Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
https://doi.org/10.5194/amt-2022-110-RC2, 2022

Reply on AC1

Anonymous Referee #1

Referee comment on "Characterization of inexpensive metal oxide sensor performance for trace methane detection" by Daniel Furuta et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-110-RC2, 2022

The authors have properly addressed most of my comments – Great work! (Not intend to be picky) I have a few further comments on their response.

Original comment and response #1:

- (Again) Figure 1: What was the response time of the LI-7810 analyzer, considering the length of tubing, averaging time, and so on? Did the authors synchronize the readings from MOx sensors and the LI-7810 by considering response time differences?

The reference analyzer was connected to the test chamber by a short length of small-diameter tubing. We found that the LI-7810 responded to the methane pulse injections into the test chamber within seconds. As we averaged all measurements to the minute and the pulse decay to background took place over a relatively long time scale, we considered this error negligible and did not synchronize the readings beyond aligning system clocks for the various devices.

Comments: I would suggest the authors list the response time of LI-7810 since it is an optical gas meter. As per the instrument supplier, LI-7810 has a response time of 2 sec for CH4 between 0-2 ppm (without considering the transfer time in tubing's). This is in fact very fast for an optical gas meter. Providing such information won't hurt (but rather help) the manuscript.

Original comment and response #2:

- Please provide the ADC's bit info for LabJack T7. As per the company, a LabJack T7 may use an ADC from 12 to 24-bit. The number of bits can have a large influence on the resolution of acquired data, especially for high Rs

Our setup used the default T7 settings, which correspond to an effective bit depth of 19.1 bits, and an effective resolution of 37 μV as per the company (https://labjack.com/support/datasheets/t-series/appendix-a-3-2-2-t7-noise-and-resolution). The largest Rs we observed was less than 150 kΩ; at a 150 kΩ resistance, a 37 μV change corresponds to a resistance change of around 0.013%. We believe that errors due to ADC resolution are likely insignificant compared to the uncertainty of the sensor itself, and likely even compared to overall electrical system noise.

As our measurements were also averaged to a longer time scale for analysis (from approximately one reading every five seconds to the minute scale), the actual accuracy may be somewhat better than this simple calculation.

Comments: The authors talked about noise-free bits. Such information is useful but not usually required as the bits are related to many factors such as sampling rates. Please simply provide the ADC bit information. Based on the authors' response, I guess it could be 24-bits, which is adequate for the sensor comparison experiments.