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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Airborne measurements of nucleation mode particles II: boreal forest nucleation events" *by* C. D. O'Dowd et al.

**C. D. O'Dowd et al.**

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There still are several spelling errors (e.g. p.2822, l.3: analyzed; p. 2823, l.4: Truvnd or Tunved as in ref listing; p. 2828, l. 6: were or where?; p. 2828, l. 27: more or mode?; p. 2829, l. 3 space between over and which; l. 10: expands; p. 2830, l. 25, move ‘)’; l. 29: indicates).

Response: Done.

The authors present many data in 14 figures, but hardly explain what has been observed. For instance, on p. 6 they describe the vertical structure presented in Figure 5 with a surface layer, a second layer and the free troposphere inversion at 1100 m, observed in the descent; Some explanation would be desirable, for me it is not clear why ‘FT is at 1000-1100 m’. This is a very shallow FT.



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Response: more clarification is introduced. A FT inversion at 1000-1100 is not uncommon..

The text on several figures is too small to read, in particular Fig. 15, but also Figs 1, 12, 13, 14

Response: the figures will be enlarged during publication/production, we feel the text size is appropriate for the figure as printed full size.

Please indicate how layer heights are defined when discussed the first time for Figure 5.

Response: text added . “The layer structure is not so defined for this case and later cases presented, nevertheless, different layers or stratification is identified by a combination of both potential temperature and relative humidity inversions – that is notable increases in potential temperature and notable reductions in relative humidity, both promoting stratification.”

In Figure 6 neither the figure nor the caption gives a hint to the difference between the two figures: I suggest that Figure and caption together are self-explained, or refer to the text if that would require too much text. Furthermore, in Figure 6 I see peak values at ca. 300 m, can the authors explain why they see them at 4000-500 m?

Response: text changed accordingly, also text is expanded as is figure caption.fig 8 is also removed as this reduces duplication.

p. 2827, l. 2: Contrary to the authors’ explanations of Figure 7, I could interpret the observations as homogeneously distributed with some outlyers in layers at e.g., 100 m, 300 m, 480 m etc. Please provide more explanation.

Response:we disagree but, nevertheless, this figure and text are removed now.

p. 2827, l. 10: suggesting what? Apparently some text was deleted here.

Response typo removed



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p. 2829: l. 2829: is the conclusion that nucleation does not occur over sea justified? Or should it be that nucleation does not occur over ice? Since the sea has been reported in this article to be frozen, and this would make a large difference!

Response:we agree and correct text accordingly

p. 2830: first par. The whole period shown is 0.06 days, since there is a ‘sequence of events’ ‘later in the day’ is correct, but the suggestion as I understood it is that there could be a longer time lapse between events; Here I suggest to show what the evolution of the surface and mixing layer were, please show in Fig 14.

Response: we have already explored this but the meteorological parameters do not show as clear an evolving pattern due to the horizontal variability, this is consistent with previous unpublished work by the lead author where it was found that aerosol fields often depicted stratification when meteorological parameters were converging in overlying layers.

p. 2831, l. 10: what is the basis for concluding that the time scale is 30-60 min?

Response: this text is now removed

p. 2831, l. 19: maps could confirm when the data were collected over forest or over lakes (also frozen)? I suggest that the authors check this rather than speculate.

Response:we made the statement on the basis of visual observations, a photo is not included.

Figure 15: I cannot really read this Figure, but it seems to me that a and b a re the same figure?

Response:section removed

The authors seem to use the term surface layer for the layer adjacent to the surface? I suggest they use common terminology, cf. Stull, Boundary Layer Meteorology, p. 10-11



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Interactive Comment



for definitions.

Response: terminology rephrased to surface mixed layer.

p. 9 and figure 12: apparently nucleation start between 10 and 10:38, see also horizontal runs in Figure 13 and the profiles show signals first between 700 and 900 m; the signals in the horizontal runs are similar when descending from 300 m to 30 m and increase only after 87.450. Yet in Figure 14 the near surface concentrations are highest in each profile. Since Figure 14 is the basis for the final conclusion that nucleation occurs just above the canopy, the authors should explain better how this extrapolation was made, because the only profile supporting Figure 14 is the one in Figure 12 at 11:23. In all other profiles there is no indication whatsoever for the strong increase close to the surface as suggested by Figure 14. How do Figures 12 and 14 connect?

Response: we disagree, in figure 12, profile at 08:42 illustrates an increase in the 3-10 nm particles first at the lowest flight level encountered. This is the first occurrence not to be confused with the peak concentration reached at 11:23. it is the first increase in concentration between 3-10 nm that locates the first detection of new particle formation..

The authors make a large effort to show that particle concentration is not a conserved parameter. Why? They observe the formation of new particles in the boundary layer, so how could their concentration be conserved? And why would that imply that production occurs in the ‘surface layer’ before mixing takes place? And why would that be close to the canopy (conclusion, last sentence), whereas we see peaks at 300 m in Figure 6.

Response: section removed

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 2821, 2008.