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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Source identification of short-lived air pollutants in the Arctic using statistical analysis of measurement data and particle dispersion model output" *by* D. Hirdman et al.

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We thank the reviewer for the positive review of our paper.

We have taken all reviewer comments into consideration and hope that our adjustments in the manuscript are sufficient for publication. Our specific responses to the reviewer's science comments are:

P4L101 "define "high" Arctic".

We have now added our definition of "high" Arctic.

P4L156: "EBC – is used here without first being defined and the definition that occurs further down the page is a little unclear."

EBC is defined on P51L32(P4L7 in ACPD) as equivalent BC and BC is in turn defined on P2L51(P2L8). For a more thorough definition of EBC please read one of the papers referenced in this section.

P7L195 "How seriously does filtering of "clear-air sector" affect the results since possible real "high" or "low" results could have been filtered out?"

In this paper, we make use of measurement data which already had been filtered prior to our analysis. This is a standard procedure for the Barrow station data. Therefore, the impact of the filtering is difficult to assess for us. It is quite likely that some of the high concentration events caused by transport from the North American continent were removed by the data filtering. However, using unfiltered data would not be a good alternative, given the strong local sources that would dominate the high-concentration events if not filtered out. Therefore, while the filtering certainly a limitation, there is no good alternative available.

P8L239/240: ""footprint layer -100 m above ground" – The PBL varies (nominally) by 1 km during the daytime down to 100 m at night and _ 500 m over the ocean. At 1 km the PBL is mixed thus diluting surface sources. How does this affect the results. Perhaps a reference to earlier work would suffice for the non-FLEXPART aficionados. ïAËŻŁ"

Assuming that emissions occur at the surface, ideally the footprint layer should be as shallow as possible. However, for very shallow footprint heights (e.g., 5 meters), particle densities are too low to obtain reliable sampling statistics and it is generally better (statistically more robust) to use a deeper footprint height (also some sources are not located exactly at the surface). For a PBL height exceeding the footprint layer depth, the results are practically not sensitive to the exact height of the footprint layer. A lower layer depth is compensated by a higher volume emission flux. Small differences can arise if particles are not well-mixed in the PBL, for instance near sources but on

the scales considered here this is a negligible effect. Systematic errors would occur only if the PBL is less deep than 100 m but minimum PBL heights in FLEXPART were set to 100 m.

P16L477/8: “Could the “NW Canada” source of sulphate be related to the Tar Sands project in Northern Alberta? This is probably the largest “point” source of CO2 on the globe and can also be seen in NOx (GOME) which would produce ozone and it is likely a SO2/SO4 source. (see also P17L503, P19L568).”

We thank the reviewer for drawing our attention to the Tar Sands. The “NW Canada” source of sulphate measured at Alert is located too far north for a conclusive relation to the Tar/Oil Sands project in Northern Alberta, but the location of this anthropogenic source agrees well with summertime sources of sulphate measured at Barrow as well as O3 source measured at Alert.

P17L514ff: “The statement concerning the correlation of average ozone with height seems a little out of place given the variability of the data, change with season. It would be hard to justify and doesn’t add to the overall picture.”

We are well aware of the fact that the seasonal variability of the ozone concentrations at the different stations are larger than the difference in concentration between the different stations but we do still think that pointing out the clear correlation between a higher altitude location of the stations and a higher ozone mean concentration gives a valuable background information when interpreting the results of our analysis.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 19879, 2009.