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## ***Interactive comment on “Single-particle characterization of the High Arctic summertime aerosol” by B. Sierau et al.***

**Anonymous Referee #1**

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Review of Single particle characterization of the High Arctic summertime aerosol by Sierau et al. (2014)

The study of Sierau et al (2014) aims to characterise single particles sampled in the Arctic. These are very valuable and very different measurements to take, as the ATOFMS often have technical problems during ship cruises.

Unfortunately the statistical counts of single particles of this study is incredibly low, with an overall counts of about 2,700 particles. If such particles were collected in other remote sites this manuscript would not merit publication. However, given the importance of the geographical location, this manuscript should be published. However, major revisions have to be carried out before this can be considered.

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1. Introduction and methods. Very well written sections and well presented. I would remove some of the references, at the moment they are more than 100!

2. Results. It is not clear if ENCHILARA or Art-2a were used. These two are very different methods. Additionally, I would try to simplify the 10 particles types presented, which are not described in details.

-It is not satisfactory not to present temporal trends and mass spectra of the particle types presented. Additionally, if the temporal trends of particles are similar, perhaps there is no room to keep 1a-b-d different. Can they be merged or are they really different? Are the temporal different? cluster 1c should be called exhaust and separated from figure 2 (which indeed is no presented!)

- Metal type and soil type needs to be also addressed. Are these simply particles coming from the ship or are the temporal trends related to something else?

- NaCl. At the moment they are correctly separated from fresh, mixed and aged, but are the temporal trends different? Do they help in separate clean-polluted periods? Are NaCl fresh particles correlating more with 1b (biogenic) or KPOx?

- I would not be surprised if the biogenic mass spectra are different from typical Mg-rich ATOFMS marine biogenic particle types, given the geographical and biological differences of the ocean and marine biota.

- What is the temporal of KPOx? Does it help to understand anything? Primary or secondary?

- I would present the best single particle mass spectra of one particle describing the KPOx particles, and look at small peaks and to see if there is anything interesting.

- There is an ATOFMS study (Dall'Osto et al., 2013 - JGR Doi:10.1029/2012JD017522, 2012) reporting Nitrogenated and aliphatic organic vapors as possible drivers for marine secondary organic aerosol growth. If you had an SMSP on board, can you compare the SMPS size distributions of the occurrence of KPOx? Do they occur during

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periods of primary production (NaCl ATOFMS) or nucleation events (SMPS size spectra).

- The most annoying part of the manuscript is to see in various part Vanadium called "Va", which I think is "V".
- Finally, given the "biogenic marine" factor of Chang et al (2011) - figure 3 and 4 of Chang et al 2011 - is rich in DMS-MSA, perhaps a query for MSA markers in the ATOFMS could be run and see what the mixing state of such particles are.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 14, 593, 2014.

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