

Interactive comment on “Field Calibration of Low-Cost Air Pollution Sensors” by Andres Gonzalez et al.

Anonymous Referee #2

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This paper describes a custom monitoring device, the Mobile Autonomous Air Quality Sensor box (MAAQsbox), for the measurement of several important gas phase air pollutants and atmospheric particulate matter. The MAAQsbox is based on commercially available “low cost” electrochemical sensors for gases and a “low cost” optical particle counter for particle measurements. The paper describes the sensor technology as well as the custom sampling and control system. This includes temperature control of the sensor measurement area and an inlet to protect the sensors from rain and high humidity, via an inlet bypass, as well as measurements of air temperature and humidity. The authors also compare data from the MAAQsbox with reference grade instrumentation and use this to develop linear calibration equations. Overall this work could be a useful addition to the growing literature on custom “low cost” air pollution sensor devices, but

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requires more evidence on the performance evaluation of the MAAQsbox and major improvements to the calibration section of the paper before it should be published in AMT.

Major comments:

- 1) The most significant flaw in the analysis presented is that it seems that the data used to train the calibration models are the same used to evaluate the same models? If so this is not a valid test, and the training and test data need to be independent data sets.
- 2) Overall the calibration approach is not clear, with no indication of the improvement achieved with the increasing complexity of the calibration equation used. It would be helpful to the reader if the authors could provide a baseline performance of the sensors using a simple linear fit to the raw sensor signals, before including other variables such as temperature. This would enable the impact of sensor interferences, e.g. from temperature, to be understood in both the laboratory and field calibrations.
- 3) As this is a description of a new instrument the authors should provide an assessment of the measurement uncertainty.
- 4) The poor performance seen for the OPC-N2 sensor when compared to reference measurements is not adequately discussed. Early studies using these sensors identified a significant humidity dependence impacting the data under high humidity conditions. A study by Antonio et al. (2018) developed a correction for this instrumental effect on the OPC-N2, resulting in an apparent improvement in data quality. The authors should at the very least acknowledge this earlier work and discuss the implications for the work presented here.

Minor comments:

- 1) Table 1 has no units on values other than the average mixing ratio.
- 2) The statement on line 321 that calibrations will last ~ 3 months has no supporting evidence and should either be removed or justified.

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References: Di Antonio A, Popoola OA, Ouyang B, Saffell J, Jones RL. Developing a relative humidity correction for low-cost sensors measuring ambient particulate matter. *Sensors (Switzerland)* 2018;18:2790. doi: 10.3390/s18092790.

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