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

Anonymous Referee #2

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In “Simultaneous aerosol measurements of unusual aerosol enhancement in troposphere over Syowa Station, Antarctica” the authors present new observational data of aerosol enhancements in the lower atmosphere of coastal Antarctica. The measurements made by the authors help address the critical lack of in situ aerosols measurements in Antarctica, particularly during the austral winter. However, the presentation of these important results in this manuscript would require significant revision to be appropriate for publication.

General Comments

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There are two major areas in which the manuscript requires significant structural revisions. The authors fail to adequately explain the significance of their results in relation to the existing body of knowledge on Antarctic aerosol research, and to explain how their research will help address any specific outstanding scientific questions. In section 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. The only substantive contribution the authors seem to make from their observations are that the observed aerosols are of oceanic/sea ice origin, which is not a particularly new or surprising result and is insufficient to show the scientific importance of these results.

Secondly, while the bulk of the paper is spent describing in detailed the method of analysis of the data, yet little justification for this analysis or most importantly discussion of the results is given and few conclusions are drawn. 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. 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. The inclusion of this information seems redundant in light of the HYSPLIT back trajectories that are also shown.

Finally, the quality of presentation in the paper (both text and figures) could be significantly improved. See technical comments for specific examples.

Specific Comments:

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

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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? To illustrate this limitation - in Figure 1, it appears that the surface OPC is increasing from some background at the start of the time series (DOY = 225), however insufficient data is shown to determine if this increase mirrors the decrease at the end of the time series.

On several occasions, assumptions or estimates about features in the data are made, even though conclusive data sources likely exist. For example on page 26275 line 20, it is stated that GPS sondes are used and temperature and humidity profiles are presented, yet on page 26279 line 16 and again on 26284 line 5 no specific boundary layer height was identified from these 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. Furthermore this sort of generalization is directly contradicted by the 600m boundary layer height observed in the previous event. 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 (eg AMSR2 data).

There are several examples in the manuscript of statements of facts made without sufficient evidence. On page 26287 line 11 it is stated “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. Similarly on page 2689 line 7 a statement about the meteorological conditions along a back trajectory is made without supporting data.

Technical comments:

The language in the manuscript does not always read fluently, and is sometimes am-

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biguous in meaning (eg the phrase on page 26281 line 24 starting “no significant difference was in transport pathways . . .” Appears to be directly contradicted by the next sentence.) The paper should be proof read for language fluency and clarity.

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. . .”

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.

Figure captions 1 and 5 do not explain what the blue vertical lines are, sonde launches?

No times are given for the OPC sonde launches in the text or figures

The color scheme for size bins in figures 1 &2 and figures 5 & 6 should be made consistent.

The surface weather charts are unnecessary and partially illegible.

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.

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

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