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Comment on amt-2022-24

Anonymous Referee #1

Referee comment on "Field inter-comparison of low-cost sensors for monitoring methane emissions from oil and gas production operations" by Vincent M. Torres et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-24-RC1>, 2022

Overall, this study strongly advances the important topic of near-source emissions detection for oil and gas applications. This is a high-quality study of significant scope, and the manuscript is generally well-written. This work should be of interest to the readers of this journal and a wider audience. In this reviewer's opinion, this manuscript should be published after considering revisions.

The authors conclude that the tested sensors demonstrate the ability to detect methane concentration enhancements in the range of 500 ppb to 1 ppm at 1-min time resolution. Coupled with impressive data completeness, the authors conclude that these systems are suitable for long term methane emissions monitoring at oil and gas sites. The analysis presented generally supports the detection performance statement for certain monitoring conditions, but the analysis could be significantly strengthened regarding the primary monitoring objective of detection of emission plumes. Currently, it is not clear that all sensors can detect rapidly changing concentrations indicative of near-field source emissions at the stated performance objective.

The modeled sensor performance criteria in Section 3.2 states that a sensor should be able to detect enhancements of 500 ppb to 1 ppm over background with 1 min time resolution. However, the analysis does not strongly examine sensor performance against these levels. Table 2, for example, shows gas challenges at 10 ppm and 100 ppm but data should be available at 2.2 PPM as well.

Regarding comparisons to QC-TIDLAS, concentration enhancements observed by near-source sensors typically represent a superposition of slowly varying background signal and rapidly varying emission plume signal from the potential emission source under study. The performance criteria for source-proximate emission detection approaches should center on the sensor's ability to detect proximate emission plumes. A sensor's ability to track slow diurnal changes in methane with high accuracy is somewhat less important. This paper could be strengthened by adding a subset analysis focused on temporally

sharp, multi-ppm enhancements likely representing plume signal from the adjacent site. For example, using QC-TIDLAS determined short term excursions (e.g. > 5 ppm), what percentage of these peaks were successfully detected by the sensors under study. This type of analysis will separate slowly varying background data from source-induced concentration enhancements (the primary application).

As it stands, the ability of the sensors to track dynamic concentration changes indicative of near-field emission plumes is difficult to understand. For example, Figure 7(d) is illustrative of baseline offset but lacks the 5-ppm signal excursions for comparison to other cases in the same figure. Looking at Table 3, how much of the decorrelation in the slow MOX sensor is due to baseline drift and how much is due to insufficient temporal response to rapidly varying plume signal that is properly captured by QC-TIDLAS reference instrument?