

This study presents measurements of trace elements and major ions in surface snow collected during three field campaigns from 2018 to 2021. The authors report higher concentrations of marine-origin species in late spring 2020, likely driven by specific meteorological and oceanic conditions. The results also show a strong correlation of impurities in Ny-Ålesund during cold seasons. The manuscript lacks a clear explanation of how these findings contribute to our understanding of climate change. The introduction sets up climate relevance, but the discussion does not adequately follow through. A more focused and contextualized discussion is necessary to justify the broader implications claimed by the authors. The paper can be published after addressing these comments.

Major comments.

R-1. Line 89: You mention that this study contributes to understanding trace element and ion interactions in the context of recent climatic changes. However, this connection is not clearly addressed in Section 5, *Summary and Conclusion*. If the stated goal is “to enhance the understanding of these interactions, particularly in the context of recent climatic changes,” then the conclusion should explicitly discuss how your findings support or inform that objective. As it stands, the broader relevance to climate change is implied but not directly explained. This should be clearly articulated before the manuscript can be considered for publication.

R-2. Line 114: Did you collect and analyze background concentrations or include any blank/control samples during sample handling? It is important to clarify how you ensured that the snow samples were not contaminated during collection, transport, or analysis. Please explain the procedures used to confirm sample integrity and rule out possible contamination.

R-3. Line 150: It would significantly improve the clarity of the manuscript to include a map showing the sampling locations. Since the sampling was conducted across multiple sites during three separate field campaigns, a visual representation in the main text (not only in the supplementary materials) would help readers better understand the spatial context of the study.

R-4. Line 202: The manuscript should clearly explain the rationale for selecting a 6-hour back-trajectory interval with a propagation time of 120 hours.

R-5. Line 238-239: You state that “the difference in concentration trends appears very low or negligible, except for sporadic peaks in sea salt and crustal tracers present in the Ny-Ålesund record from November to February.” However, the term *negligible* needs to be supported with quantitative data. Please specify the concentration values and the average

concentration differences compared to the November–February period to substantiate this claim.

R-6. Line 405: Please provide appropriate references to support the statement that enrichment factors (EF) below 10 indicate a crustal origin of the elements.

R-7. Line 520: You refer to correlation results multiple times throughout the manuscript, but you do not indicate which figures or tables support these findings. Please clearly reference the relevant figures or tables in the text. If these results are not currently included, they should be added to the supplementary information to support the discussion.

R-8. Line 554: As previously mentioned, you need to provide specific values rather than stating that “the errors associated with the EFs are quite high.”

Minor comments.

R-9. Line 210: Provide the full name for the acronym NCEP/NCAR at its first mention in the text to ensure clarity for all readers.

R-10. Line 233: There is a missing period at the end of number 3. Please add it to maintain proper punctuation.

R-11. Line 271: In Table 1, “Total” should be capitalized to maintain consistency with proper noun formatting. Change “total” to “Total.”

R-12. Line 396: Instead of using vague terms like “slightly above,” I recommend providing the exact number to improve clarity and precision in your results.

R-13. Figure S2: In the figure, the plots for Pb and Ca²⁺ slightly overlap, particularly where their highest concentrations coincide. To improve clarity, consider adjusting the plot style to avoid confusion in interpreting the peaks.

R-14. Figure S3: You need to explain why the graph includes a gray background for the periods from autumn 2018 to autumn 2020 and from spring 2019 to spring 2021.

R-15. Table S2: The “k” in “Km²” should be lowercase. Correct it to “km²” to follow proper SI unit formatting.

R-16. Figure S7: The figure needs to be provided in higher resolution. The text and numbers under the Ice Categories are difficult to read in the current version.

