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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Source identification and airborne chemical characterisation of aerosol pollution from long-range transport over Greenland during POLARCAT summer campaign 2008" *by* J. Schmale et al.

Anonymous Referee #2

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The paper presents AMS measurements made on the ATR-42 research aircraft over Greenland as part of POLARCAT. FLEXPART products are heavily used in the analysis. There is much useful information in the paper but it is difficult to read as the details hide many of the results. The paper could be publishable after the concerns described below are addressed. Most significantly, readability of the paper should be improved by highlighting major findings and using data examples to support them (rather than vice versa) and discussing and quantifying the uncertainties of the FLEXPART products used since they make up a large part of the analysis. In addition, I have questions about

the data quality given the lack of a reasonable comparison between AMS total mass and SMPS volume (based on Figure 10). A formal comparison of these parameters with an uncertainty analysis should be provided.

p. 7595, line 18: change to "low-volatility, highly oxygenated aerosol"

p. 7595, lines 19 – 20: Instead of merely stating that the volume size distributions were "rather similar", please describe the characteristics, i.e., modal diameter and width.

p. 7595: Why is only the aerosol lifetime for North American emissions given in the abstract? Also, it is not clear what this term is without more of an introduction. Lifetime since emission? Lifetime in the Arctic?

p. 7601, line 6: LOD should be defined (i.e., what are the values based on) when it is first introduced.

p. 7601, line 6: Should this be "Therefore, only a selection of m/z corresponding to the most abundant ions observed in all flights was chosen. . .."?

p. 7601, line 14: Was the number of increased points above LOD compared to the total organic mass signal included in the analysis in any way?

p. 7601, line 19: Please quantify "a high representation of mass of the total organic mass."

p. 7602: Based on the aerodynamic lens used in the AMS, what size range of particles of that actually made it into the instrument?

p. 7603, line 7: change to ". . .because the vacuum pressure decreases over time."

p. 7603, line 8: omit "still".

p. 7605: The treatment of "aerosol-like BC tracers" is confusing. If it is truly an aerosol-like BC tracer, why is it treated like sulfate? It should be termed a "hygroscopic aerosol tracer".

p. 7605, lines 20 – 22: I am confused by the statement that "even though CO and BC do not necessarily have the same sources, it seem suitable to compare these tracers within the uncertainties of the source-receptor analysis." Are the two species being used to discriminate between sources or combined to represent single sources?

p.7607, line 12: Should be "constraints."

p. 7608, lines 18 – 19 and Figure 3: On p. 7605 it is stated that the aerosol-like tracer's wet deposition is overestimated. How, then, can its use to derive an aerosol wash-out ratio by justified?

p. 7611, lines 10 - 15: Without a BC measurement and with a highly uncertain "aerosol-like" modeled tracer of BC, nothing can be said about BC concentrations in particular plumes.

p. 7612, lines 2 – 4: It is stated that pollutions plumes were sampled (Event III). SO4 and organics are elevated but measured CO is not. Any explanation?

Sections 4.1. and 4.2. I found Section 4.1 difficult to read as the main points (which are summarized on p. 7614, lines17 – 22) are lost in all of the detail that is given. I suggest the section be re-written so that the main points are delivered and the data are summarized in order to illustrate the main points, not vice versa.

Fig 10: Has any attempt at closure between the AMS mass and the SMPS volume been performed? I realize that the AMS only detects non-refractory mass but SO4 and organics should make up the majority of the total aerosol mass in lieu of any major dust events. Yet, AMS total mass and SMPS volume as displayed in this figure appear to not be in agreement. Why are the two peaks in total AMS mass below 3.5 km not see in the SMPS data? Why is there more structure at the high altitudes in the AMS data than the SMPS data?

p. 7615, line 23: what non-plume aerosol is being referred to here? The entire experiment? The altitudes of low total aerosol mass concentration? The altitudes of low CO

mixing ratio?

Figure 11 and in general: The paper relies heavily on FLEXPART products. Uncertainties associated with these products (e.g., age spectrum and average plume age) should be discussed as quantified to the extent possible. Is there a significant difference between 10 and 15 days in plume age given the uncertainties in the transport model?

p. 7620, lines 1 – 4: Isn't it possible to have similar O:C ratios for different organic compounds? Why is the similarity in O:C ratio assumed to mean that the composition of the organic aerosol is the same regardless of origin?

p. 7622: What is "chemical quality?"

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 7593, 2011.