

Interactive  
Comment

## ***Interactive comment on “Analysis of particle size distribution changes between three measurement sites in Northern Scandinavia” by R. Väänänen et al.***

**R. Väänänen et al.**

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The authors thank the reviewer for the constructive remarks and suggestions. Below are our answers to the comments. Review's comments are marked by italics.

*General comment:*

*The manuscript presents interesting results on particle population changes based on over-land transport times in non-populated areas. In principle, the paper misses some conclusions or at least speculations in sections 3.2.1 to 3.2.4 where transport patterns between the station pairs are discussed. In general, the wording size distribution is*

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very often used. It should be mentioned each time if it is a mass, volume or number size distribution which is discussed. It is also easier to introduce an abbreviation as PNSD (particle number size distribution) and thus being consistent throughout the whole manuscript. Apart from this I found a large number of typing errors that require some language corrections. I would highly recommend to do a final intense proofreading of the manuscript by an English speaking person.

In the revised manuscript, we will consistently use the term “particle number size distribution”. The language will be checked out throughout the paper.

*Detailed scientific comments:*

### 1 Introduction

*Page 9404, Line 3: Secondly, . . . Comment: This sentence does not make sense!*

We will change this sentence into the following form: “Secondly, black carbon aerosols in Arctic air and snow contribute to local warming and resulting snow-albedo climate feedback mechanism during the springtime (Law and Stohl, 2007; Flanner et al., 2009)”.

*Page 9405, Line 3-5: Comment: With respect to what?*

We will modify the sentence into the following form: “In the boreal forest environment, aerosol dynamics during atmospheric transportation has been investigated in only few studies.”

*Page 9405, Line 23-24: Comment: Air masses do not form particles!*

We will change this sentence into the following form: “They found that the formation of new particles could be observed only after the air masses have been travelled a few hours over the boreal forest zone, and that. . .”

### 2 Materials and methods

*Page 9407, Line 10-22: Comment: Please specify road distances for Abisko and Pal-*

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las!

We will modify this sentence into the following form: “. . . , and the distances from Abisko to Pallas, from Pallas to Värriö and from Abisko to Värriö are approximately 230, 230 and 440 km, respectively.”

*Page 9411, Line 12 starting: The algorithm . . . Comment: I do not understand this principle!*

We will modify the text into the following form: “The algorithm groups the data into k clusters so that the measure between the center of each cluster and its members will be minimized. In other words, our aim is try to reduce the complexity of the data sets by finding such data subsets that are internally similar to each other, which in our case means having similar aerosol size distributions.”

*Page 9411, Line 27: Our aim . . . Comment: How can you show this?*

This sentence was modified into the form “Our aim was to divide the size distributions into separate groups, and the results showed that the method suited for that.”, which solves the problem raised by the reviewer.

*Page 9412, Line 10: I suggest to add an additional headline as e.g. “Trajectory classification”.*

We will add a new subsection title here, as suggested.

### *3 Results and discussion*

*Page 9412, Line 1: The periods . . . Comment: I do not understand this sentence!*

This comment seems to refer to line 1 on page 9413. We will modify the sentence into the following form: “Simultaneous data from all the three sites were more frequent for summer and autumn compared with the other two seasons.”

*Page 9413, Line 17: The particle formation rates . . . which made easier . . . Comment:*

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*Please check this sentence!*

We will modify this sentence into the following form: “The particle formation rates were calculated at 3, 7 and 10 nm for the Värriö, Pallas and Abisko data, respectively, which is the lowest measurable particle diameter at these three sites. By doing this, our results can be compared with previous studies conducted at the same sites (Table 2).”

*Page 9415, Line 14 - 27: Comment: What does this mean? Please draw your conclusions!*

We will modify this paragraph to make it easier to understand.

*Page 9416, Line 10: . . . fitting was worse. Comment: What do you think was the reason for this? Are there other dominating processes? Please draw your conclusions from that paragraph!*

The most likely reason for the worse fit when including longer time-over-land hours is the low number of data at the high end of over-land transport times and their apparent scatter. We cannot, however, exclude the potential effect of other factors such as atmospheric processes taking place during air mass transportation.

*Page 9417, Line 10: In this kind . . . I do not get that following sentence. Could you make your statement clearer!*

We will modify this sentence into the following form: “We speculate that on average, the air measured in Abisko is constrained into a shallower boundary layer than the air measured in either Pallas or Värriö (Fig. 7), allowing more efficient accumulation of condensable vapors originating from biogenic emissions over Abisko.”

*Page 9421, Line 9-19: Comment: What does this summer –winter comparison mean for the uptake of aerosol mass over the continent?*

As suggested by the other reviewer, we have extended our analysis for the winter period. We will divide section 3.1 into two parts: “3.1.1 Summer period” and “3.1.2 Winter

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period". The results from this analysis will be utilized elsewhere in the manuscript.

