



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 #3

Received and published: 12 July 2013



Interactive Comment

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

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The authors present an original dataset of the vertical distribution of aerosol particles, trace gas samples and meteorological parameters over the high Arctic region using ship and helicopter-based measurements. From these measurements, the authors study the processes which lead to low altitude cloud formation and discuss the impact of pollution particles on such processes.

The manuscript is well written and matched the ACP standard. Thus, I recommend it to be published after the authors address the minor issues raised below.

Introduction

p 10402, L.6-7: “... are highly complex and... “. Of course, prediction of cloud properties from surface measurements is complex but it is especially uncertain. The authors should mention that.

P10402, L. 26: replace “a tracer” by tracers.

Results

p10411, L. 20-23, Figure 3b: The authors should specify the cloud radar reflectivity unit somewhere. In addition, a color-bar, or at least information on the range, is needed.

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p 10412, L 13-16: When looking at Fig. 3b, the magnitude of the reflectivity seems very similar in the 2 regimes. Do the authors have any idea why the temperature in the fourth regime dropped to -10°C while it “only” dropped to -6°C in the second regime?

p 10413, Fig. 5: Figures 5a and 5b need to be updated using, e.g., semi-transparent colors to represent the quartile. By now, when these figures are used to support discussion in the text, it’s not always possible to literally see the point (e.g., description of period 1 p 10418, L 8-9).

p 10413-10414, L 1-3: The cross-sections of temperature unit must be specified on Fig. 6 and optionally in the text.

p 10416, L 6-10, Fig. 7. In the middle panel, very high particle concentration is measured for a specific flight (or maybe more). It is not clear to me in the following part of the paper if this flight is treated. If not, is there any explanation for this high concentration (A order of magnitude in the first 1500m)?

p 10416, L 11: “ $D > 300$ particle concentrations...” Is it about the median particle concentrations?

p 10416, L. 21-end: This sentence is unclear. Can the authors precise the meaning of “coincide”?

P 10417, section 4.3: Can the authors explain briefly here how high are the acetonitrile values regarding the background and/or the already observed concentrations?

p 10421, L.3-9: According to p 10418, L 23, the cloud top on August 15th is estimated at 270m. Why is the part of the flight discuss here (above the cloud) not shown in Fig. 9a.

p 10422, L. 9-10, Fig. 10b. What is the meaning of the blank period? Fog/Cloud contamination? Why, after the blank period, the Aitken mode is more concentrated and broader?

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p10422, section 4.5, Fig. 9b: The DMS profile show an increased at ca. 1200 m. This is quite contradictory with the text in section 4.3. Is there any explanation for this DMS peak in the free troposphere? Can a back-trajectory be useful in that case? Also, the acetonitrile profile is not mentioned in the text, some comments about it need to be added (or the profile removed).

p 10425, section 4.6: This period present a very interesting evolution of the aerosol plume vertical. Fig 10c should be used to support this presentation in the text. In addition, due to the limited visibility of the $D > 300$ increase in Fig 10c, I suggest to add a figure which would presents aerosol size distribution from TDMPS at the three flight time, highlighting the evolution of the $D > 300$ particles.

p 10430-10431, section 5: The biomass burning origin hypothesis is correct but the source region identified in Siberia is also now known for important flaring emissions (Stohl et al., 2013). Also, you have several acetonitrile samples, wasn't a flight with aerosol pollution layers and acetonitrile samples available?

p 10431, L7: "...instrumental...", do you mean critical?

Conclusion

p 10433, L21-25: The removal processes should be added to Fig. 15.

Reference

Stohl, A., Klimont, Z., Eckhardt, S., and Kupiainen, K.: Why models struggle to capture Arctic Haze: the underestimated role of gas flaring and domestic combustion emissions, *Atmos. Chem. Phys. Discuss.*, 13, 9567-9613, doi:10.5194/acpd-13-9567-2013, 2013.

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

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