

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## **Comment on acp-2021-530**

Anonymous Referee #1

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Referee 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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Review of "Occurrence of new particle formation events in Siberian and Finnish boreal forest"

This paper summarises new particle formation (NPF) events observed at four measurement stations in the northern boreal forest. It appears that the measurement data have been presented before, but a new analysis of the data leads to modest differences in the results – NPF events are significantly more common in Siberia (at ZOTTO) than previously calculated by Wiedensohler et al (2019) for example, but still rare compared to events at (for example) Hyytiälä.

The paper emphasises the importance of a low instrument cut-off size for identifying NPF events. This emphasis is welcome and valuable and does give additional insight into the ZOTTO measurements, but it is not particularly novel. For example, an almost identical statement is made by Brilke et al, 2020 in the last sentence of their abstract: <https://acp.copernicus.org/articles/20/5645/2020/>, and this same point was also made by Nieminen et al (2018, cited in the paper) in the conclusions.

The methods applied are valid and the paper is well structured.

However, in my view this paper does not yet contain 'substantial new concepts, ideas, methods or data' as required for ACP. With major revisions, it could be suitable for the journal.

**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 Hyytiala 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 Hyytiala 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.

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

### **Minor comments**

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

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

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

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

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.

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

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