

Interactive comment on “Atmospheric black carbon and sulfate concentrations in Northeast Greenland” by A. Massling et al.

Anonymous Referee #2

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This study discusses three years of EC (thermo-optical method), equivalent BC (MAAP) and particulate sulfate (ion chromatography) measurements at Station Nord in Northeast Greenland. The publication of these data is worthwhile as our knowledge on seasonal and geographic Arctic aerosol properties, and black carbon in particular, is still very limited. The authors discuss the seasonal variations of EC, EBC and particulate sulfate, compare EBC and particulate sulfate, and EBC and EC concentrations. In addition they performed model calculations with the Danish Eulerian Hemispheric Model and compare modeled and measured EBC and sulfate data. Some discussion on potential atmospheric transformation processes of EBC and particulate sulfate is also included. Overall, this work should be published after the authors have addressed the following minor comments.

C2715

General comments:

The expression “BC” should be changed to “EBC” (equivalent BC) when referring to measurements by the MAAP following the recommendation by Petzold et al. 2013.

There is no outlook or discussion of what data and measurements will be needed in the future to better answer current unknowns. Those include for example a better determination of the MAC value and size resolved chemical composition data of the aerosol in order to determine the mixing state that may support or contradict the hypothesis of sulfate functioning as ‘transport container’.

The idea of particulate sulfate functioning as ‘transport container’ for BC containing particles is misleading as particulate sulfate tends to decrease the lifetime of BC by making it more hydrophilic which contradicts the idea of a ‘container’ which would function as a protection.

Specific comments:

The abstract needs to be more quantitative. For example, in l. 4 on p. 11466 concentration values should be included, in l. 19 “good agreement” should also be quantified.

Include information on the source regions that are being referred to in l. 21f in the abstract.

p. 11470: Include considerations on the seasonal variation of the MAC as reported for another Arctic site by Sharma et al. 2004 and 2006. Also the values those authors report (19 m²/g for winter/spring and 29 m²/g for summer) are much higher than the MAC value that is used in the present manuscript which requires some discussion.

p. 11477, l. 15 – 18: Include a brief discussion why this was not the case in spring when there are also biomass burning events.

p. 11479, l. 27: “associate” is a very unspecific term, replace it by a word that precisely describes what you mean.

C2716

p. 11480, l. 1 and 5: Is this the radius or diameter? Please, specify and include information which type of diameter (radius) you are referring to, e.g. effective, volume equivalent, mobility etc.).

Technical comments:

p. 11467, l. 10: Delete “not”, otherwise it reads like small BC particles are better CCN.

p. 11467, l. 11: Here, you mention CCN the first time, so it needs to be spelled out (currently this is done in line 15).

p. 11470, l. 24: Delete “according to these two factors”, this is redundant.

p. 11472, l. 13: “originating” instead of “originated”

p. 11477, l. 12: Insert “a” between “is little”.

p. 11477, l. 14: no capital “S” for “Sulfate”.

p. 11478, l. 23: change “decrease on” to “decrease of”

p. 11480, l. 29: Change the sentence to “Also, in general, a low dry deposition rate is observed. . .”

p. 11481, l. 9: “Siberia”

p. 11481, l. 12: Replace “This finding” by “These circumstances. . .”, since this is not a finding of your work.

p. 11481, l. 14: Delete “somewhat”

p. 11481, l. 23: Replace “individual” by “the”

p. 11482, l. 7f: Change the sentence to “This was found in both, measurement and. . .”

p. 11482, l. 16f: Delete “information”

References:

C2717

Petzold, A., Ogren, J. A., Fiebig, M., Laj, P., Li, S. M., Baltensperger, U., . . . Zhang, X. Y. (2013). Recommendations for reporting “black carbon” measurements. *Atmospheric Chemistry and Physics*, 13(16), 8365-8379. doi: 10.5194/acp-13-8365-2013

Sharma, S., D. Lavoué, H. Cachier, L.A. Barrie and S.L. Gong, 2004. Long-term trends of the black carbon concentrations in the Canadian Arctic. *Journal of Geophysical Research*, 109:D15203, doi:10.1029/2003JD004331.

Sharma, S., Andrews, E., Barrie, L. A., Ogren, J. A., and Lavoué, D.: Variations and sources of the equivalent black carbon in the high Arctic revealed by long-term observations at Alert and Barrow: 1989–2003, *Journal of Geophysical Research: Atmospheres*, 111, D14208, 2006.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 15, 11465, 2015.

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