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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Sea salt aerosols as a reactive surface for inorganic and organic acidic gases in the arctic troposphere" *by* J. W. Chi et al.

**Anonymous Referee #1**

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Generel comment:

This paper reports detailed characterization of sea-salt particles collected from the arctic. The authors used various microscopic techniques to measure those particles. The results include important implications to the atmospheric chemistry in the region. On the other hand, the interpretation for some data needs to clarify, and some discussion should be more careful. For example, the authors discuss nitrate as an important coating material from little data obtained by their measurements. Please consider the following specific comments below for the details.

Specific comments:

1: Authors discuss nitrate as coating materials on sea-salt particles in several sections



(e.g., 4.1). However, there is no N signal in Figures 3-5, and authors mention that "N content cannot be directly measured but has been inferred based on the probable aerosol components". If substantial amounts of nitrate occur within the particles, N peak may arise between C and O in the EDX signals (e.g., Fig. 4 h and j), although it depends on the detection efficiency and the energy resolution on the EDX. I cannot see N in the mapping data in Fig. 7. SIMS data in Fig. 8 does not show the presence of nitrate as well. Although theoretically it will be likely that nitrate occurs on the coating, the main discussion should not be based on "the probable aerosol components." I suggest distinguishing between the result and discussion clearly, i.e., nitrate should be discussed only in the discussion with proper references. Also the occurrence of nitrate is not a direct evidence, and the relative sentences need to be revised (e.g., Page 16727 line 23).

2: Similar to nitrate, I am also wandering the occurrence of organic. The authors used 12C14N- as an organic tracer. It seems to me that 12C14N- may be a tracer of organonitrate or some specific types of organic, although I am not familiar with the technique. Please specify the availability of 12C14N- as an organic tracer.

3: The authors classified sea-salt particles into fresh, partially aged, and fully aged ones based on morphology and chemical compositions. Is there any relation between the aging process and the back trajectory analysis? If not, it may not be appropriate to discuss compositional changes as particles age since the classification was made depending on the compositions but not aging, i.e., "it is shown that there is a major change of their internal structure and composition as the particles ageing (page 16724 line 24)" is not accurate because the particles aging was determined based on their internal structure and composition. Overall, it should be more careful to discuss the aging process unless the classification was determined based on the "aging."

Detailed comments

4: Page 16715 Name and e-mail may not be consistent in the first corresponding

author.

5: Page16718 Line 5: Recently, Laskin et al. (2012)... Here and elsewhere, authors refer Laskin et al. (2012). I suggest taking out “Recently” since it was published in 2012.

6: Page16721Line 21 (equation 1): I guess this equation is wrong (take out 4/3).

7: Page 16729 line 11: “Comparisons of fresh and aged SSA in Fig. 8 suggest that these organic coatings likely took part in the chloride depletion during particles ageing.” In Fig. 8 (and Fig. 7) authors show particle elemental mappings to show particle aging. However, they are different particles and do not show their aging process directly. Thus, the increasing or decreasing of elements may not reflect the aging process but just particle differences. Thus, it may be too strong to conclude “The chloride depletion in the SSA induced by the presence of organic matter should be incorporated into the atmospheric chemistry models for clean marine air (Page 16730 line 22)” from this study. At least, more careful discussion will be needed.

8: Figure 3: Fig. 3j shows O signal for MgCl2 in EDX but Fig. 3k does not have O for CaSO4. Why?

9: Figure 6: Please specify the cutoff size in aerodynamic diameter for the sampler if any. The cutoff sizes will influence the particle size distributions.

10: Figure 7: N mapping may be artifact since it was determined without detecting N in EDX. It can come from C and O since N peak is between these elements. Please check it. The TEM images are rotated comparing to the mapping images. Can it be fixed?

Supplement file:

11: Figure S2: Please check if the R2 value is correct. It looks the value (R2=0.9888) is too high for the plotting.

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 16715, 2015.