

Interactive  
Comment

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

**A. Massling et al.**

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Response to reviewer 2:

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.

Author: Yes. This will be done in the revised version of the manuscript. Another reviewer has been putting up a similar issue. We will also use the proposed reference for this.

There is no outlook or discussion of what data and measurements will be needed in the

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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.

Author: We agree on the need for more speciated chemical data on particles. We have thus carried out a campaign this year where sub-micrometer particles are analyzed by a Soot Particle Time-of-Flight Aerosol Mass Spectrometer (SP-ToF-AMS). We do not agree on the following statement regarding the lifetime of BC as we have clearly described the processes in the comment to the reviewer/editor after pre-review and also have inserted a section in the latest version of the paper. BC from traffic is typically emitted in the size range from 50-100 nm and needs to grow to sizes above 0.1 – 0.2  $\mu\text{m}$  in order to have a sufficient long lifetime due to minimum deposition velocity to be transported over long distances (see Seinfeld and Pandis 2006, page 905). We will include a short outlook in the summary part of the revised version of the manuscript stating future needs to support our theory.

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.

Author: This criticism was also mentioned by another reviewer. We will improve the abstract in the revised version of the manuscript accordingly.

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

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report (19 m<sup>2</sup>/g for winter/spring and 29 m<sup>2</sup>/g for summer) are much higher than the MAC value that is used in the present manuscript which requires some discussion.

Author: A general discussion on the used MAC will be included. This value is actually highly impacting the uncertainty of the calculated BC mass concentrations.

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

Author: From receptor analysis using PMF and COPREM we failed to identify the contribution from biomass burning (Nguyen et al. 2013, ACP). From other high Arctic stations we expect that biomass contribution is significant and we have ongoing work to distinguish more efficiently between the various sources. We have thus measured the chemical composition of particles with a Soot Particle Time-of-Flight Aerosol Mass Spectrometer (SP-ToF-AMS) this spring at Villum Research Station.

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

Author: We mean that BC is typically emitted in the submicrometer size regime. This will be changed and described more clear in the revised version of the manuscript.

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.).

Author: Thanks for the comment. It is really not clear from the text now. We refer to aerodynamic diameter, this will be mentioned in the revised version of the manuscript.

Technical comments:

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

Author: This will be done in the revised version of the manuscript.

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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).

Author: This will be done in the revised version of the manuscript.

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

Author: This will be done in the revised version of the manuscript.

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

Author: This will be done in the revised version of the manuscript.

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

Author: This will be done in the revised version of the manuscript.

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

Author: This will be done in the revised version of the manuscript.

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

Author: This will be done in the revised version of the manuscript.

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

Author: This will be done in the revised version of the manuscript.

p. 11481, l. 9: “Siberia”

Author: This was also mentioned by another reviewer. This will be done in the revised version of the manuscript.

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

Author: We agree. This will be done in the revised version of the manuscript.

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p. 11481, l. 14: Delete “somewhat”

Author: This will be done in the revised version of the manuscript.

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

Author: This will be done in the revised version of the manuscript.

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

Author: This will be done in the revised version of the manuscript.

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

Author: This will be done in the revised version of the manuscript.

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

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