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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 #2

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The study focused on the individual aerosol particles at different altitudes during the Polar Airborne Measurements and Arctic Regional Climate Model Simulation Project. Certainly, the data from this study is important and valuable due to the ARCTIC polar aerosol in particular from the aircraft data. The study found several particle types associated with continental emissions which might be interesting for potential climate and CCN study in the Arctic. For example, the authors found one BB case based on the K-bearing particles >3900 m. Also, they found several aspects on inclusions such as fly ash, soot, and Fe-aggregates particles. For my views, I would like to recommend this paper published in ACP after one minor revision.

L26, the ice-nucleating particles. Maybe this authors consider whether it is suitable here. I did not noticed any discussion on these. Also there particles were internally mixed with sulfate. The secondary aerosol particles become important.

L27, For the first time. As your introduction, Hara et al. had some works in Arctic air through the aircraft. Right?

L142-144, There is no need to mention the P-rich particles. In this paper, you give details of several particle types. I might suggest to delete it.

L188 About local emission, I might have confused. You need to more data to support the statements such as back trajectories. For me. It is not necessary to classify the local emission. Below 1000m, there are still large part of particles from the long range transports.

L235, as seen in the TEM results (need Figure ?)

L236-237, terms of the BB samples, the sampling areas were > 4600 km far away from the BB sources, and the samples had aged for a week or more (need Figure ? to support)

L245-247, There are absent several important references about "organic salts" (Laskin et al., 2012;Chi et al., 2015) on aged sea salts beside nitrate and sulfate in this sentence. As you mentioned L256-257, you found C in coating. This is very significant information.

L250-251, you mentioned N in aged particles. The authors should be familiar with the N underestimated by the TEM/EDS, although there are nitrates in aged sea salts.

L280, The TEM images are not strong enough the statement about the mineral dust particles. In the Figure 10bc, Elemental Na can be existing in mineral dust particles. Also, I noticed there is no Cl in the particles. I suspected that these particles could be externally mixed particles. As you discussed below, the mineral dust particles might source from the local Arctic areas instead of the out of Arctic.

L310, interesting, the authors detected some satellite particles. Recently, one study found the satellite particles also contain organic acids (Yu et al., 2019). That mean these contain sulfuric acids and organic acids instead of only sulfuric acid. Moreover, does the study found the significant organic coating on sulfate as reported by Yu et al. on the ground in Arctic air.

L330, “suggesting that they reacted with other species and had aged during LRT.”. There is no evidence to show their reaction. In previous study, there is some irregular primary organic particles.

L340-341, I might delete the sentence. Even the soot mixed with mineral dust particles . They are not inclusions.

L403, i.e., BC

L420 ALSO, the author mentioned the reactions between tarball and sulfate. How? There is no evidence. Seemly, this is very complicate question.

Figure 13, the a, b should be noted (b) after sublimed particles or beam damage? The potential readers can directly read the information a, and b.

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