

Interactive comment on “Seasonal variations and vertical features of aerosol particles in the Antarctic troposphere” by K. Hara et al.

Anonymous Referee #2

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Review of “Seasonal variations and vertical features of aerosol particles in the Antarctic troposphere” by K. Hara et al.

General comments: The paper presents year-round observations of the vertical distribution of aerosol particle number in the Antarctic coastal troposphere. All together, 27 vertical profiles are presented. The presented data is unique and I find the topic of the manuscript relevant and suitable for the scope of the ACP. However, I also suggest some improvements for the presentation of measurements and data and the general structure of paper, since I find the current form of the manuscript slightly lengthy and partly confused. I suggest publishing the manuscript in ACP after careful consideration of my detailed comments presented below.

Specific comments:

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Introduction p. 7556 line 24: “Climate change through the indirect effect” What does this mean?

Some more discussion on the aerosol – climate effects, and issues relevant to Antarctic might be added in the introduction. Now the first chapter - motivation for the study - is very short. Generally, Antarctic is considered as relatively isolated continent, is it possible that global changes in anthropogenic aerosols would be reflected in the Antarctic climate? I find this a relevant question for this study, dealing with aerosol transport in (and into) the region. Unnecessary repetition should be removed (e.g. it is mentioned at least twice that free tropospheric aerosols are poorly quantified in the Antarctic).

2. Measurements

Measurements were insufficiently described; please note at least the following questions:

- How often and at which time of the day the samples were taken? Was the routine always the same?
- General description of the measurement site: surroundings, any local sources?
- Instrument flowrates?
- Were there simultaneous ground based aerosol measurements?
- Were the measured diameters wet or dry?
- Did you made any corrections to data for temperature and pressure?

3.1. Air mass history

Figure 2b-e is referred in a text by 2a-d, correct either figure or text

p. 7460 lines 18-20: What were the criteria for classification of the air masses?

3.2.1. Variation of coarse and fine particles

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In this section (and also later), free troposphere / boundary layer are mentioned frequently. How do you define the different layers of the atmosphere? Please, indicate their definitions before using them. Could you use the data to define them more accurately? Was there much variation in mixing heights between the measurement days?

Also, I find this section demanding for the reader, while high/low concentration periods in different layers of the atmosphere are discussed in turns. In my opinion, it might benefit from a clearer structure, e.g.

- 1) seasonal characteristics (comparison with ground level measurements included)
- 2) concentration enhancement periods (days) and their possible explanations
- 3) low concentration periods (days) and their explanations

I however leave the decision of structure for the authors to decide.

p. 7561 line 21: "This seasonal variation showed.." Did you had simultaneous measurements on ground level? Could these numbers be compared directly and not only with previous results?

p. 7563 lines 21-25: "The mean concentration of fine particles..." Rephrase this sentence, it is not clear.

3.2.2. Seasonal and vertical features of CN concentration

Also here I would wish to see a comparison of year-round ground measurements with those in the balloon. How representative the 27 measurement days were for the seasons?

3.3. The CN-enhanced layer over Syowa Station

In the beginning of this section, local pollution sources are discussed. I think, this issue should be raised already before presenting any results. Could the additional ground based measurements be used to help to identify possible local pollution or to exclude

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it?

p. 7569 lines 3-4: "Indeed, previous..." The authors suggest that the reason why CN-enhancement was not observed in winter were smaller concentrations of aerosol precursors from the Ocean. It might be relevant to mention how many cases (days) of air masses coming from Southern Ocean were measured in winter (without observing the enhancement).

Especially this section contains too much repetition, e.g. p. 7568 lines 1-2 vs 3-5. Please, read it through and compress. Although an interesting and good addition, three pages is too long for the discussion of possible growth time scales of the particles, which is very speculative considering the real data. This could be compressed and not all equations (e.g. 3-4) are necessary to be presented.

Tables and Figures:

Check that all axes have labels and units and add the missing ones.

Technical corrections:

p. 7560 line 14 "to discuss": you mean "to understand" or?

p. 7570 line 23: Fig 7a missing

p. 7572 line 2: "already at 1600.." here already seems to refer to height, should it not refer to time?

Please, re-read the manuscript and check the spelling mistakes.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 7555, 2011.

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