

Atmos. Chem. Phys. Discuss., author comment AC1  
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## Reply on RC1

Helmi Uusitalo et al.

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Author comment on "Occurrence of new particle formation events in Siberian and Finnish boreal forest" by Helmi Uusitalo et al., Atmos. Chem. Phys. Discuss.,  
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We thank the reviewer for the helpful comments and suggestions for improving our manuscript. Below we give our replies (shown in *italics*) to each of the comments (shown in normal font).

### Major comments

The paper currently does not add substantial scientific insight to that of Wiedensohler et al (2019) and various papers documenting NPF at the other sites studied.

One obvious way to increase the appeal of the paper would be to get closer to answering the question of why NPF events are not as frequently observed at ZOTTO (and Tomsk) as they are at Hyytiälä and Varrio. For this there could be several possibilities, including for example

- A trajectory analysis on similar lines to that of Dada et al (2017):  
<https://acp.copernicus.org/articles/17/6227/2017/> coupled with some consideration of sources of emissions that intersect with the air mass trajectories
- An analysis of chemical transport or climate model output that could provide relevant concentration estimates of nucleation precursor vapors at the different sites, albeit with large uncertainties. The large uncertainties could be mitigated somewhat by evaluation studies at Hyytiälä where data on precursor vapor concentrations exists.
- Further measurements or use of measurement data in at least one Siberian location, especially of nucleation precursors, and comparison to the existing measurements in Finland.

Of course alternative ideas are also welcome.

*We will include in the revised manuscript an air mass source area analysis based on backtrajectories and the distribution of biogenic (volatile organic compounds) and anthropogenic (SO<sub>2</sub>, particulate matter) emission sources in the areas surrounding each measurement site. Unfortunately the suggested further measurements of nucleation precursors are not possible at this point.*

The introduction could benefit from some more specific detail that would better motivate the manuscript.

*We will add to the introduction as one of the objectives the study of air mass source areas in relation to the new particle formation observations at each site.*

### Minor comments

Title: poor grammar, suggest: "Occurrence of new particle formation events in the Siberian and Finnish boreal forests"

*We will correct grammar of the title as suggested.*

First paragraph: context is too broad for this journal, suggest closer focus on the importance of new particle formation for climate.

*We will remove from the introduction the discussion about the health effects of aerosol particles, and focus more on the contribution of new particle formation to the number concentration of aerosol on boreal forest environment. References to previous studies in this area will be added, e.g. Kerminen et al. (2012).*

What is the effect of lack of temperature measurement at ZOTTO?

*The lack of temperature measurements affects the calculations of coagulation sinks (collision rates between particles of different sizes are temperature dependent), but we estimate that using constant temperature instead of the actual ambient temperatures at ZOTTO does not introduce large errors (at most 10-20% change to the calculated coagulation sink values).*

Why Kerminen-Kulmala (2002) and not the improvement by Lehtinen et al (Journal of Aerosol Science, 2007)?

*The utilization of the Kerminen-Kulmala approach was mainly chosen for the more simple calculations compared to the Lehtinen et al. approach. The main improvement in the Lehtinen et al. formula is the more accurate treatment of the effect of background aerosol size-distribution on the coagulation scavenging efficiency for the growing particles. Since the typical size-distributions observed at the four sites included in our study can vary between sites, we will repeat the analyses related to particle survival probabilities using the improved Lehtinen et al. method for the revised manuscript.*

I don't understand the x axis of Figure 3b, c – what do the 3, 10, 15 represent? I assume it's the same as the columns of Table 1 (e.g. J3, J10, J15) but this is not specified anywhere.

*Indeed, the numbers on the x-axis of Fig. 3b, c refer to the particle sizes where formation and growth rates are calculated. We will revise the figure and caption text to make this more clear.*

Lines 20-25 improve written English descriptions of aerosol sizes.

Lines 39, 231 and various other places: improve sentence and written English.

*We will check the proper English language usage and accordingly modify these parts of the text in the revised manuscript.*

References:

Kerminen, V.-M., Paramonov, M., Anttila, T., Riipinen, I., Fountoukis, C., Korhonen, H., Asmi, E., Laakso, L., Lihavainen, H., Swietlicki, E., Svenningsson, B., Asmi, A., Pandis, S. N., Kulmala, M., and Petäjä, T.: Cloud condensation nuclei production associated with atmospheric nucleation: a synthesis based on existing literature and new results, *Atmos. Chem. Phys.*, 12, 12037–12059, 2012.