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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurement of black carbon at Syowa station, Antarctica: seasonal variation, transport processes and pathways" *by* K. Hara et al.

Anonymous Referee #2

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General assessment

Only a few atmospheric records of black carbon (BC i.e. elemental carbon) exist from Antarctica. Thus, adding further multi-years observations from a coastal site the present work would eventually help improving the current, incomplete understanding of the climatology of this important species within the Antarctic realm. However, I cannot recommend publication of the present work which is mainly due to the following reasons:

(a) the description of the measurement and the reasoning of respective data selection procedures are by far insufficient. In view of the basically indirect BC quantification

method and the outstanding contamination risk the authors need to show clearly, (1) that their net signal definitely reflects the elemental carbon fraction and, (2) that it is representative for the background conditions and associated long range transport, they are intending to investigate. As long as these prerequisites are not adequately presented the offered evaluation in terms of long range transport properties and, especially, in terms of any far reaching implications would not be warranted (as its significance cannot be assessed by the reader).

(b) the basic misconception of the paper, which a priori attempted to explain the observed EC variability (from the synoptical to the seasonal time scale) by regional circulation pattern and even by the local (i.e. ground level) meteorology. This approach resulted just in an extended series of rather speculative suggestions which are not univocally supported by the data (even if they would solely reflect long range transported BC). Generally, it is hard to conceive why this kind of BC should still hold information on its pathway through the vigorously mixed and intensively scavenged atmosphere between the continental source areas and Antarctica. Similarly, substantial short term BC increases indicate local artefacts for the most part rather than distinct air mass transport properties.

Recommendations

Putting the two basic shortcomings together I refrain at this stage from going through the many details deserving improvements. Instead, I propose to reorganise the work as to present first of all:

(1) a thorough descriptions of analytical aspects associated with the raw BC data (i.e. clear statement and reasoning regarding used calibration and estimates of the lower detection limit (depending on time resolution)).

(2) a clear outline of the deployed data selection procedure, which reliability needs to be substantiated, at least, by demonstrating the sensitivity of the final results by the choice of alternative selection criteria. In view of the present (loosely stated) method,

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it is not clear why only the variability of the continuous CN readings is used and why high wind speed episodes are not skipped from the data set? It is known that the latter (as going along with snow drift) may easily bring fragmented ice crystals to the aerosol filter, adding to artefacts by anthropogenic BC or biogenic, light absorbing material. Also sea salt likely originating from sea ice during winter may be associated with such biogenic material (e.g. micro-algae, pigments, etc.). Thus, I wonder if the high BC readings during winter are related to sea salt and/or to a depletion of SS-sulphate versus sodium, which might change the author's current explanation for the relatively high BC level during the winter half year. A more illustrative description of the Syowa environment would be helpful, not only in this context.

(3) a presentation of the deployed data reduction, collapsing the remaining raw data into the final records at various time resolution. Here, the probability distribution of the BC data greatly matters, which is expected to be heavily skewed towards higher concentrations making the arithmetic means (apparently reported here?) controlled by few outstanding values.

(4) an adequate reporting and illustrating of the final continental BC data set backed up by an overall quality assessment (addressing among others the temporal distribution of contamination or negative signal readings).

Only now, comparison with typical results from other BC records would be meaningful in the context of significant differences. The same is true for the authors attempt to relate their BC data to synoptical features. In this respect, any significant finding would deserve, at least, some information on the respective frequency of the observations (how strong and how often), which is presently not given.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9883, 2008.

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Interactive Comment