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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Vertical profiling of aerosol particles and trace gases over the central Arctic Ocean during summer" *by* P. Kupiszewski et al.

Anonymous Referee #4

Received and published: 16 July 2013

General Comments:

The authors have described a thorough and comprehensive measurement campaign to understand questions of cloud formation and cycling in the summertime Arctic. This is an issue of undeniable importance to climate, and the observations described here contribute significantly to our knowledge. The authors find evidence for in situ particle production and claim that CCN for these summer clouds are mostly locally sourced, and I find these views to be supported by their observations. However, the organization and readability of the manuscript could be improved.

My main complaint about the manuscript is that it reads more like a chronicle of events, with a few somewhat detached conclusions at the end. Very detailed accounts of a handful of atmospheric conditions are given, but the summary doesn't do a good job of reviewing what we learned from each of the regimes/periods. It seemed as if the statements made in the summary/conclusions could have been supported by a much shorter paper. Perhaps the novelty of these measurements and the fact that this work will serve as a reference for other ASCOS manuscripts together warrant this detail-intensive approach. However, the manuscript can feel somewhat meandering and unfocused as a result.

This issue is compounded by sometimes unwieldy and dense sentence structure, with multiple clauses set off by commas (and separated by mid-sentence citations). The manuscript could easily be made more readable by cutting a few sentences down a bit.

All in all, I admire the quality and ambition of the measurements and analysis, and I find this a valuable contribution, but the manuscript would probably benefit from just a little more synthesis and tightening up.

Abstract:

10397:13-15 "Near the surface. . ." This is an example of a sentence that could really use restructuring (two subordinate clauses and two pairs of parentheses!)

10397:26-27 I was a little disappointed with the last sentence: "local sources. . . are suggested to constitute the origins of CCN particles"- you state this conclusion much more confidently in the Conclusions, and I think you should do the same here.

Introduction

10398:11 "mid-2000" This sounds like halfway into the year 2000. Change to mid-21st century or simply 2050.

10400:2 I'm curious why you state "former Soviet Union" rather than naming Russia and/or other modern countries- is the specificity implied by this intended?

10401:5 Why refer specifically to the dissolved ions MSA- and SO4(2-) and not the gas phase species? Should there be a sentence about new particle formation/growth to motivate this here?

Section 4.3

10417 I was confused about the mixing ratio notations here. Sometimes a value was followed by another value in parentheses, and sometimes not. What does this represent?

10417:23 Can you support an 'exponential' decrease in DMS with height? I don't disagree that this is likely at least some of the time, just seems that there's a lot of variability in the observations.

Section 4.4

10418:8 I think you should state fully "25-75 percentile intervals."

Section 4.5

10422:4 I think you should spell out why you mention the raised DMS concentrations here if you think it's important.

Section 4.7

10428 It's not clear to me why only semi-volatile organics are brought up here. Couldn't extremely low volatility species contribute to the early stages of growth? I see your point though- if the D(14-300) and D(3-14) truly increase simultaneously, I agree that classical nucleation and growth by condensation are probably not responsible.

Section 6 Conclusions

It would be nice if the authors could put these observations into a larger temporal context, particularly given the decision to devote considerable efforts into describing each flight period. What conditions are likely do dominate over the summer? Are we

witnessing a cycle that will likely recur throughout the summer? At what point could long-range particle transport play more of a role?

10433:25 "diminishing the extent of the raised D(>300)". Wasn't totally sure what you meant by this- the vertical extent?

10434:11 "...plumes... are not considered to have any direct..." You need to more clearly state that this work shows this is true, or reference something else that shows this. Otherwise I don't know who 'considers' this to be true.

Figure 9 It would be very helpful for the reader if you would refer to the periods (period 1, 2, etc.) and/or their short names in each of the subplots.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 10395, 2013.