Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Frost flowers and sea-salt aerosols over seasonal sea-ice areas in north-western Greenland during winter–spring" *by* Keiichiro Hara et al.

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This paper contains an impressive amount of data on frost flower and surface brine composition on Arctic sea ice, as well as a large amount of varied data on aerosol size distribution and chemical composition at the same sites. To my knowledge, such a data set is novel and deserves to be made available to the scientific community and to be fully exploited in terms of physical and chemical processes.

I however have to say that I was disappointed by the very limited use of the data made by the authors. No real scientific plan seems to have driven their campaign other than data collection, and this paper falls short of providing significant new insights into processes at the surface of sea ice, processes of aerosol generation above sea ice, in the

presence and absence of frost flowers (FF), and processes of aerosol chemical evolution, although this last aspect is somewhat discussed. Clearly, the scientific discussion is not up to the level of the data set and at present, I just do not think that the paper is good enough for publication in ACP. The somewhat tedious point-by-point description of results should be completely replaced with a discussion focussed on solving a few selected scientific questions such as for example : "how does the presence of FF affect aerosol composition?" or "what are the processes leading to halogen enrichment in FF and surface brine?". More aggressive attempts to make deductions from the observations are mandatory. For example the authors do not even consider the surface to volume ratio of aerosols to attempt to quantitatively examine chemical evolution. An all too frequent phrase is "Similar observations were made at Syowa" and I must confess that after reading this over 10 times without any subsequent deduction of any process, I started to become a bit frustrated, perhaps even irritated. The authors may cross their data with GOME2 BrO data to perhaps reach some interpretation on halogen activation.

http://atmos.eoc.dlr.de/gome/product_bro.html

http://atmos.eoc.dlr.de/gome/image_browsing.html

http://www.iup.uni-bremen.de/doas/scia_data_browser.htm

In summary, before I can recommend serious consideration of publication, I strongly suggest to completely reorganize the paper as follows:

1- Select a couple of novel scientific questions to be addressed by the data set.

2- Select the data to be presented to address the selected questions. A couple of case studies focused on a few events may be interesting.

3- Separate results and discussion and write in a much more concise form to produce a much shorter paper.

4- Reach some strong and novel conclusion. For example, finding out that the presence

of FF does not significantly affect aerosol composition would be quite interesting.

5- Place the data not used here but of potential interest to others in supplementary material or any other accessible place.

The authors should feel free to adopt any other strategy, the objective being to make a good and concise use of the data to derive strong conclusions. At present, the manuscript is more a detailed preliminary campaign report than an actual scientific paper.

Specific points.

Page 1, line 28. Vapor is supplied TO the atmosphere, not FROM. See the references on the same line. 2, 31. Specific surface areas are now expressed in m2 kg-1. Please convert.

Section 2.2. Was snow present in FF and brine samples? This should be mentioned as it dilutes the samples. Re. section 3.4.

6, 7. Please add a + sign: +1.8°C, to avoid any ambiguity.

Throughout: replace liberated with released

7, 18. Replace correlation with determination.

7, 32. The structure of the paper is such that the mention of solar radiation here is a bit odd and unexpected, and maybe not readily understood by all. Separating results and discussion would have helped.

End of section 3.3. A more in-depth discussion of the causes of Br and I enrichment is in order.

9, top. Air T is a useful variable for many purposes, but the actual variable of interest here is surface T. All the speculation between air T and processes is really not useful, unless a surface T can be produced. Several lengthy discussions could just be

removed.

9, 28. Replace larger by greater. The sea ice thickness may be important for the relationship between air and surface T, but not for surface processes. This is a good example that the variable of interest is the surface T, not the air T or the sea ice thickness.

10, 4-5. This statement does not lead to any useful conclusion. Please delete.

11, 5. Since or until ?

12, 1-3. What useful conclusion do we derive from these Mg-rich and K-rich particles? Data description just is not enough for a scientific paper.

13, 9. Could you please discuss the presence of non-sea salt sulphate?

14, 11-13. This is where your impressive data set could be put to good use to address these points. "At the moment, release processes of mirabilite-like and ikaite-like particles from the sea-ice surface without frost flowers remain unknown". Sure, but is not this campaign supposed to contribute to solving this problem ?

14, 17. "Therefore, most of the aerosol particles around Na2SO4 ratio in fine mode might be the modified sea-salt particles by heterogeneous reactions with nss-SO42-." Can't you get to a stronger statement than just "might" by more in-depth examination of your data?

15, 6. "Therefore, sea-salt modification (Cl loss) might be most likely to occur in fine mode." Sure, you may even use your data quantitatively and examine the role of aerosol surface to volume ratio on reaction kinetics. Again, "might" is not sufficient here.

16, 33 to 17, 6. Again, a more in-depth use of the data should allow useful conclusions, not vague suppositions.

17, last lines. These mentions of just observations, without any scientific deductions, are very disappointing. The authors have a unique data set and hardly do anything

novel with it. Honestly, I expected a breakthrough paper, which is what those data deserve, and only get descriptions. How frustrating ! I am certain that you can do much more, please just do it!