

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-156

Anonymous Referee #2

Referee comment on "Measurement report: Black carbon properties and concentrations in southern Sweden urban and rural air – the importance of long-range transport" by Erik Ahlberg et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-156-RC2>, 2022

The article of Ahlberg et al. investigated black carbon concentrations, size distributions, mixing state and sources in two measurement campaigns in Southern Sweden; urban and rural locations. They measured BC by a single particle soot photometer and aethalometer, and complemented the measurements by number size distribution and PM1 chemical composition measurements. In addition to examine the characteristics of BC, the aim of this study was to investigate the contribution of regional sources and long-range transport to the observed BC concentrations.

BC concentrations were larger at the urban site than at the rural site, especially during the traffic rush hour. Also the number of particles having BC core was larger at the urban site and BC particles were smaller in size and had thinner coating. Based on the trajectory analysis, air masses coming from Eastern Europe comprised twice as much BC compared to Western Europe. Nearby Malmö/Copenhagen region impacted rural site BC concentrations only to some extent.

This article presented new results from the field measurements and had enough conclusions for a measurement report. However, the paper is missing a lot of details (for example the measurement sites and periods) and is therefore partly unclear for the reader. This paper merits publication in ACP measurement reports after addressing the comments given below.

General comments

The paper is confusing for the reader as there are so many different measurement periods that are not clearly described in text. For example, the rooftop urban site is only mentioned in one sentence even though the results from the rooftop are shown in

supplemental material and discusses in text. Also, the one year measurements for BC are not mentioned in methods section at all. A table or figure listing all sites, instruments and measurement periods would help the reader to get an overall picture of the dataset utilized in the paper.

Specific comments

Title: The title does not cover all the aspects of the text. Based on the title, the study focuses on background air and the effect of regional sources, whereas to me, the object of this paper is much broader. I suggest considering to change the title to reflect better the whole study.

Abstract

lines 22-23: higher than the background levels... higher than background levels at the urban site or at the rural site? Specify

line 25: fresh plumes of traffic?

line 25: "hydrocarbon-like organic aerosol", why parentheses?

Methods

lines 64 and 70: PM cut-off was different at urban and rural site (PM_{2.5} vs PM₁₀). How much that impacted the BC results, can you estimate?

lines 64-65: add details of rooftop measurements

lines 71-72: Why SP2 sampling system is described here only for the rural site?

line 76: "During the latter part of the urban campaign, chemically resolved particle constituents were measured simultaneously at both sites..." were there simultaneous measurements only for the SP-AMS? Also for AE?

lines 128-129: It's very difficult to understand why the mass concentrations from the SP-AMS could not be calculated at the urban site as the SMPS number size distributions can be converted to mass size distributions. Were there some issues with the SPMS data as well?

lines 133-139: traffic plumes, did you have any gas monitors (NO_x, CO₂, CO) that could have been used to indicate traffic plumes as well? How was the diurnal distribution of traffic plumes, were they detected only during rush hours?

line 157: APM was run only during five days in spring 2019; how comparable is this data to summer/autumn 2018 data in terms of weather and traffic volume/fleet?

lines 168-170: why the trajectory analysis was carried out only for the rural site, why not both sites?

Results and discussion

line 184-185: traffic intensity; any figure on that?

line 192: "The AAE is similar between the sites with small differences..." To me, 1.13 and 1.24 are not that similar. Could you speculate more the reasons for the difference? Also, AAE is smaller at traffic site than at rural site, is this typical trend?

lines 244-257: bimodal distribution, could you discuss more on the sources of two modes?

lines 270-271: "It was clear that SW winds had more occurrences of high eBC than e.g. NW winds." I somewhat disagree with this sentence. It is clear that the occurrence of SW winds was higher but eBC concentrations are difficult to compare based on Fig. 5 since the occurrence of NW winds is so low. However, Fig 6. shows nicely larger concentration of eBC related to the SE winds.

lines 314-315, correlation of non-refractory-PM1 and thickly coated BC fraction (Fig 8); why 24-hour averaged data with only 15 data points? Why not for example 1-hour averaged data? Was it because of SP2 data?

line 317: non-refractory-PM1 (dominated by secondary material); HOA related to traffic

plumes was discussed earlier but there is no data showing that organics were mostly secondary. Could you add some contributions for primary (HOA?) and secondary OA?

Summary and conclusions

lines 341-342 "...but composed of a small fraction of the total aerosol." How much?

Supplemental material

Fig. S4: Add instruments and time-resolution of data

Technical corrections

line 185: ...levels show are similar... correct

line 339: change HR-ToF-AMS to SP-AMS