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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Vertical profiles of aerosol and black carbon in the Arctic: a seasonal phenomenology along two years (2011–2012) of field campaign" *by* Luca Ferrero et al.

**Anonymous Referee #3**

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This manuscript is based on vertical profiles of aerosol number density, eBC and ground measurements of the above at the Ny Alesund Arctic research station. This study is providing very useful data for the vertical structure of the aerosol column at a well studied area, where this type of data are still missing.

As a general outcome, the topic of the manuscript is relevant and suitable for the scope of "ACP". However, there are several points where the manuscript is failing to follow and deliver the methods and data quality needed for this study.

General comment: The description of the vertical structure of the atmosphere is well documented and useful and the classification of the different structures useful to relate to known aerosol properties based on the aerosol number size distributions from OPCs.



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Discussion paper

There is also a good documentation of aerosol contamination events from harbour traffic of large boats

Major problems can be identified as follows:

1. The classification and discussion of results is not based on the understunding we can derive for the aerosol microphysics based the origin of aerosol during the study.

2. There is no attempt to compare with data obtained by numerous studies in the area using aircraft or lidar techniques. Although several studies are mentioned no quantitative comparsion is given at least for the ground measuremnts or data published.

3. The use of micro aethalometers in this area can be only used for obtaining EBC concentrations at minimum concentrations, which the authors have yet to derive. They show in figure 2c) a good correlation between the two micro-aethalometers used. This also shows an uncertainty at a 100% level for concentrations below 30 ug/m3 The other serious flaw in the processing of these data is the calculation of the absorption coefficient using a well established methodology and an unrealistic “C” factor. They quote a study in Milan where the “C” factor was derived for urban concentration levels and mixture of urban aerosol species. The authors must remove all absorption coefficients calculated in this manner and reported in this manuscript.

4. The chemical composition reported in figure 8 is given only in % of the total mass. How is the total mass derived and what are the actual mass concentrations of the different species reported in otherwise incredible detail where the non sea salt and non crustal fractions are calculated? These data do not appear realistic. For example in most cases the EC is found to 0.1 % of the aerosol mass. If one assumes that in the worst case eBC and EC mass concentrations can differ by a factor of 2 (+/- 100%) in the HO case where the eBC is found on average at 25 ng/m3 the aerosol mass concentration levels would range between1 to 50 ug/m3. This upper limit is totally unrealistic and even the 25 ug/m3 is extremely high. The other cases would produce even more grossly biased results.

This comparison puts in doubt the whole dataset of eBC and chemical data leaving the OPC and ground SMPS measurements as the only dataset worth considering for this manuscript.

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