

## ***Interactive comment on “Characterization of aerosol growth events over Ellesmere Island during the summers of 2015 and 2016” by Samantha Tremblay et al.***

### **Anonymous Referee #2**

Received and published: 12 June 2018

Tremblay et al. describe aerosol growth events observed during the summers of 2015 and 2016 at Eureka and Alert in the Canadian Arctic. Aerosol size distributions were measured at both sites, with over a month of Aerodyne AMS data for non-refractory PM<sub>1</sub> composition at Eureka. This is a unique dataset, particularly given the paucity of observational data available in the rapidly changing Arctic. I provide suggestions below primarily to clarify the text. In addition, the authors reference the NASA MODIS imagery quite a bit in the text, yet they provide no images in the text or SI; since the influence of open water is key to the results of this work, I highly recommend adding representative images as a figure in the main text.

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Major Comments: Page 1, Lines 23-24, Page 9, Lines 32-33, Page 11, Lines 31-32: Please define the size range measured, rather than just “smaller than 100 nm”. It appears from Fig 7 that 60-100 nm is the size range measured. Please state as such to avoid misleading the reader since much of this paper focuses on <50 nm particles. Since organics are expected to be primarily responsible for aerosol growth, one would expect that the mass of 60-100 nm would be dominated by organics.

Introduction: It would be useful to add a brief summary of previous Arctic growth event papers to give greater context for the reader.

SMPS, OPC, & AMS size comparisons: It is not clear whether the diameters have been adjusted (between mobility, optical, vacuum aerodynamic) for comparisons between these instruments. This is necessary. See DeCarlo et al 2004 (AS&T). Please also label mobility diameter appropriately throughout (e.g. Fig. 1, 3, 5).

Page 6, Line 8: Provide the exact number of events identified. Please also define how these events were identified, and how they were differentiated from local emissions.

Page 6, Lines 31-32: This references circulation patterns in a paper that is over 10 years old. What was the meteorology during the observations presented herein? Was the meteorology similar between the two summers? Were there ever periods when a growth event was observed at one location and not the other? IF so, could differences in circulation or weather (e.g. precipitation) explain this?

Page 7, 2nd paragraph: Please test for statistical significance to bolster these arguments.

Page 7, Line 21: This sentence mentions 28 events, but the previous page (line 8) references 40 events. Please explain or fix this discrepancy.

Page 8, Line 21: Provide the growth rates observed by Nieminen et al in parentheses here for easy comparison. Please also clarify that by “all the events”, I believe you mean “all five events”?

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Page 8, Line 31: Comment on sea ice vs open water in the area at this time.

Section 3.2: Does m/z 79 (MSA tracer) vs size show a pattern?

Figure 4: What time resolution was used to make this plot (was averaging done)? Since this paper focuses on ultrafine particles, it would also be useful to add a section to this plot with the same categories, but only showing the <100 nm particle concentration binned.

Figure S1: Please add a note, with references, that this doesn't include the instrument inlet efficiencies so that the reader is not confused.

Minor Comments: Page 1, Line 20: Fix typo.

Page 1, Lines 25-26: Define 'larger particles' here for the reader not familiar with the AMS size range. Similarly, please define "m/z 44" here in terms that the non-AMS reader will understand.

Page 2, Line 12: It would seem appropriate to cite an older paper by Leck here

Page 2, Lines 15 & 25: Add references.

Page 3, Line 4: Fix sentence phrasing – "which is photo-mediated" doesn't describe the Canadian Arctic.

Sections 2.1 & 2.2: Please provide tubing diameters in metric, rather than English, units. Also, inner diameters would be more useful than outer diameters.

Page 3, Lines 25-28: Provide sampling inlet information, as was done for the Eureka sampling.

Section 2.2 and Page 9, Line 11: Provide the size range of the AMS.

Page 5, Line 21: Please clarify what is meant by "in a straight line". Upwind?

Page 7, Line 11: Please clarify "this year".

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Page 7, Line 22-23: Is this the case for all 23 other events? Please clarify.

Page 7, Line 26: Are these references misplaced? The data shown in Table 1 is original to this work.

Page 9, Lines 7-8: Please clarify – did only one growth event (of the 5?) have a similar growth rate and back trajectory? Did other growth events, for which growth rates weren't calculated, have similar back trajectories? This would be useful to know.

Page 9, Line 13: By “later in the year”, do you mean “later in the summer”?

Page 10, Line 10-11: This sentence is not related to this paragraph.

Page 12: Line 1: Please clarify the exact size range measured in this previous work.

Figure 2b: Are these daily averages? This needs to be clarified.

Figure 6: Please state the years included in this plot.

Figure 7a-d: These plots are missing legends, which impacts interpretation of the figure.

Figure S2: Please note the averaging used for this plot. Were the diameters adjusted?

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-428>, 2018.

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