

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

**Anonymous Referee #3**

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The paper presents size segregated inorganic anion concentrations from Station Nord for the month of March 2009. Given the lack of these kinds of data for high Arctic stations, this is a valuable data set and the paper should be published after the following concerns have been addressed.

p.14815: Lines 13 – 15: Sentence needs to be edited for grammar.

p. 14816, lines 3 – 7: Add more details to the description of the impact of increasing solar radiation on photochemistry in the atmosphere (e.g., formation of secondary aerosol such as SO<sub>4</sub>) and in the snowpack (e.g., production of NO<sub>x</sub> that can lead to production of aerosol NO<sub>3</sub>). This discussion will then lead into results that are described later in the paper.

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P. 14816, line 19: change to “carried out at Station Nord FOR THE first time”

p. 14817, lines 4 – 20: The wind speed data is used in the discussion toward the end of the paper. I think the figure shown in the supplementary material should be put into the paper itself. Plus, the paper length is short enough to accommodate it.

p. 14818, line 4: Was the laboratory at Greenland or were samples shipped somewhere?

p. 14818, line 21: The SMPS size distributions should be shown averaged over the impactor periods. As indicated later in the paper, these size distributions were converted to mass and used to calculate total aerosol mass. It would add a great deal to the paper to show the SMPS number and derived mass size distributions in order to place the anion mass size distributions into context.

p. 14819, line 4: change to “the concentrations of NO<sub>x</sub> (NO<sub>2</sub> and NO) WERE estimated as...”.

p. 14819, line 7: A time series of total (or submicron and supermicron) concentrations of each ion should be plotted and shown similar to the NO<sub>x</sub> and NO data shown in Figure 3. Showing these time series will aid when comparing to the wind data in Figure 2 and in making connections between the measured aerosol NO<sub>3</sub> and the NO<sub>x</sub> and NO concentrations.

p. 14819, line 24: change to “are associated WITH this size fraction”.

p. 14820, lines 16 – 18: SO<sub>4</sub> size distributions are constant in terms of shape but not magnitude.

p. 14820, lines 25 – 27: Presumably the formation of SO<sub>4</sub> on coarse sea salt particles occurs via oxidation of SO<sub>2</sub>. This process should be briefly described.

p. 14821, lines 3 – 4: The sentence starting with “Of the three analyzed anions...” is redundant as this has already been stated.

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p. 14822, lines 1 – 5: The process of chloride depletion from particles should be described in more detail including what is known about the dependence on particle size and how the process involves NO<sub>3</sub>.

p. 14822, lines 6 – 7: It is stated that “the finest mode here (referring to Cl-) is found to be associated with the long-range transported SO<sub>4</sub>”. What is the evidence for the association between Cl and SO<sub>4</sub>? SO<sub>4</sub> peaks at 0.32 μm while Cl peaks at a larger diameter (0.56 μm). This difference indicates they are not internally mixed.

p. 14822, line 9: I wouldn’t call these Cl “profiles”. Stick with size distributions.

p. 14822, lines 16 – 19: explain the process of “re-fractionation of the aerosol size distributions”.

p. 14822, line 20: What is meant by “more varying fractionation”?

p. 14823, lines 26 – 27: This description of the relationship between NO<sub>x</sub> in the snow-pack and NO<sub>3</sub> in the aerosol should be expanded.

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