

Interactive comment on “High–Arctic aircraft measurements characterising black carbon vertical variability in spring and summer” by Hannes Schulz et al.

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Received and published: 7 December 2018

–Arctic aircraft measurements characterising black carbon vertical variability in spring and summer

We would like to thank the referees for their detailed and constructive comments, which helped us to improve our manuscript.

For easier reading, we attached our comments as PDF, where the referee comments

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are given in black bold, our answers are given below in blue letters. Additionally, we added the changes we made in the revised manuscript in blue bold letters.

Answers of the authors to anonymous Reviewer2

Anonymous Review of Manuscript acp-2018-587 GENERAL REMARKS:

This paper presents novel data of black carbon (BC) aerosols obtained by aircraft observations over the Canadian Arctic in summer 2014 and spring 2015. The authors report clear seasonal variations of BC mass concentrations, mass-mean diameter, BC/total aerosols number ratio, and BC/CO ratio, and then try to understand the mechanisms that controlled vertical profiles of BC properties based on the analysis of potential temperature and back-trajectory. The instrumentation is clearly written in the Method section. Because the data of the vertical profiles of BC in the Arctic is very important to assess their radiative impacts and validate numerical models, the novel data presented in this paper is valuable to the community. One aspect of the paper that I thought could be improved is the discussion on the mechanisms controlling vertical profiles. In many parts of the paper, the authors try to interpret the profile variations by “wet removal” or “nucleation scavenging”. However, their conclusion is rather speculative and not well supported by data. I understand that the wet removal process is complex (especially ice-cloud scavenging) and difficult to examine, but if the authors can use any supporting data such as precipitation amount or humidity that air masses had experienced along the back-trajectory paths, more quantitative discussion on the observed variability (and also related new insights) may be achieved in the paper.

The authors would like to point out that the referees raised questions concerning the interpretation of the BC/CO ratio as indicator for wet scavenging and encouraged us to verify the subsequent hypothesis and conclusions. Due to the high number of

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comments on this specific topic, we prefer to provide here a general and common answer to all reviewers. As a consequence of the above-mentioned reasons, Section 3.4 was substantially modified. The discussion now focusses on the importance of transport patterns on the observed BC concentration. Thus, Figure 7 and Figure 8 were modified. The discussion on potential impact of wet scavenging on BC and BC/CO ratio is now substantially reduced. However, additional analysis of back trajectories, including encounter with clouds, is now presented in the supplementary material.

Specific comments of Reviewer2

Please find our comments in the supplementary material to this AC!

Please also note the supplement to this comment:

<https://www.atmos-chem-phys-discuss.net/acp-2018-587/acp-2018-587-AC2-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-587>, 2018.