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Atmospheric Measurement Techniques Discussions

Interactive comment on "Use of electrochemical sensors for measurement of air pollution: correcting interference response and validating measurements" *by* Eben S. Cross et al.

Anonymous Referee #2

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General comments: This paper is timely in describing how to improve the performance of a set of Alphasense electrochemical sensors, which are being widely incorporated into may emerging multipollutant air quality sensor technologies. The paper goes into great depth in exploring causes of sensor measurement artifacts and demonstrates an approach to improve the data quality. However, this paper will have a limited impact if several important issues are not addressed. A recommendation of major changes is suggested, focusing upon these areas of improvement:

1. How are authors defining "good enough" for sensor data quality? They indicate a goal of having credible data and "acceptable accuracy" (line 27), but need to clarify

what they consider to be their target (accuracy, measurement range, etc.) and for what purpose. 2. The authors note in their concluding sentence that "This compression of the training period is especially important. . ." Currently, they used 35% of a 4 month period of data to develop a complex model to improve the data. Why 35%? What is the performance if only 10% of the data were used? What if only the first week of data were used? Authors have sufficient data to explore the implications of different training periods that would provide important insight to researchers looking to employ sensors and develop study plans yielding reasonable data quality. It is recommended that authors go into substantially more depth to investigate the training period required. 3. Authors should investigate an aging effect – they indicate they will only explore this later, but should at minimum demonstrate whether there is any relationship with the number of "out of box" or "in use" days. In Jiao et al (2016, https://doi.org/10.5194/amt-9-5281-2016), aging was clearly demonstrated in a number of sensor types that incorporate Alphasense sensors. 4. How variable is the performance between identical sensors? How variable are the HDMR models from one RAMP to another? 5. The HDMR analysis is fairly opaque – authors cite papers that describe the approach, but do not provide sufficient detail for this to be reproducible. It is recommended that authors provide more specific information on the HDMR analysis and resulting model in the supplemental information. Given some sensor applications involve real-time transmission and display of data to the public, does the HDMR approach support this or must it be performed post hoc?

Minor comments: 7. Quality of the text on figures needs improvement – recommend not using red font text and ensuring clear, readable axes. 8. Authors compare against DEP monitors – they should indicate what are the detection limits of the monitors and implications for their calibration. Since regulatory monitoring stations are employed to evaluate air quality relative to the NAAQS, detection limits can be an issue in low concentration areas (e.g., some CO monitors have $\sim$300 ppb detection limits, which may be fine for the NAAQS at a ppm level but may be an issue for co-location and calibration of sensors to be used for low-ambient sampling). 9. Abstract has some awkward

statements that could be improved, as well as providing more quantitative results. e.g., “live, work, breathe. . .” – breathing is something that happens at all locations. . .one would hope. Also what is meant by “stakeholders”? The public? Industry? 10. Did the authors ever characterize the response time of the sensors? (e.g., against high time-resolution instruments also made by Aerodyne). A brief statement on their utility for a mobile sampling approach and time base of the data would be helpful, as many low cost sensor systems are being employed in a mobile fashion.

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