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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 #2**

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This manuscript describes vertical profiles of aerosol number density over Arctic during spring and summer and presents authentic and original scientific material that has relevant implications for atmospheric science (aerosol, clouds, CCN, and others). This study is based on very important aerosol data over Ny-Ålesund, Svalbard, although the tethered-balloon-borne aerosol measurements are restricted to the good weather (i.e., clear sky, calm winds etc.). On the whole, the topic of the manuscript is relevant and suitable for the scope of the "ACP". However, there are several points which require some careful revision and corrections before publication.

General comments: 1. Quality of English I found many typo, miss-spell, and grammatical errors (e.g., location of ",").



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2. Comparison with previous airborne aerosol measurements Several airborne aerosol measurements have carried out in Arctic area since 2000, for instances, ASTAR (2000, 2004, and 2007), ARCTAS (2008), ARCPAC (2008), and PAMARCMiP (2009 and 2011). Particularly, ASTAR campaigns were made around Svalbard. I suggest strongly that your data are compared to these previous results, and that these campaigns should be added into description of introduction.

3. Classification of aerosol type In this study, authors classified aerosol profiles into four groups. I agree with the classification of aerosol profiles. Unfortunately, typical weather/meteorological conditions and air mass origins in each type were not mentioned in the text. These information is very important to characterize vertical features of aerosols in Arctic region, and to be compared to aerosol data taken in the other project.

4. Relation between aerosol vertical profiles and structure of boundary layer Vertical features of aerosols in the lower troposphere are associated with the structure of boundary layer (i.e., surface inversion and height of boundary layer). What is typical height of top of boundary layer in each type? Aerosol data should be compared to vertical structure of boundary layer (surface inversion and top of the layer).

5.

Specific comments 1. Abstract: Height range of aerosol measurements are added in the text of abstract.

2. Page 5 Line 11, Unit of conductivity: M Ω cm-1 (not M Ω cm)

3. Page 9 – 10, Sensitivity (detection limit) of BC measurement In general, high flow rate is required for BC measurements in regions with lower BC concentration. Flow rate for BC measurement was 2.5 X 10-6 m3 s-1 (0.15 L min-1) in this study. I understand that authors chose the largest flow rate of the micro-aethalometer. However, this flow rate might be not enough in lower BC concentrations. Although BC concentration





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increases during winter –spring in the Arctic regions, the BC level is lower than that in the mid-latitudes. What is the sensitivity (detection limit) of BC measurement in your measurement setting and analytical procedures?

4. Page 10, Aerosol stratification height (ASh) Procedure for ASh estimation should be mentioned in the text.

5. Sections 3.1 - 3.2 In the sections of 3.1 – 3.2, typical examples of vertical profiles of aerosols and meteorological parameters were mentioned. The description is slightly redundant. Some sentences can be simplified. In addition, general vertical structure of the boundary layer over Ny-Ålesund (i.e., thickness of surface inversion layer, and height of top of boundary layer) should be mentioned to understand characteristics of the vertical profiles. The vertical structure is associated closely with vertical features of aerosols.

6. Figure 5 In addition to four groups, general vertical profiles (all data) should be shown in the Figure. The general profiles can be useful, when authors want to know general (average) vertical profiles. Because the vertical profiles of aerosols related to profiles of meteorological parameter (potential temperature and relative humidity), mean profiles of meteorological parameter (or normalized meteorological parameter) should be shown together with those of aerosols.

7. Page 15 Line 8 Before statement about Figure 6, Figure 7 and explanation appeared here. Check or arrange figure number or description in the text.

8. Page 15 Line 30 – 34 It is true that wet removal processes have an impact on aerosol number density, but dry deposition make an important contribution to the aerosol number density, especially in coarse particles.

9. Page 15 Line 35-39 Air mass origins was shown and explained in only in “positive gradient profiles”. However, transport pathway should be discussed together with aerosol source areas to show “plume” transport. In addition, general pattern and char-

acteristics of transport processes in each type should be shown and discussed to understand relation between vertical profiles of aerosols and air mass origins.

10. Page 15 Line 38- Some of particulate organics can be derived from secondary formation. However, there are matters to be discussed whether organics can play an important role in “new particle formation” or not. Actually, organics are condensable vapors to grow aerosol particles in ultrafine mode. So, authors should distinguish between new particle formation and secondary formation and mention them in the text.

11. Section 3.4 Different condition of solar radiation between spring and summer can engender change of height of top of the boundary layer. This change is very important to vertical profiles of aerosols and meteorological parameters. Other comments about section 3.4 is similar to previous comments about section 3.3.

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