible to use some other methods, such as modelling method (i.e. simulations by regional model) in case studies?

2. Can other vertical observations, such as lidar data, satellite data etc. support your study?

3. Some implications need to be added in the conclusion or even in the abstract. For example, how does this study improve the recent knowledge of NPF study? What are the highlights of this study? Why do we need to do the vertical observations? What else is needed in future?

Minor comments:

P2, L41-42: This sentence is not clear and need to be rewritten. BLH is not process.

P2, L58: What kind of observations reported by Chen et al. (2017) need to be described. If it is same with observations by Siebert et al. and Platis et al., merge these two sentences.

P3, L79-85: This paragraph is a little bit abrupt here and need to be moved to somewhere above. Maybe put it after the third paragraph.

P5, L136-137: The instrument used to measure the meteorological variables need to be described here.

Figure 1: The A11 manual said the CPC should be placed on a higher level than the PSM outlet. From the left panel of Fig. 1, it looks like the CPC is below the PSM. I wonder if it will influence the operation or observation accuracy of PSM. Moreover, some text or label can be added in the Figure. For example, add the names of each instrument in the left panel of Fig. 1 and mark the direction of the inlet in the right panel.

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P6, L171-172: A citation or explanation is needed for 'COMSOL Multiphysics'. Is it a software or what? Explain the acronym once.

P7, L194: Explain the acronym once.

P8, L226-229: The expression of 'the values inside the BL' is not suitable as 'the Ground level' is also 'inside BL'.

Table 1: Give the median of height for the observations by airborne.

P8, L236-238: Merge this paragraph with previous paragraph. The guessed explanation of observed phenomenon should be right after the expression of phenomenon (i.e. after P8, L229-230.).

P9, L260: 'above the ground level'?

P10, L274-278: Why was a layer of 3-10 nm particles observed? Is it related to the origin of air mass? Section 3.3 what are the main conclusions or findings through the case study?

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