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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Sources of anions in aerosols in northeast Greenland during late winter" *by* M. Fenger et al.

**Anonymous Referee #1**

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Review of Fenger et al "Sources of anions in aerosols in northeast Greenland during late winter"

This paper presents a unique data set from an appropriate field location to address the topic at hand: the size, source, and anion chemical composition of aerosols in the Arctic winter. The paper is mostly well written and the text, Figures, and content present a clear story of the research. I have a few text and grammatical edits to propose and some comments/suggestions but I would recommend this paper be published with minor revisions as noted by myself and the other Reviewers. I feel strongly that this paper could be strengthened by incorporating more of the sea ice regime and a few more strategically placed references. Especially with respect to frost flowers, nilas ice, leads, etc.- the paper could fit nicely into the work done previously but should consider



work done by Simpson and Kaleschke on frost flowers and snow chemistry:

Simpson (Atmos. Chem. Phys., 7, 621–627, 2007) Kaleschke ( Geophys. Res. Lett., 31, L16114, doi:10.1029/2004GL020655, 2004)

And a few papers since that have addressed the snow/sea ice/frost flower composition topic.

Page 14814 Line 5 "the" not needed between "of" and "aerosols" Line 8 "the" not needed between "analyze" and three" Line 24-25 "climatic processes where our understanding is insufficient"

Page 14815 Line 1-2 "to continue in the future" no "climates" Line 4 "chemistry of the high Arctic are still very limited due to its remote location and the small number of sites where measurements are made." Lin e8 needs a few references for albedo/aerosols. Maybe Warren, Grenfell, or Perovich references? Line 22 "known as "Arctic haze"" Line 28 "in high Arctic air" References are needed here, too How about some snow references as well so the sentence reads: "Concentrations of aerosols in high Arctic air (refs) and snow (refs) are at their highest during late winter and early spring when anthropogenic pollution is most eïňČciently transported from lower latitudes (e.g. Heidam, et al. 2004)."

Page 14816 Line 2 "of the aerosols observed from" Line 5 "and" not needed after "atmosphere" Lines7- 8 "the composition of Arctic aerosols" Before "It is important" how about "As a consequence, " Line 11 "inorganic anion components Line 16 "transformations, and transport patterns." Line 19 "Nord for the firs time" Lines 23-24 "the year, mainly during summer"

Page 14817 Line 2 "exposed to Eurasian air masses coming from the northern and eastern directions" Line 4 "after polar sunrise" Line 10 no "s" needed at the end of "measurement" Line 19 "yet a comparison of wind"

Page 14819 Line 25 "are associated with this size fraction."

Page 14820 Line s 3-10 Is there a way to express any of this in terms of time or distance over ice versus snow versus nilas ice versus frost flowers? This gets to the heart of the paper. If you look at the papers a few years ago by Kaleschke and Simpson there was some interest in the “potential” location of frost flowers (ie new ice in dynamic locations where exposed ocean water was leading to frost flowers. This versus older ice where a snow cover may impede exchange. Can this paper address the trajectories over different types of ice?

Lines 14-30 What about non-sea salt sulfate? I know you ay not have the cations to quantify this but do others or have others? This is a likely player in the sulfate world.

Page 14821 Lines 22-26 Consider breaking this into a few sentences as it is long and rambling

Page 14822 Lines 4-5 I am not sure the Journal mandates this but here and elsewhere the study references should be presented in chronological order by year Line 17 no comma needed Line 18 no comma needed after “distribution” Line 19 Again do you have any sense from MODIS or other imagery as to whether there was in fact open water, then nilas, then frost flowers? Perhaps a map like the one as Figure 8 but of the area immediately near the Station could be used to show the ice situation with time during sampling? Maybe four MODIS images over the three week period (maybe a little before the sampling started to provide more info) or something like that?

Line 24 “and Domine et al. (2004)” Line 27 “On 20 March” or “on “March 20” Line 28 Here and elsewhere it should be “sea ice” with no hyphen. I some places there is no hyphen. Be consistent.

Page 14823 Lines 1-8 I wonder if saltation of snow against frost flowers could kick up or break up the frost flower crystals? Also where you have frost flowers you have or recently had a lot of brine. Winds or saltating grains over and through the brine could be a source of halides without the frost flowers playing a role. In fact, with time since the frost flowers form the amount of brine goes down.



Page 14824 Line 15 “on the sea ice are a potential source of Cl-“

Figures 3. Use the same x-axis time/scale/format for all Figures (ie 2, 3, and S1). Figure 2 has the easiest to comprehend x-axis scale and label.

Figures 5 and 6. This may be an artifact of my printer but the horizontal lines are not consistently present across the Figure groups. Are the lines needed at all?

Figure 8. This is hard to read or identify subtleties. Perhap shave a second set of Figures from the same two times but for a “zoomed” in view of the sea ice around Station Nord? This could help identify ice types/frost flowers, open water, etc.

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 14813, 2012.