Reviewer's comments in black, Authors' response in blue
Line numbering in the answers is related to the version of the revised manuscript where the "track changes" mode is not shown.

Authors' response to referee #3

I am providing a follow-up review to Heutte et al. "Observations of high time-resolution and size-resolved aerosol chemical composition and microphysics in the central Arctic implications for climate-relevant particle properties". Heutte et al. have made useful revisions to their manuscript. Notably, the manuscript had been significantly shortened by merging sections and moving sections to the Supplement. Also, the readability had been improved by removing redundant information and shorten a few long sentences. While the manuscript could still be more concise, it is comprehensive, which is also important. I have just two further minor comments provided below.

• Thanks for clarification with the NO3+ signal and the interferences at m/z 30 with C18O. However, can you please clarify if this is an instrument-specific issue or if it was something specific for this measurement period.
The interference is actually related to the processing of the AMS data. For the MOCCHA data (August-September 2018), processed by Karlsson et al. (2022) , the CO^+ fragment at *m/z* 28 was fitted and by extension the $C^{18}O^+$ fragment at *m/z* 30 was defined based on the intensity of the signal for the CO^+ fragment. This led to the interference between the NO^+ and $C^{18}O^+$ fragments at *m/z* 28, for the MOCCHA period.

However, for the MOSAiC AMS dataset, the CO^+ fragment was not fitted but calculated based on the intensity of the CO_2^+ fragment at *m/z* 44. Hence, interferences between the NO^+ and $C^{18}O^+$ fragments were not possible. We therefore deleted the statement at lines 407-408 of the manuscript which stated that "As for the MOCCHA measurements, NO_3^- likely suffered from interferences with the $C_{18}O^+$ fragment at *m/z* 30, which could explain its relatively high fractional contribution to the PM_1 mass.".
The increased nitrate signal in October-November during MOSAiC could have, as pointed out below by the reviewer, originated from sodium nitrate following chloride displacement in aged sea-salt particles. Nitrate has also been previously found in long-range transported haze particles, associated with combustion processes (Quinn et al., 2007). We added a statement regarding the potential sources of nitrate in October-November at lines 419-421: "Similarly, for NO_3^-, part of the signal could be associated with sodium nitrate following chloride displacement in aged sea-salt particles (Gard et al., 1998), while long-range transport of NO_3^- in haze particles is also likely playing a role (Quinn et al., 2007).".

• Besides that, I just recognized that the nitrate signal is partly correlated with the NaCl signal from the AMS (Fig. 5). Is it feasible that some measured nitrate was incorporated in sea salt particles? This might by indicative for aged sea spray particles as for example discussed in Gard et al. (1998).
The reviewer made a valid point that the nitrate signal seemed to have a partial correlation with the NaCl signal in Fig. 5. We quantified this potential correlation taking all data between November 8th and December 3rd during MOSAiC (see Fig. A1 below), the period when nitrate and sea salt concentrations were the highest. The linear Pearson correlation between NO_3^- and NaCl was low overall ($\rho_{Pearson} = 0.28$) as shown in Fig. A2, which suggest that if a relation exists between the two variables, it is not necessarily linear. Periods when NO_3^- and NaCl covaried in time (such as on December 3rd, see Fig. A1) could indicate that NO_3^- could have been incorporated in aged sea salt particles as sodium nitrate. However,

periods when the two variables did not covary in time (such as between November 12th and 15th) suggest that NO_3^- and NaCl were externally mixed. Furthermore, a low correlation was found between Na^+ and NO_3^- ($\rho_{Pearson}$ = 0.24), and a high correlation was found between NaCl and Na^+ ($\rho_{Pearson}$ = 0.70), suggesting that the signal of the sodium fragment in the AMS was related with NaCl and not with sodium nitrate ($NaNO_3$).

Since the relation between NO_3^- and NaCl is not entirely clear, we decided not to discuss it in the storm case study in Sect. 3.2 and only keep the statement added at lines 419-421 (see the answer to the previous reviewer comment).

