Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
https://doi.org/10.5194/amt-2022-118-RC2, 2022
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Comment on amt-2022-118

Anonymous Referee #2

Referee comment on "Improvements of a low-cost CO_2 commercial nondispersive near-infrared (NDIR) sensor for unmanned aerial vehicle (UAV) atmospheric mapping applications" by Yunsong Liu et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-118-RC2, 2022

Subject: Review of "Improvements of a low-cost CO2 commercial NDIR sensor for UAV atmospheric mapping applications"

General comments:

This manuscript presents a study on the development and validation of a novel portable CO2 measuring system suitable for operations on-board small-sized UAVs. The system is based on low-cost commercial NDIR CO2 sensor, it can perform autonomous CO2 in-situ measurements with a precision of ±1 ppm (1σ) at 1 Hz. When compared to reference Picarro instrument, the accuracy of the system was found to be ±2 ppm (1σ) at 1 Hz and ±1 ppm (1σ) at 1 min. Due to the fast response time (1 Hz), the system has the capacity to be used to monitor emission plumes, characterize their spatial and temporal distribution within its uncertainty budgets. The applied methodology is sound. The test campaign results are very interesting with the indication of traffic signal, possible sink over the forest and mixing later during the day. It would have been interesting to have the wind information also at 50 m and 100 m. The paper is well written. I recommend it for the AMT publication with some minor additions as outlined below.

P2L43: add ground-based remote sensing observations to the list. TCCON – Wunch et al., 2011 and COCCON – Frey et al., 2019.

P1L25: please expand IPCC, add a reference to the report of 2021 and 2018 (line29)

P3L73: the reference of Reuter et al. (2021) is not listed

P15L312: -314: this is a particularly important message; perhaps the authors can put more emphasis on this in the main section of the paper and suggest some recommendations for future users.

References:

Wunch, D., Toon, G. C., Blavier, J.-F. L.,Washenfelder, R. A., Notholt, J., Connor, B. J., Griffith, D.W. T., Sherlock, V., andWennberg, P. O.: The Total Carbon Column Observing Network, Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences, 369, 2087–2112, https://doi.org/10.1098/rsta.2010.0240, 2011.

Frey, M., Sha, M. K., Hase, F., Kiel, M., Blumenstock, T., Harig, R., Surawicz, G., Deutscher, N. M., Shiomi, K., Franklin, J. E., Bösch, H., Chen, J., Grutter, M., Ohyama, H., Sun, Y., Butz, A., Mengistu Tsidu, G., Ene, D., Wunch, D., Cao, Z., Garcia, O., Ramonet, M., Vogel, F., and Orphal, J.: Building the COllaborative Carbon Column Observing Network (COCCON): Long-term stability and ensemble performance of the EM27/SUN Fourier transform spectrometer, Atmospheric Measurement Techniques, 12, 1513–1530, https://doi.org/10.5194/amt-12-1513-2019, 2019.