All the language comments given below were checked out and corrected.

*Language comments: Page 9403, Line 2: . . . aerosol number size distribution . . .*

*Page 9403, Line 5: . . . this data . . .*

*Page 9403, Line 9: . . . air mass . . .*

*Page 9403, Line 9: . . . aerosol particle number size distributions during air mass transport . . .*

*Page 9403, Line 12: . . . growth rates.*

*Page 9403, Line 15: . . . over-land transport times . . .*

*Page 9403, Line 21: . . . direction . . .*

*Page 9403, Line 25: . . . an important and complex role . . .*

*Page 9405, Line 3: . . . measurement stations.*

*Page 9405, Line 3: . . . within a couple . . .*

*Page 9405, Line 9: . . . Southern . . .*

*Page 9405, Line 11: . . . 300km north of . . .*

*Page 9405, Line 21 . . . such air masses based on trajectory analysis . . .*

*Page 9405, Line 23: . . . to forest areas . . .*

*Page 9406, Line 1: . . . of air mass transport.*

*Page 9406, Line 4: . . . within a distance of . . .*

*Page 9407, Line 5: . . . located in Finland.*

*Page 9407, Line 6: The data set is . . ., located in Sweden . . .*

*Page 9407, Line 7: . . . in a small corridor from . . .*

*Page 9407, Line 16: . . . at a distance from . . .*

*Page 9408, Line 6: Instrumentation*

*Page 9408, Line 14: . . . condensation . . .*

*Page 9408, Line 23: . . . particles . . .*

*Page 9408, Line 23: The inlet was located at a height about 2m above ground level.*

*Page 9409, Line 5: At event days, new growing . . . and at undefined days either*

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nongrowing . . .  
Page 9409, Line 20: The lower detection limits . . .  
Page 9410, Line 2: . . . also the Abisko station.  
Page 9410, Line 12: . . . and assigned those . . .  
Page 9410, Line 21: . . . distributions used for averaging were . . .  
Page 9411, Line 1: . . . at each of the stations . . .  
Page 9411, Line 18: Now we calculated . . .  
Page 9411, Line 20: . . . has been shown to work best . . .  
Page 9411, Line 26: . . . vectors are not a normalized . . .  
Page 9412, Line 12: . . . were calculated once per hour.  
Page 9412, Line 17: As an example, this means, . . .  
Page 9412, Line 23: . . . at the three stations . . .  
Page 9412, Line 25: . . . originated from . . .  
Page 9412, Line 23: . . . dataset . . .  
Page 9414, Line 8: . . . in diameter.  
Page 9414, Line 9: This finding . . .  
Page 9414, Line 15: . . . and followed a slow saturation . . .  
Page 9414, Line 16: . . . the main process . . .  
Page 9415, Line 13: . . . made for the data . . .  
Page 9415, Line 17: . . . with values between . . .  
Page 9416, Line 7: . . . were between .. depending on. . . ?  
Page 9416, Line 11: . . . was found to increase . . .  
Page 9416, Line 19: . . . to each other.  
Page 9416, Line 24: . . . over-land transport times . . .  
Page 9417, Line 25: . . . event-day . . .  
Page 9417, Line 26: . . . located in a corridor . . .  
Page 9418, Line 9: Since our aim was . . .  
Page 9418, Line 21: . . . was almost doubled . . .  
Page 9419, Line 3: . . . one third of this value.

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Page 9419, Line 4: . . . but with smaller concentrations in Pallas compared to Abisko.

Page 9420, Line 9: . . . for the one cluster . . .

Page 9420, Line 10: . . . and . . .

Page 9420, Line 21: . . . this insignificant total concentration . . .

Page 9420, Line 24: . . . summer compared to winter . . .

Page 9421, Line 2: . . . particle number size distributions . . .

Page 9421, Line 4: . . . in the accumulation region . . .

Page 9421, Line 10: . . . became evident.

Page 9421, Line 19: . . . compared to the summer.

Page 9422, Line 14: . . . in the Aitken peak mode diameter were around 1 nm/h . . .

Technical comments:

Tables

Table 2 description: . . . cut-off sizes . . .

Table 3 description: . . . air masses . . .

Table 4 description: . . . when air masses transported from . . .

Figures

Figure 1 description: . . . in a corridor from . . .

Figure 2 description: . . . from corresponding stations . . .

Figure 4 description: . . . corresponding air mass . . . . . for all stations . . .

Figure 5 description: . . . mass concentration . . . . . number concentration . . .

Figure 8 description: . . . air masses . . . . . 16

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 9401, 2013.

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