

We thank the Referee #1 for the valuable comments on the manuscript. Please find the point-to-point answers to the comments below.

- **Careful checking of the English language and the text as a whole is necessary.**

The manuscript has been proofread in order to check for any mistakes in grammar and spelling.

- **There are also a few misstatements which I would advise correcting.**

Removed statement that “Black Carbon is the second highest warming agent in the atmosphere” as the newest IPCC report does not support this statement.

- **The author should change the title. It does not only examine the spatial variability of ambient black carbon.**

The title has been changed to:

The applicability and challenges of black carbon sensors in dense monitoring networks

- **In introduction: Please correct PM_{2.5} to PM_{2.5}.**

Corrected.

- **Page 11, Paragraph 210: A sharp ATN change $|\Delta\text{ATN}| > 30$ was manually identified. What could be the reason for this sharp change? Please explain it.**

The original wording was indeed confusing and referred to the sharp change of ATN related to the filter change. As an example, if a filter has an ATN of 80 and it is changed, the new filter will have a ATN of 0. Therefore, the change in ATN is larger than 30 i.e $|\Delta\text{ATN}| > 30$

The wording has been changed to: The filter changes were manually identified, and two hours of data were removed starting from the nearest hour before the filter change.

- **Page 11, 3.1 section: The authors used different flow rates for the same type of sensors. This is sometime hard to follow in the article. Please create a table summarizing this. How much during each campaign, etc.**

Table 3 has been added at line 210 to summarize the flow rates used at specific date ranges with the specific sensors. A reference to the table has been added to the start of paragraph 190. Section 3.1 has been edited to prefer referring to Table 3 when necessary.

- **Page 12, Paragraph 255: The authors wrote that the 1st intercomparison has on average lower concentrations compared to the 2nd intercomparison. Is it not because of the different meteorological condition? Please explain it.**

Yes, the difference is most likely because different meteorological conditions between these periods. Also, the 1st intercomparison is at the start of the summer vacation season in Finland when traffic density can be expected to be less in the urban environment. In comparison the 2nd intercomparison is more everyday life when traffic especially on the Kustaa Vaasa road can be expected to be quite heavy.

Additions have been made to the statement as follows:

The 1st intercomparison has on average lower concentrations compared to the 2nd intercomparison. This is due to the difference in meteorological conditions and in traffic density during these periods.

- **Page 13, Figure 2: Please check the labels (date) at the x-axis. Please correct it.**

The figure features a split x-axis marked with the red vertical lines and the dashes on the axis itself. I.e it consists of 1st Intercomparison on the left, missing section of approximately 3.5 months in the middle and then the 2nd Intercomparison. The labels are therefore accurate in their representation. The figure caption has been updated to:

Figure 2. Timeseries of both intercomparison periods a) 26.5. – 6.6.2022 and b) 16.9. – 3.10.2022. In the figure there is a split x-axis, where the period in between panels (a) and (b) marked with the vertical red lines is approximately 3.5 months. This period was the deployment phase between the intercomparisons. Data points are 5-minute averages.

- **Page 22, Paragraph 400: The authors wrote the following: With the MA-series sensors (MA200, MA350) the change of the temperature and RH caused clearly erroneous data as seen in Fig. 12. However, we cannot see the results of MA200 sensor in the Figure 12. Please include its results in the figure.**

Figure 12 has been renamed to Figure 13 and Figure 12 has been added to show the results of the MA200. A separate figure has been used to ensure the clarity of the figures.

- **The conclusion contains some statements that need to be clarified. For instance: what is DST? please explain it.**

Added the abbreviation DST to line 136 at page 6 (Distributed Sensing Technologies). Unfortunately, Distributed Sensing Technologies ceased operations in the end of 2023. Therefore, the conclusion paragraph has been revised to remove any mentions of the company and instead refer to the Observair sensor. For the environmental compensation, reference to the original publication Caubel et al. (2018) is added and a clarifying statement as the original publication uses the name Aerosol Black Carbon Detector (ABCD) for the Observair sensor. The paragraph reads now:

Temperature changes significantly affected the measurements and provided a challenge in the deployment of the sensor network. Development of robust enclosures or deployment in locations

that have stable or controlled temperature is needed. Alternatively, the environmental compensation used by the Observair sensors was seen to reduce the effect of temperature changes. Unfortunately, the Observair sensors are not being produced as of the end of 2023. Therefore, a suggestion is made that the environmental compensation utilized by the Observair and outlined in Caubel et al. (2018) could be applied as a measurement method to the data via post-processing or implemented to other sensors by manufacturers as a solution to the temperature artifacts. Please note that in the publication Caubel et al. (2018) the name Aerosol Black Carbon Detector (ABCD) is used, which is the academic prototype of the Observair sensor.