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Atmospheric Measurement Techniques Discussions

Interactive comment on "Validation of XCO_2 and XCH_4 retrieved from a portable Fourier transform spectrometer with those from in-situ profiles from aircraft borne instruments" *by* Hirofumi Ohyama et al.

Anonymous Referee #2

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The paper "Validation of XCO2 and XCH4 retrieved from a portable Fourier transform spectrometer with those from in-situ profiles from aircraft borne instruments" by Ohyama et al. presented the validation study of EM27/SUN using in-situ aircraft profile measurements. They have done thorough analyses of the descending and ascending aircraft profiles and used descending profile to derive the correction factors for XCO2 and XCH4 for the portable FTS. The paper is clearly written and the approach and technical details are well elaborated and presented. Because this study is one of the first attempt to derive the correction factors for EM27/SUN using in-situ profiles from aircraft

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borne instruments, I recommend publication with the following comments addressed:

1. Abstract: The sentence “The EM27/SUN XCO2 and XCH4 data . . . were not applied” is in my opinion redundant. You may remove this sentence and add a separate sentence to compare the correction factors for EM27/SUN and TCCON instrument.

2. Line 84: other satellite validation studies include: https://www.atmos-meas-tech-discuss.net/amt-2020-19/ https://www.atmos-meas-tech.net/8/5023/2015/amt-8-5023-2015.pdf

3. Line 85: Long-term observations using EM27/SUN have also been conducted in urban areas, for example in Munich when deploying an automated enclosure system (https://www.atmos-meas-tech.net/11/2173/2018/amt-11-2173-2018.html).

4. The authors have specified the total time duration for the ascending and descending flights, could you please specify how long they take individually to get a sense about the time duration for the profile sampling.

5. Line 227: can you please elaborate more in detail how did you determine the errors in the aircraft CO2 on the basis of precision and accuracy of the LICOR NDIR spectrometer?

6. Figure 1 and Figure 3, subfigures b and c: Can you please show/mark the tropospheric heights together with the measurement profiles?

7. Line 354: compare the influence of the transport on XCO2 and XCH4 with the uncertainties. Please specify the uncertainties or referring a citation e.g. Frey et al. 2019.

8. Line 377: the number of EM27/SUN data are 4 and 24 according to the temporal coincident criterion are not really visible in the Figure 5.

9. I would include the instrument line function parameters in the table 3 or table 4. The different instrument line function of the EM27/SUN at different locations could be part

of the reason for the different relative differences.

10. Figure 5: it is hard to see the comparison between corrected EM27/SUN, TCCON and airborne instruments, maybe you can zoom in a bit.

11. Figure 5, caption: without . . .. (AICFs = 1) and with (AICFs $\sim$= 1)

12. Table 3 caption: we note -> please note

13. I would recommend language check including usage for commas and consistency check for past and present tenses.

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