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Atmospheric Measurement Techniques Discussions

Interactive comment on "Understanding the ability of low-cost MOx sensors to quantify ambient VOCs" *by* Ashley M. Collier-Oxandale et al.

Anonymous Referee #2

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This manuscript presents a field evaluation of two different metal oxide (MOx) sensors for volatile organic compound (VOC) detection, comparing the sensor signals with speciated VOC measurements from a proton-transfer mass spectrometer (PTR-MS). Measurements were made for approximately 3 weeks as part of a larger air quality study at the Platteville Atmospheric Observatory, Colorado, which is in close proximity to extensive oil and gas activity. The analysis is detailed and well written, and the work is a good addition to the available literature on these devices.

My main comment on the work is how applicable the conclusions are to more typical environments. The proximity to large emissions of VOCs from oil and gas activity makes for a very favorable environment for the MOx sensors being evaluated, due to the elevated VOC mixing ratios and the large dynamic range observed. The authors

suggest that these technologies could be used more widely for monitoring public health exposure, however, even in polluted urban environments mixing ratios of VOCs can be at least an order of magnitude lower than observed in this study. For example, Warneke et al. (2013) show benzene data from Los Angeles, from both ground and airborne measurement platforms, where all measurements are below the suggested 0.5 ppb lower limit for data exclusion proposed by the authors in Section 3.1.4. It would be very useful for the reader if the authors commented more on this and repeated some of the comparisons with the PTR-MS for only data in a range that would be comparable with a more typical urban environment.

Minor comments:

Page 9 lines 15:23: What was the motivation behind choosing ppbC instead of ppbV for the summed compound comparisons? In theory which unit gives better agreement should depend on the mechanism of the sensor interaction with the compounds. Unless the sensor converts a fixed fraction of a VOC to CO2 and H2O does the use of ppbC not weight the signal from the larger compounds more than the smaller ones? The authors should comment on this, as if the use of ppbV instead of ppbC changes the agreement shown in Figures 2-5 it would suggest something about the sensor sensitivities to different VOCs in the groupings.

Table 3: More details required on why the models used were chosen. Was the formulation of these models informed by experiments or are they the best performing from a larger selection of randomly selected models?

Figures 2-5: Although the bootstrapping shown in Fig. 9 illustrates well the sensitivity of the model performance to the choice of training and test data, a statement in Sect. 3.1 on how sensitive model performance is to the choice of training data would be informative.

Page 11 line 11: Proton-transfer within the PTR-MS is also a chemical reaction. The slower time response could be due to a slower surface reaction on the MOx sensor but

more likely due to the diffusion control of gas sampled to the sensor surface.

Figure 7: The authors should explain the reason for the choice of values held constant (0.75 and 0.05 ppb for benzene, 19 and 38 ppb for summed aromatics, and 2.5 and 3 ppm for methane). The authors need to explain the reasoning behind choosing these values and the effect it has on the conclusions of this section of the paper.

SI: SI plots require more descriptive captions.

References Warneke, C., et al. (2013), Photochemical aging of volatile organic compounds in the Los Angeles basin: Weekday-weekend effect, J. Geophys. Res. Atmos., 118, 5018–5028, doi:10.1002/jgrd.50423.

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