Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-210

Anonymous Referee #2

Referee comment on "Evaluating uncertainty in sensor networks for urban air pollution insights" by Daniel R. Peters et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-210-RC2, 2021

General Comments

The manuscript describes the results from a deployment of up to 100 low cost sensor units across Greater London, focusing on data from NO2 by electrochemical cells and comparing them to the regulatory urban network.

The study aims to address a question of interest for the scientific community, e.g. to what extent are low cost sensor units suitable for air pollution monitoring in urban areas? What might be the strength and weakness of a low cost sensor network?

The study presents an extensive and impressive amount of work, whose publication will be beneficial for the scientific community.

Specific Comments

- [line 275] "Aside from the seasonal variation in sensor bias and error, the initial calibrations seem to hold over the duration of the 18-month collocations." This sentence to me sounds almost self-contradictory. There is no standard for the definition of a "successful calibration" for LCS, but using the proposed benchmark of nRMSE < 50% and $R^2 > 0.7$, unit 83 at SK6 (figure 3c) is not within this range.

- The threshold in nRMSE and R^2, to be consistent, should be referred to the same time period (e.g. over 7-14 days for both long term collocations and other calibration methos); e.g. in figure 3b RMSE should be estimated over 7-14 days base to be comparable with figure 2. This might show that the initial calibration is not holding throughout the 18 months.

- paragraph 2.3.2 "Ozone cross-interference correction": the drift due to O3 interference is puzzling. According to Hossain et al (2016), the O3 scrubber should last at least for 14 ppm*day (figure 4 Hossain et al (2016)). O3 hourly annual average at North Kensington for 2020 (data from https://londonair.org.uk/) is 28 ppb, resulting in ~7.4 ppm*day, so there should not be any breakthrough over 6 months (line 171). I wonder if the calibration protocol, or the two stage calibration protocol (AQMesh + CERC), is playing a role in this instead of the O3 interference. How this could be checked without the access to the raw voltages of the cells?

- [lines 324-326] to me figure S8 points to a question: what is the lowest concentration which can be reliably measured with this network? Could it be reliably measured a 10 – 20 μg/m³ annual average of NO2?

- a minor point: in figures 4, 5, 6 it would help to have a bold dash horizontal line at 0 error for the lower panel, similarly to figure 3b

References

Marlene Hossain, John Saffell, and Ronan Baron, Differentiating NO2 and O3 at Low Cost Air Quality Amperometric Gas Sensors. ACS Sensors 2016 1 (11), 1291-1294 DOI: 10.1021/acssensors.6b00603