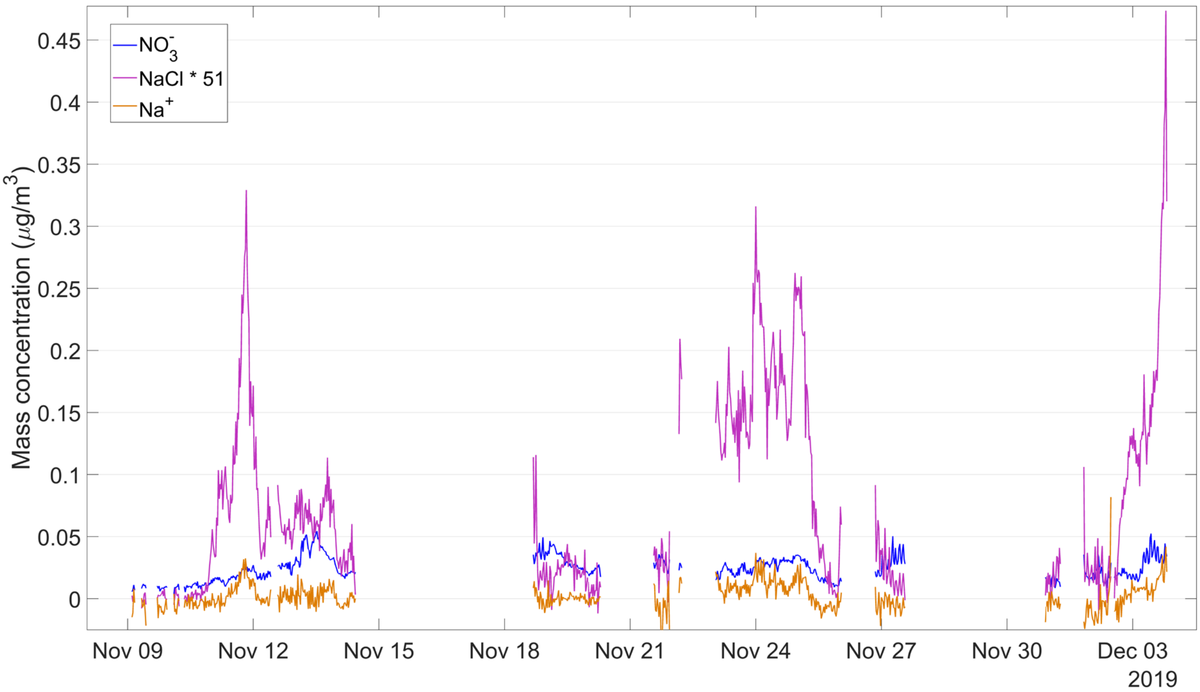

Figure A1: Timeseries of nitrate mass concentrations (NO_3^-), sea salt signal (NaCl * 51), and of the sodium fragment (Na^+) in November and early December during MOSAiC.

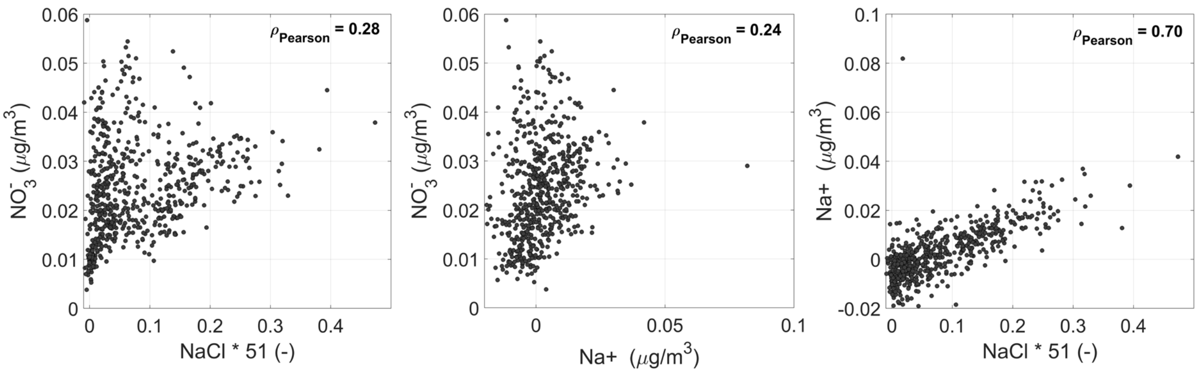

Figure A2: Scatter plot and Pearson correlation between NO_3^- and NaCl (left), NO_3^- and Na^+ (middle), and Na^+ and NaCl (right) for the month of November and early December during MOSAiC.

References (from anonymous referee #3):

Gard et al., Direct Observation of Heterogeneous Chemistry in the Atmosphere.Science 279,1184-1187(1998). DOI:10.1126/science.279.5354.1184

References (from the authors):

Karlsson, L., Baccarini, A., Duplessis, P., Baumgardner, D., Brooks, I. M., Chang, R. Y.-W., Dada, L., Dällenbach, K. R., Heikkinen, L., Krejci, R., Leaitch, W. R., Leck, C., Partridge, D. G., Salter, M. E., Wernli, H., Wheeler, M. J., Schmale, J., and Zieger, P.: Physical and Chemical Properties of Cloud Droplet Residuals and Aerosol Particles During the Arctic Ocean 2018 Expedition, Journal of Geophysical Research: Atmospheres, 127, e2021JD036383, https://doi.org/10.1029/2021JD036383, 2022.

Quinn, P. K., Shaw, G., Andrews, E., Dutton, E. G., Ruoho-Airola, T., and Gong, S. L.: Arctic haze: current trends and knowledge gaps, Tellus B, 59, 99–114, https://doi.org/10.1111/j.1600-0889.2006.00238.x, 2007.