

## Response to Anonymous Reviewer #2

We thank the reviewer for the valuable and helpful comments. We believe that addressing the issues raised by the reviewer will considerably improve the manuscript.

Please see our reply to each comment below.

Note: All reviewer comments are in *italics*. All author responses are in normal format. The new text included in the manuscript is in **bold face**.

1. *As I see one of the major contributions of this paper to be presentation of the data set itself, I recommend explicitly showing the mass spectra and time traces of all the cluster types. It lends credibility to show all such data, and in this specific case will show in detail the lack of statistics which make further analysis impossible for most of the cluster types. These data can also be shown in a supplementary material.*

A chapter “supplementary material” was produced presenting temporal trends/time traces of the individual clusters including mass spectra of cluster types, and, when necessary, of individual particles (see comments of reviewer no. 1) for the ice floe station. The only exceptions are time traces of the clusters 1c, 4 and 5 as the contained particles were sorted by hand (a reevaluation of all “unidentified” particles would be necessary to extract the corresponding time stamps) and represent a total fraction of only  $\ll 2\%$ . However, a screening showed that these three types did not occur during a confined time period (compared to cluster 1c “pollution” – see comment 3 to reviewer no.1).

Time traces are discussed in the supplementary, and the arising lack of statistics explicitly for the sparsely populated clusters is emphasized in the text, e.g. for type 4 and 5 particles (Sect. “Origin of the particles”):

**“A detailed source characterization study for these small numbers of analyzed particles was not conducted as the lack of statistics made a further analysis implausible. The particles contained in both groups did not occur during a confined time period but were rather distributed over the entire IF measurement period. As a consequence, a source could not be apportioned to type 4 and 5 particles.”**

2. *Fig. 4: I find this figure very confusing for several reasons:*

- *The y-axis shows a “median” concentration for three values based on percentiles. It would be more intuitive at least to me, if the y-axis showed concentration, and then three distributions were plotted, which showed the median together with the 25- and 75-percentiles, as is usually done. Presumably it turns out to show roughly the same results.*

- *The distributions should be colored with different colors, and the scaling removed, so that one could actually see the variability.*

- *The legend shows numbers like “2008x0.01” which is extremely confusing. The year 2008 should not be included here, as there are no other data presented in the paper, and should especially not be shown as a multiplication with some scaling constant.*

The figure was modified according to point 2 and 3 of this comment (see manuscript). As the data were provided by our collaborators in the presented manner and taken from Heintzenberg *et al.*, 2012, the parameter “median concentration“ had to be kept. After discussion with the co-authors and as noted by the reviewer itself, the scientific information remained „roughly“ the same by doing so.

3. *The use of the word “station” is a bit misleading, as typically stations are permanent structures. In case this terminology is in common use in previous publications, then it should stay, but if it is only used here, I suggest changing it to “site” or similar.*

The terminology “station“ is in common use in previous publications (see, e.g. *Tjernström et al., 2013*, or *Chang et al., 2011*) and thus we would prefer to keep the wording as is. Indeed, the argumentation of the reviewer is coherent, but I was told by oceanographers that the terminology “station” is common sense in their community.

#### 4. Technical comments

Page 612, 18: “time series”

622, 9: “saccarides”

624, 6: “do not”

All done

#### References

Chang, R. Y.-W., Leck, C., Graus, M., Müller, M., Paatero, J., Burkhart, J. F., Stohl, A., Orr, L. H., Hayden, K., Li, S.-M., Hansel, A., Tjernström, M., Leaitch, W. R., and Abbatt, J. P. D.: Aerosol composition and sources in the central Arctic Ocean during ASCOS, *Atmos. Chem. Phys.*, 11, 10619–10636, doi:10.5194/acp-11-10619-2011, 2011. 597, 599, 604, 612, 625

Heintzenberg, J. and Leck, C.: The summer aerosol in the central Arctic 1991–2008: did it change or not?, *Atmos. Chem. Phys.*, 12, 3969–3983, doi:10.5194/acp-12-3969-2012, 2012. 610, 616, 626, 644

Tjernström, M., Leck, C., Birch, C. E., Bottenheim, J. W., Brooks, B. J., Brooks, I. M., Bäcklin, L., Chang, R. Y.-W., de Leeuw, G., Di Liberto, L., de la Rosa, S., Granath, E., Graus, M., Hansel, A., Heintzenberg, J., Held, A., Hind, A., Johnston, P., Knulst, J., Martin, M., Matrai, P. A., Mauritsen, T., Müller, M., Norris, S. J., Orellana, M. V., Orsini, D. A., Paatero, J., Persson, P. O. G., Gao, Q., Rauschenberg, C., Ristovski, Z., Sedlar, J., Shupe, M. D., Sierau, B., Sirevaag, A., Sjogren, S., Stetzer, O., Swietlicki, E., Szczodrak, M., Vaattovaara, P., Wahlberg, N., Westberg, M., and Wheeler, C. R.: The Arctic Summer Cloud Ocean Study (ASCOS): overview and experimental design, *Atmos. Chem. Phys.*, 14, 2823–2869, doi:10.5194/acp-14-2823-2014, 2014.