Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-1114-RC3, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Compositions and mixing states of aerosol particles by aircraft observations in the Arctic springtime, 2018" *by* Kouji Adachi et al.

Anonymous Referee #3

Received and published: 8 December 2020

This manuscript investigates size and composition of individual aerosol particles collected from the Arctic using transmission electron microscopy. The authors applied the Meteorological Research Institute Earth System Model to investigate the transport patterns and aerosol sources. The authors found several types of particles and compares size resolved chemical composition below and above 1000m. Overall the manuscript is well written, nice illustrative TEM images and the research topic is relevant and important for the community. However, the discussion regarding the atmospheric implications and what are the impacts of these findings need to be discussed in detail. Some of the observations are rather qualitative. The authors used the Earth System Model but it could be better utilized for discussion in relate to the particle composition and sources.

Printer-friendly version

Discussion paper

Specific comments:

Particle classification is bit confusing to me. The authors discussed about the K-bearing particles. Are those associated with carbonaceous or sulfate? Fig 6 shows some TEM images where K-bearing particles are both associated with carbonaceous and sulfate but what are their number fractions? Did you observe any size dependency of K-bearing particles, like smaller particles contain higher wt% or vice versa?

Number fraction of sulfate did not show any trend with altitude but what about their size? May be the authors can provide a plot of size of these particles as a function of altitude. Based on Figure 3 sulfate particles are smaller in size for <1000m but increases at >1000m. Please add some discussion.

As one of the focus of this manuscript is looking at size resolved particle composition at different altitude, it might be useful to add additional plot in figure 2 of size distribution of particles for <1000 m and >1000m for different particle classes.

The authors suggested that sea salt particles are mostly processed by sulfate. What about nitrate or organics? Did you observe smaller particles more processed compared to larger particles? Figure S6 can be improved by looking at the elemental ratio and size information as color code or bubble plot.

The authors describe soot, fly-ash and Fe-aggregates separately. What about their relative contributions? Soot should come under carbonaceous particle class. What are the relative number fractions of soot with respect to total carbonaceous particles? What are the number fraction of soot and tar balls in the biomass burning plumes investigated here?

I did not follow discussion about the tar balls aging. The authors discussed that “their composition is similar to that of particles from young BB smoke plumes” and later discussed that particles were probably >1 week aged and the surface of tar balls contain sulfate.

The authors discussed that for the same field campaign previous study found good agreement between the SP2 measurement and TEM observation. Did they observe similar number or mass fraction of Fe-bearing particles? Is the reported number fraction relative to total particles or contribution within dust category?

I suggest the authors to improve the atmospheric ageing and climatic impacts part.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1114, 2020.

Printer-friendly version

Discussion paper