Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-205-RC2, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Seasonal variation of atmospheric particle number concentrations, new particle formation and atmospheric oxidation capacity at the high Arctic site Villum Research Station, Station Nord" *by* Q. T. Nguyen et al.

Anonymous Referee #2

Received and published: 23 May 2016

The manuscript presents an analysis of aerosol characteristics at the high-Arctic site Station Nord in Greenland, based on continuous measurements during 2010–2013 (concentrating on year 2012). The focus of the manuscript is in analysis of new particle formation (NPF) events. Ambient conditions favoring NPF at the site are reported based on case-studies, and NPF events are also analyzed with respect to source areas based on airmass back-trajectories. The dataset presented in the manuscript is interesting, higlighting the importance of atmospheric NPF to the aerosol number even in the remote Arctic regions. This work is within the scope of Atmospheric Chemistry and Physics, and could be considered for publication after the comments below have

Printer-friendly version

Discussion paper

been taken into account.

My major concern is the analysis of the airmasses in relation to the three NPF events presented in the paper. The arrival times of the airmass back-trajectories shown in Figure 7 do not seem to coincide with the NPF events presented in Figure 6. The first airmass shown arrives in-between of the double event A and all the other airmasses of Fig. 7 on the midnight following the events A, B and C. I don't see how any conclusions on aerosol and trace gases measured at Station Nord during these three NPF events could be drawn based on the airmasses shown in Fig 7. Therefore, the analysis of the whole of Section 3.2.3 should be redone by analysing airmasses arriving to the station at the start of the NPF event or at some other relevant time during the event.

Other general comments:

1) Page 2, lines 3–4: "only nucleation and Aitken-mode particles were observed during the summer months". Based on Figures 3–4 and Table 1, this does not seem to be the case. There are clearly particles larger than 100 nm present during all the months, although the concentrations of accumulation mode particles are lower during the summer.

2) Also Asmi et al. (2016) reported on NPF observations at the Arctic measurement station Tiksi in northern Siberia. This could be added to the discussion on NPF observations in the Arctic (third paragraph of the Introduction section).

3) Page 4, lines 32–33: Is the local pollution source taken into account in the data-analysis (for example by excluding data when the local wind direction is from the sector towards the pollution source)?

4) Page 7, line 19: "during the time period from July 2010 to February 2013". I suppose this should be "during 2012", as was stated at the end of Section 2.2.2. Also, Figures 3–5 refer to the year 2012.

5) Page 8, line 27: This sentence is little unclear, consider revising to e.g. "Since

nucleation mode particles were almost absent in April and relatively minor in May, the high median or average N values observed during these months were attributed to .."

6) Could the analysis of Section 3.2.2 on the role of O3 and NOx in NPF made more general by including data during all the NPF events, instead of just using 3 case-studies? Also, comparison of the O3 and NOx between NPF and non-NPF days could provide useful information. Such analysis should probably be done seasonally in order to exclude the strong difference in NPF occurince between summer and winter.

7) Page 14, lines 29–31: What were the criteria used in the removal of the local pollution episodes? An exceedance of certain NOx level? Why weren't the episodes during August 2nd (Fig. 6) removed from the dataset, if they were identified as local pollution as discussed on lines 19–24 of page 14?

8) Page 15, lines 26–27: Are you certain that the airmasses descend from above the boundary layer in these two cases? At least for Event C the airmass arriving at 50 m height stays constantly below 250 m, which seems quite low to be above the boundary layer.

9) Page 15, lines 28–30: I don't fully understand how can the vertical mixing of the airmasses be inferred from Fig. 7 for the case of mid-day of June 19. According to the map, the two airparcels do not follow the same horizontal path, so even though they are at the same altitude at the same time on mid-day of June 19, they are not at the same location horizontally and therefore not interacting with each other.

10) Page 17, lines 1–2: Is the map of Figure 8 constructed using all the trajectories arriving at Station Nord during the year 2012? Is the number of trajectories big enough for drawing conclusions on the source areas of airmasses favouring NPF?

11) Page 17, lines 30–31: Asmi et al. (2016) reported similar NPF day frequency, 30–40%, during summer in Tiksi, Russia.

12) In the conclusions, the statement on the close relationship of ozone to the particle

growth (lines 18–19) seems hard to justify on the basis of the presented material, which is currently 3 case studies of NPF. What were the exact growth rates of 10–25 nm particles during these events? Could this analysis be made more thorough by including all the NPF days and showing the relationship between O3 concentration and particle growth rates (see also my comment 6)?

Technical comments:

Page 1, line 23: “focus” should be “focuses”

Page 6, line 16: section number “2.2.2” should be “2.2.3”

Page 12, line 5: “Fig. 9” should be “Fig. 6”

Page 17, line 30–31: “.. relatively higher compared to ..” should be “relatively high compared to ..”

References:

Asmi, E., Kondratyev, V., Brus, D., Laurila, T., Lihavainen, H., Backman, J., Vakkari, V., Aurela, M., Hatakka, J., Viisanen, Y., Uttal, T., Ivakhov, V., and Makshtas, A.: Aerosol size distribution seasonal characteristics measured in Tiksi, Russian Arctic. Atmos. Chem. Phys. 16, 1271–1287, 2016

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-205, 2016.

Printer-friendly version

Discussion paper