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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simultaneous aerosol measurements of unusual aerosol enhancement in troposphere over Syowa Station, Antarctica" *by* K. Hara et al.

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We are grateful for helpful comments and suggestions from Referee #2. We improved our manuscript on basis of comments by Referee #2.

(1) Comment from Reviewer: 3.3 "Implications...." the authors make some general observations on how their results may be useful to ice core interpretation (26288 Line 2) and to the release of reactive halogens (paragraph starting 26288 line 21), however no specific links between the observations and analysis and these outstanding issues are given.

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Author's Reply: Section 3-3 "Implications...." was removed in revised manuscript.

(2) Comment from Reviewer: Just one example of this is the fitting of a Junge distribution to the aerosol size distribution and the calculation of the Junge slope for a variety of subsets of the data (paragraph starting 26276 line 23). However no real discussion is provided on what the scientific implications of the variability of the Junge slope are.

Author's Reply: Descriptions of Junge slope were removed in revised manuscript.

(3) Comment from Reviewer: Another example is the inclusion of synoptic meteorological charts (Figures 3 and 7) and the accompanying description of the large-scale meteorology do not appear to be in support of any particular conclusions of the paper.

Author's Reply: Synoptic meteorological charts were removed from revised manuscript. These figures were moved to "Supplementary".

(4) Comment from Reviewer: The authors provide no observational context to the two specific events that are discussed in the manuscript. No information is provided as to the overall period for which measurements were made, or what typical background aerosol profiles are for this location using this set of instrumentation. Furthermore, no analysis is given about frequency of such events. Were these two events the most severe, or most interesting, or just happen to occur when all instruments were running?

Author's Reply: To understand seasonal and vertical features of appearance of aerosol enhanced layer over Syowa Station, we added discussion about vertical profiles of aerosol backscatter ratio and aerosol enhanced layer in 2012 using continuous MPL data. Because aerosol number concentrations in background and Antarctic haze conditions were already discussed well in our previous study (Hara et al., 2010), more description was not added in the revised manuscript.

(5) Comment from Reviewer: on page 26275 line 20, it is stated that GPS sondes are used and temperature and humidity profiles are presented, yet on page 26279 line16 and again on 26284 line 5 no specific boundary layer height was identified from these

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profiles. The reference to the 'usual boundary layer height (Hara et al 2011b)' is odd as the data to identify the actual boundary layer height (wind, temperature, RH profiles) exists.

Author's Reply: Based on the sonde data such as potential temperature and relative humidity, we identified altitudes of boundary layer height, and add these descriptions in the revised manuscript.

(6) Comment from Reviewer: Another example of overlooking specific data is the use of typical sea ice extent (page 26286, line 11, Comiso 2010 reference) when actual observations of sea ice extent for the specific time exist (e.g. AMSR2 data).

Author's Reply: We checked sea-ice extent by AMSR2 data in 2012 seasons. Seasonal trend of sea-ice extent in 2012 was similar basically to other years described in Comiso (2010).

(7) Comment from Reviewer: "Sea-salt particles were released only slightly from the sea-ice surface under calm wind conditions." No data showing wind speed along the back trajectory for the air mass is given, and no reference is provided for the critical wind speed for the lofting of particles is provided.

Author's Reply: High concentrations of sea-salts (e.g., Na+) and non-volatile particles were observed under the strong wind conditions (i.e., blizzard and storm) at Syowa Station (Hara et al., 2004, 2011). These references were added in the text.

(8) Comment from Reviewer: a statement about the meteorological conditions along a back trajectory is made without supporting data.

Author's Reply: We estimated diurnal mean wind speed from the transported distance for 24 hours in trajectory data. The data were used in discussion in the revised manuscript.

(9) Comment from Reviewer: the phrase on page 26281 line 24 starting "no significant difference was in transport pathways ...." Appears to be directly contradicted by the

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next sentence.

Author's Reply: Sentence of "no significant difference was in transport pathways ...." was removed in the revised manuscript.

(10) Comment from Reviewer: There are several typographical errors in the text, eg: 26271 line 29 "Launched balloon borne.." should just read "Balloon borne..." 26276 line 9 "by less than 5ms" should read "to less than 5ms" 26278 line 26 "ratio ranged in 2-3 in" 26280 line 14 "gended" 26289 line 18 "were taken twice on" should read "were taken on..."

Author's Reply: These descriptions were corrected in text of the revised manuscript, as suggested by referee #2.

(11) Comment from Reviewer: The use of two different date schemes - UT calendar time and DOY is redundant and confusing, standardize to one time scheme for the text and figures.

Author's Reply: UT and calendar time were used in the revised manuscript.

(12) Comment from Reviewer: What the blue vertical lines are, sonde launches? No times are given for the OPC sonde launches in the text or figures

Author's Reply: The blue vertical lines indicate sonde launch time. Descriptions were added into figure captions. Launch times were written in section 2-3 of ACPD manuscript.

(13) Comment from Reviewer: The color scheme for size bins in figures 1 & 2 and figures 5 & 6 should be made consistent.

Author's Reply: The color scheme for size bins was changed in the revised manuscript.

(14) Comment from Reviewer: The surface weather charts are unnecessary and partially illegible.

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Author's Reply: As mentioned above, the surface weather charts are removed from text and moved to "supplementary".

(14) Comment from Reviewer: Too many trajectories are plotted in Figures 2 and 8, one from the enhanced particle region and one from either side of the region (above and below) would suffice. Secondly, the trajectories need to be color coded to show which initialization height corresponds to which horizontal trajectory.

Author's Reply: Because several layered structure was identified in vertical profiles of aerosol backscatter ratio, we showed many trajectory in Figures. To understand each trajectory easily, color coded trajectories were used in the revised manuscripts.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 26269, 2013.