

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

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This paper presents an interesting data set of light-absorption (black carbon, BC) measurements from an otherwise relatively data-sparse region: the Antarctic. It has some potential to become a worthwhile reading. However, at present I cannot recommend publication, unless the following major points can be addressed:

- The authors repeatedly show a strong dependence of BC concentrations on wind speed, in almost all meteorological situations (e.g., katabatic winds, cyclone passage). Yet, a clear plot showing this relationship (e.g., a scatter plot of BC as a function of wind speed) is missing.

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- The light absorption data have not been corrected for the effect of light scattering particles on the filter. In the presence of a large amount of light scattering particles on the filter, the signal from absorbing material can be significantly enhanced (see, e.g., Bond et al., 1999), thus biasing the data towards the high side.
- The above two points are especially worrisome when combined: Can the authors demonstrate that the increase of inferred BC concentrations with wind speed is *not* due to the scattering effect of sea salt? It is likely that sea salt concentrations increase with wind speed which might explain the apparently measured increase of BC concentrations. If that were the case, most of the paper's conclusions would be based on an artifact.
- The use of the English language is not up to ACP's standards. As a non-native English speaker myself I have full understanding for the authors' situation. However, I found the article quite difficult to read and I am not sure I understood everything correctly. Therefore, I recommend that the authors either improve the usage of English themselves or use the copy-editing option offered by ACP.
- Figure 8 shows a collection of trajectories started at 1000 and 1500 m asl over Syowa. I presume the station is located near sea level (please mention the height!). In a generally stable atmosphere like the Antarctic one, there may be a strong vertical gradient in wind direction/speed. Therefore, the trajectories may be started much too high in order to be representative of the air masses sampled at the station.
- On page 9900, line 5, CO measurements at Syowa are mentioned but they are never shown (or were they made during a different time periods?). A correlation of the two data sets would be quite revealing.
- The Syowa measurements are compared to measurements at Amsterdam island and at other Antarctic stations. While the text describing this comparison is very

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long (much too long, in my opinion), no data from these other stations are actually shown. This makes it extremely difficult for the reader to follow these discussions. I suggest removing a lot of the text and rather show one or two figures comparing directly these data sets (after all, a picture does show more than 1000 words).

Minor points

One important source of BC in the Antarctic atmosphere may be cruise ships by which tourists are being brought to Antarctica. This source may exceed the emissions caused by research activities. Do such ships come close to the station in summer?

Measurements were first done with a PSAP, later with an aethalometer. Have parallel measurements been done with these two instruments?

Figure 5: It would be good to superimpose a smoothed curve showing the mean or median concentrations.

Fig. 8 shows a large number of trajectories started obviously at many times to discuss a single episode. However, this does not help to understand this episode. I suggest that trajectories only during this episode are shown or at least highlighted. Also, to me it is not clear how the trajectories shown were selected and which criteria were used.

Page 9894, line 7: The trajectories are used to infer the approach direction of cyclones. However, a trajectory does not follow the path of a cyclone. There is certainly some relationship but you would need a cyclone tracking algorithm to say where the cyclones really came from.

Regarding the transport of BC with a cyclone. The supposed southward transport pathway would frequently be associated with the air mass being lifted and washout being very likely. Can the surface measurements even "see" such a transport of BC?

In several places of the manuscript, CO₂ and how it is affected by transport is mentioned. However, CO₂ data are never shown. It would be good to also show CO₂ data

if it is important for the discussion. If not, avoid speaking of CO₂ too much.

BC is enhanced during katabatic winds. The authors may be right that this indicates higher BC concentrations aloft, which are being brought down by strong katabatic winds. However, is there a stretch of open sea from the direction the katabatic winds normally arrive from? If so, might this also be sea salt?

The authors seem to use the word "blizzard" quite loosely for any kind of strong wind situation. I would avoid speaking of a "blizzard", unless certain criteria defining a blizzard are fulfilled (usually heavy wind AND snow fall).

Language (these are just a few examples and is by no means an exhaustive list)

Page 9885, line 1: have been growing interest -> have received growing interest

Page 9886, line 23: Antarctic regions with huge area -> Antarctic as a whole

Page 9889, line 24: Particle absorption photometer -> Particle soot absorption photometer

Page 9892, line 14: spike peaks -> spikes

Page 9893, line 3: BC and CN in BC peak -> BC and CN during a BC peak

Page 9893, lines 4-5: Here the authors describe a certain episode but then make a general statement (during higher BC concentration episodes). Don't mix the description of an episode with broader implications.

Title of section 4.1.1: BC injection into Syowa station by cyclone -> Transport of BC towards Syowa by (or in) cyclones; more generally, the word injection should be replaced with the word transport at many places (injection suggests something like emission, whereas you clearly mean transport)

Page 9894, last line: MODIS does not directly measure biomass burning but detects fire hot spots.

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Page 9899: variability and BC -> variability of the BC

Page 9903, line 6: mean BC concentration minus the BC peaks???? Do you mean mean BC concentration calculated by excluding periods when BC peaks were measured?

Reference

Bond, Tami C., Anderson, Theodore L. and Campbell, Dave (1999) 'Calibration and Intercomparison of Filter-Based Measurements of Visible Light Absorption by Aerosols', *Aerosol Science and Technology*, 30:6, 582-600

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