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Atmospheric Measurement Techniques Discussions

Interactive comment on "Testing the near-field Gaussian plume inversion flux quantification technique using unmanned aerial vehicle sampling" *by* Adil Shah et al.

Anonymous Referee #1

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Shah et al. employ two different UAV platforms to quantify known sources of CH4 during a series of release experiments. The deployment of a lighter prototype Micro-portable Greenhouse Gas Analyzer (pMGGA) is new and may be interesting to other potential users as well. The authors have done a reasonable job to characterise the sensor in the laboratory; however, testing of the sensor in a harsh environment with varying temperature and pressure is missing. The near-field Gaussian plume inversion methodology presented in previous work was applied to the release experiments, and the estimated fluxes and associated uncertainties were compared with the known sources. The paper is well structured and well written, and can be published at AMT after taking into account the following comments.

General comments:

1. A weak point of the calibration in Section 3.2 is that the temperature and pressure dependence of CH4 measurements by both the MGGA and the pMGGA is not characterised, which may be potentially much larger than the gain factor uncertainty and the offset uncertainty. In the case that the field characterisation was not performed, why not characterize it in the laboratory?

2. What's the reason behind the exponential decay of H2O with CH4 mole fraction? Is it due to line interferences? It is difficult for readers to judge when the wavelengths of H2O, CH4 are not given. Is there an interference between CO2 and H2O as well? Notice that the exponential fits in Figures S3&S4 are based on very limited data points. What's the air matrix of the 100 ppm CH4 cylinder? Could the dependence of H2O measurements be caused by other species?

3. Regarding the uncertainties of the estimated fluxes σF, what are the fractional contributions due to individual components? This information may help reduce the uncertainties in future measurements.

Detailed comments:

L92-93: The flow rate needs to be given when the e-folding time is discussed. Alternatively, the e-folding volume can be provided.

L97-98: The unit should be ppb instead of ppm.

L159-162: should make it clear that +0.27% and +1.8% are the differences between with and without the water vapour corrections, instead of an increase of measurement accuracy.

L207: Equation 10 should use the molar density of dry air since CH4 is given in dry mole fraction.

L234-239: what was the nominal flow rate? Was the flow rate recorded? What fraction

of measurements on average were omitted from each flight?

L239-240: what was the flow rate through the pMGGA?

L326-330: Comparing T1.1 with T1.2 in Figure 3, I expect that larger emissions would be quantified for T1.1 and with larger uncertainties, however, the results showed the opposite. Why is that? Where are the centers of the plumes found?

L335-341: It looks that the crosswind distance is not sufficient to cover the plume, especially for UAV1. Why were the transects of UAV1 not centered? The current sampling tends to miss the center of the plume.

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