Marine Carbohydrates and Other Sea Spray Aerosol Constituents Across 1 **Altitudes in the Lower Troposphere of Ny-Ålesund, Svalbard** 2

Sebastian Zeppenfeld1*, **Jonas Schaefer2, Christian Pilz2, Kerstin Ebell3, Moritz Zeising4, Frank** 3 **Stratmann2, Holger Siebert2, Birgit Wehner2, Matthias Wietz4,5,6, Astrid Bracher4,7, and** 4 **Manuela van Pinxteren1** 5

1 Atmospheric Chemistry Department (ACD), Leibniz Institute for Tropospheric Research (TROPOS), 6 Leipzig, Germany 7

2 Atmospheric Microphysics (AMP), Leibniz Institute for Tropospheric Research (TROPOS), Leipzig, 8 Germany 9

3 Institute for Geophysics and Meteorology, University of Cologne, Cologne, Germany 10

4 Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany 11

5 Max Planck Institute for Marine Microbiology, Bremen, Germany 12

6 Institute for Chemistry and Biology of the Marine Environment, University of Oldenburg, Oldenburg, 13 Germany 14

7 Institute of Environmental Physics, University of Bremen, Bremen, Germany 15

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**Correspondence to*: Sebastian Zeppenfeld (zeppenfeld@tropos.de)

Overall impression

This research provides a comprehensive overview of vertical profile of marine carbohydrates including SSA tracers in aerosol particles and relate it well with the seawater concentration (both bulk surface and SML). I particularly liked the investigation of meteorological conditions and atmospheric mixing state to explain the observed vertical profiles for the three case studies. I recommend acceptance of this manuscript subject to some minor revisions as outlined below.

Minor Comments

Line 71: I recommend dropping the abbreviation – DFCHO – as it hasn't been used enough.

Lines 111-116: I understand that the detection limit and resolving power may explain the lower combined carbohydrate measurements. However, how do the limitations of lightweight, powerful pumps present a challenge? Are you specifically referring to

vertical profiles that are measured using a sampler loaded onto a balloon or a drone? If so, I recommend clarifying this point to ensure that all readers, especially those who are not directly measuring vertical gradients, understand your intention.

Line 139: Please rename Section 2, as the word "Experimental" is an adjective and cannot stand alone. I suggest using "Methods" instead. Additionally, it would be helpful to include two sentences explaining what this section includes. It feels a bit abrupt to have a main heading followed immediately by a table and then sub-sections.

Lines 163-165: Consider rephrasing this sentence to below to be grammatically correct.

'Furthermore, boundary layer mixing can occur even when a positive gradient in potential temperature exists, suggesting more stable stratification.'

Line 233: What does gently thawed mean here? Did you use a controlled warming rate? Or the samples were thawed at room temperature?

Figure 3: Explain the meaning of all marker types. For example, what do hexagonal and pentagonal markers mean here? and what does half shading of markers mean? A figure should be fully understandable on its own

Line 414: I would recommend changing the subheading to 'Combined carbohydrates in fresh SSA and seawater' to keep it coherent with the rest of text (eg line 425) and make it easier to follow for the reader.

Line 424: I would recommend adding correlation coefficient here to quantify the similarity in seasonality of monosaccharides and SST as well as monosaccharides (dissolved) and CCHOaer to further support the conclusion of this section, as stated in lines 457-458

Line 435: Please add full form for TEP.

Figure 4: I recommend combining all of these subpanels into one plot. This will make it easier to follow the trends of different monosaccharide units with SST and to compare the concentrations of the monosaccharides with one another. You can use the same marker shapes and change the colors for the different monosaccharides.

Also, add unit for concentration on y-axis.

Line 453: Missing preposition – should be 'likely due **to** being….'

Line 525-527: The sentence needs to be rephrased. You may consider the following modification: ' To examine how meteorological conditions and atmospheric mixing influence $Na+_{aer}$ and CCHOaer at high altitudes, three distinct cases with constant weather conditions were selected (Figure 5).'

Figure 5: Need a colon after the word 'Case' in the panel headings. It could also be read as Case 12, November 2021, for example.

Line 772: This sentence needs to be rephrased. The word ‘precursors’ is used twice. Or did you mean precursors of oxalic acid precursors?

Figure S3: Is the space for first sub-panel left blank intentionally? It looks incomplete