

Summary/recommendations:

This is an interesting paper that provides a generally clear and thorough analysis of particulate-phase MSA in the Ross Sea region. The authors have done an excellent job presenting several different results that provide a clear picture of MSA-containing particles in this region for particles between ~ 0.1 - $2\ \mu\text{m}$. I particularly appreciated their discussions upon why MSA condenses on some particle types but not others. This study can become a useful resource to the community. However, there were details missing in the methods that made a complete evaluation of this study difficult. My primary concern is that the authors did not make it clear whether the datasets were screened for ship exhaust (pollution) contamination. If this was not done, the results would likely be skewed, in particular those that discuss particle speciation. I have outlined a few other concerns in my review below. If the authors have corrected their data for ship contamination and simply didn't include these details in the manuscript, then I recommend that this study be published after the revisions discussed below. If the authors have not corrected their data for ship contamination, then I request either evidence that ship contamination was not a problem during the entire study, or that the data be corrected and reanalyzed.

General comments:

The paper should be edited throughout for grammar. The authors use tense in confusing ways--they often use past tense when present tense is more appropriate and clear. For example, Lines 43-44: "The chemical components and sources of aerosol particles in the marine atmosphere *were* rather complicated" (italics mine). The chemical components and sources are still complicated, and the present tense should be used here. Please check tense use throughout. As well, verb endings are often incorrect. For example, line 25: "...*deriving* from the oxidation...". This should be "derived" here.

Define the size ranges meant by 'fine particles' and 'coarse particles' in this paper. Different studies use different definitions.

The authors must define each acronym when it is first used. For instance, MP1 and MP2 are brought up in lines 139-144 but are not explained or defined. Same for 'MA' (line 148).

There needs to be discussion in the methods of:

--Particle size range of the IGAC and SPAMS. In the results, there is mention that particles between $.1$ - $2.5\ \mu\text{m}$ were considered from the SPAMS. Is this the size range used throughout the study? Not being able to capture particles $<100\ \text{nm}$ is a limitation of this study and should be acknowledged and discussed.

--Very important: how the authors corrected for potential contamination of pollution from the ship. Although pollution from the ship likely wouldn't impact the MSA measurements, it would impact the total aerosol population and mass concentrations. As well, contamination from ship pollution could alter the speciation of the particles, skewing the authors' results. Did the authors exclude time periods in which the ship pollution would have impacted the measurements?

--Length of the tubing used for sampling and whether there were corrections for particle and vapor losses within the tubing and associated uncertainties.

Line 125: 'and their populations' is confusing here. I see later in the text that particle populations are determined by the SPAMS. Please make that clear here.

Lines 145-147: The authors provide the MSA particle population. It would be of interest to provide the total particle population as well, for comparison. I see this comparison is made in section 3.3; perhaps the authors can refer the reader to that section for comparisons of MSA-containing particles to the total particle concentration.

Sections 3.3.1-3.3.7: For consistency and to provide a complete picture for each speciation, I suggest briefly including results from Figs 4 and 5 for each species subtype. Figs 4 and 5 are currently inconsistently discussed between sections. (For example, provide the mean fraction that each subtype contributes to the total population [Fig 4] within each section and so forth.) The authors are not limited by space for this journal, and this discussion is currently unsatisfying.

Section 3.3.7: discuss sources of NO_x, HNO₃ in the marine atmosphere here

Figures/tables:

Supplemental figures are not currently referenced in order in the main text. For instance, lines 68-72 jump from Figure S1 to Figure S4. Please update the SI figures to reflect the order they are referenced in the text.

Figure 3: it is very hard to read the speciation (Na⁺, C₄H, etc) on each mass spectra plot. I recommend increasing the font size, if possible.

Figure 4: It is very hard to read the legends on this plot. I highly recommend increasing the font size; there is likely enough space to make each legend into 2 columns. As well, the percents in the pie chart are difficult to read.

Figure S4: There need to be units on the colorbars for sea ice coverage (presumably percent) and Chl-a. As well, the units can be included in the figure caption (that should be updated to Fig. S4 instead of Fig. 4).

Figure 6. I quite like this schematic; all of the text could be larger for clarity.

Technical comments:

I suggest defining ‘polynya’ the first time it’s mentioned in the abstract and main text, as it is not a common term.

Line 11: change to “lacking in knowledge”

Lines 17-18: do the authors mean that MSA uptake favored sea salt particles? Suggest rewording.

Line 104: W should be capitalized and there is a missing negative in the denominator of ‘W/cm⁻²’

Line 116: ‘cloud effect’ is confusing, I suggest rewording. I assume the authors are referring to the loss of data due to clouds?

Line 119: please define ‘centration data’

Line 179: Do the authors mean “was consistent” instead of “consisted”?

Line 278: do the authors mean ‘species’ rather than ‘particles’?

Line 284: the word ‘except’ here is confusing. It is unclear to me what the authors intend by this statement.