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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Arctic aerosol life cycle: linking aerosol size distributions observed between 2000 and 2010 with air mass transport and precipitation at Zeppelin station, Ny-Ålesund, Svalbard" *by* P. Tunved et al.

Anonymous Referee #1

Received and published: 13 December 2012

The paper presents an analysis of 10 years of aerosol size distribution measurements at Zeppelin. The data will be highly valuable for validation of transport models and for understanding processes controlling aerosol concentrations in the Arctic. I recommend that the paper be published in ACP after the comments below are fully addressed.

Overall: The paper needs to be fully edited for English grammar and spelling before it is publishable.

p. 29969, lines 6 – 8 state that "the reason for 'Arctic amplification' is not fully under-

stood, but likely relates to the complex feedbacks as well as the environmental conditions that are characteristic of the Arctic environment'. More is known about Arctic amplification than is captured by this statement. It is generally understood that Arctic amplification is a result of the lowering of ice and snow albedo and the positive feedback that results – as the next sentence of the paper acknowledges.

p. 29970, line 27: define "larger sized particles".

Figure 1. State in the figure caption what blue and red represent. It looks like it is odd and even years.

p. 29976, line 10: Reads as if the Aitken and accumulation mode size ranges each contain 2 modes for a total of 4.

p. 29977: Supply a reference(s) for the statement that number concentrations in remote regions at lower latitudes are between 300 and 500 cm-3.

p. 29978: There is no mention here of removal processes that result in the loss of Arctic Haze accumulation mode aerosol and the transition to summer conditions. See, for example, Garrett et al., Tellus, 62, 2010.

p. 29978, lines 20 – 22: There also is no mention of the possibility of entrainment of newly formed particles from the upper troposphere into the boundary layer during summer. Can this be excluded as a source of nuclei mode particles in the summertime Arctic? [After reading the entire paper, I see that this is mentioned on p. 29982 but it should first be mentioned here].

p. 29979, last paragraph: Why is an unrealistic density of 1 g/cm3 assumed for the conversion of mass to number? Why not use something more representative such as the density of ammonium sulfate?

p. 29980m lines 6 – 7: Please be quantitative. Give the size range in diameter of the "smaller sized particles".

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p. 29980, lines 11 – 12: Previously published studies based on measurements in other regions of the Arctic have found this same result. These studies should also be mentioned. For example, Bodhaine, Atmos. Env., 23, 1989 and Quinn et al., JGR, 2002 describe number and mass size distributions at Barrow. There are likely similar results for Alert that should be reported to show the Arctic-wide nature of the shift in size distribution between summer and winter.

p. 29981, line 12: “percentile rages”?

p. 29981, line16: What about September? Concentrations for the two size ranges appear the same based on Figure 10.

p. 29981, line 22 – 24: It is impossible to see diurnal variability in the sub 60 nm number concentration based on the log plots shown in Figure 10 – there may be hint of it for August but that is being generous.

p. 29984, lines 23 – 25: Sentence is not readable.

Figure 12 caption: Grammar issues and misspelled words.

p. 29986, lines 10 – 19: As suggested, a comparison of the results presented here with those of, for example, Hirdman et al. (2010) would benefit the paper. That is not what follows in the rest of the paragraph, though.

Section 3.5.: Is it possible to provide a case study (or two) to support this analysis? As shown in Figures 17 and 18, an increase in precipitation during sunlight leads to a lowering of existing particle surface area and an increase in new particle production due to photochemical processes. It would be useful to see a time series of plot of precipitation rate and particle number and surface area concentration as a function of size. Are such precipitation data available at Zeppelin?

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 29967, 2012.

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