

Dear reviewer 3,

We are very grateful for your comments and suggestions, which have helped to improve our manuscript significantly. We have revised the manuscript accordingly. The following is a point to point response to your comments and suggestions. Corresponding changes in the manuscript are also made available below at the appropriate places, if applicable.

Sincerely,

Maximilian Reißmann and Jia Chen on behalf of all co-authors.

Colocation criteria: I have some concerns about the time selection of +/- 30 min. It seems to be too long especially when looking at gradient signals between closely located sites (< 10 km). Rather there should be a good compromise between the colocation geometry and the time. To motivate the choice made by the authors a sensitivity study for one selected day (with highest wind speed) would help.

We appreciate this comment. We had a few reasons for the selection of the colocation time. First of all, a constant colocation time of +/- 30 mins makes our work better comparable to other studies that compared and validated OCO-2 against ground based measurements. Second we believe, that due to the relatively low average wind speeds of 2.33 +/- 1.54 m/s during the overpasses featured in our study, the colocation time of +/- 30 mins is justified. Due to these low wind speeds, we assume the EM27/SUN column signals to coincide with the spatial extend of our comparison domains during the entire comparison time frame. Changing the colocation time also had relatively small effects on the overall mean XCO2 measured by the MUCCnet spectrometers. Consequently, we do not think that for our study the colocation time was too long.

We added a short paragraph about the wind speeds to our manuscript.

L192	The relatively long colocation time frame is chosen due to the low average wind speeds of 2.33 +/- 1.54 m/s during the overpasses featured in this study.
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L88: Reference Frey and Gisi, 2021 is not correctly labeled / missing doi or link?

Here we refer to the official PROFFAST calibration guidelines for EM27 instruments of the COCCON network. Hence, there is no doi. We updated the reference in the script.

L89	This indirectly ties the MUCCnet XCO2 retrievals to the TCCON site in Karlsruhe since the COCCON reference device is calibrated against the TCCON site in Karlsruhe (Alberti et al., 2022; Frey and Gisi, 2021).
L407	Alberti, C., Hase, F., Frey, M., Dubravica, D., Blumenstock, T., Dehn, A., Castracane, P., Surawicz, G., Harig, R., Baier, B. C., Bès, C., Bi, J., Boesch, H., Butz, A., Cai, Z., Chen, J., Crowell, S. M., Deutscher, N. M., Ene, D., Franklin, J. E., Garcia, O., Griffith, D., Grouiez, B., Grutter, M., Hamdouni, A., Houweling, S., Humpage, N., Jacobs, N., Jeong, S., Joly, L., Jones, N. B., Jouglet, D., Kivi, R., Kleinschek, R., Lopez, M., Medeiros, D. J., Morino, I., Mostafavipak, N., Müller, A., Ohyama, H., Palmer, P. I., Pathakoti, M., Pollard, D. F., Raffalski, U., 410Ramonet, M., Ramsay, R., Sha, M. K., Shiomi, K., Simpson, W., Stremme, W., Sun, Y., Tanimoto, H., Té, Y., Tsidu, G. M., Velazco, V. A., Vogel, F., Watanabe, M., Wei, C., Wunch, D., Yamasoe, M., Zhang, L., and Orphal, J.: Improved calibration procedures for the EM27/SUN spectrometers of the COllaborative Carbon Column Observing Network (COCCON), Atmospheric Measurement Techniques, 15, 2433–2463, https://doi.org/10.5194/amt-15-2433-2022 , 2022.
L427	Frey, M. and Gisi, M.: Calibration of the EM27 / SUN Instruments, https://www.imk-asf.kit.edu/downloads/Coccon/2021-04-30_Instrument-Calibration.pdf , 2021

L131: should be “starting from April, 2020”

Done, thanks for noticing!