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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #4

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General comments;

This paper describes the results from the aircraft measurements of black carbon (BC) aerosols over the high arctic region. The vertical distribution of BC is one of the most important characteristics for assessing its radiative impact. Authors analyzed in detail the vertical distributions, their seasonal variations, and transport pathways of BC using the data sets from the aircraft observations which were performed in the summer of 2014 and the spring of 2015. The analyses of the vertical distribution of BC with potential temperature illustrated the fundamental feature of the transport of BC from the lower latitudinal region (i.e., Sub-Arctic). Single particle soot photometer (SP2) was de-

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Discussion paper

ployed on the aircraft to reveal one of the microphysical parameters, size distributions, of BC. The changes in the size distributions of BC in the vertical coordinate indicated that the removal process of BC during the transport to the high-arctic region is related to precipitation. The results and discussion presented in this study meet the scope of ACP. The observed features, which are well illustrated in this study, will be really helpful for the research community of Arctic climate changes as well as I actually enjoyed reading this paper.

What this paper does not present in detail is the analyses of wet removal process of BC during the transport and its impact on the abundance and microphysical parameters of BC-containing particles. The cloud processing and following precipitation during the transport in East Asia can significantly affect the microphysical parameters of BC-containing particles in the lower free troposphere (Moteki et al., 2012; Kondo et al., 2016) and even in the planetary boundary layer over the outflow area (Miyakawa et al., 2017). There should be a difference in the actual wet removal process between East Asia and Arctic, because the scavenging of BC particles can be affected by cloud phase (e.g., Browse et al., 2012). Furthermore, we are interested in where BC-containing particles were removed and deposited in Arctic region in order to well understand the snow darkening induced by deposited BC. The more data analyses of precipitation during the transport (intensity of precipitation, where air masses were affected by precipitation, etc.) magnify the significance of the data sets used in this study.

Other minor comments are shown as follows.

Minor comments;

P1, L10. “a factor 10” should be “a factor of 10”. P15, L2. “an air parcel” should be “in air parcel”. P23, L11-13. The finding in Moteki et al. (2012) is that the average mass of non-BC materials on rBC-containing particles increased with increasing rBC core diameters. They just discussed shell to core (S/C) ratio of rBC-containing particles.

When we translate the relative enhancement of shell mass of non-BC materials into the S/C ratio, the similar tendency given in Kodros et al. (2018) will also be found in Moteki et al. Please modify this description and add appropriate discussion on this part.

References;

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