

## ***Interactive comment on “Validation of $X_{CO_2}$ and $X_{CH_4}$ retrieved from a portable Fourier transform spectrometer with those from in-situ profiles from aircraft borne instruments” by Hirofumi Ohyama et al.***

### **Anonymous Referee #1**

Received and published: 18 June 2020

### **General comments**

The manuscript “Validation of  $X_{CO_2}$  and  $X_{CH_4}$  retrieved from a portable Fourier transform spectrometer with those from in-situ profiles from aircraft borne instruments” by Hirofumi Ohyama et. al. describes the validation of retrievals of the column averaged dry air mole fractions of  $CO_2$  and  $CH_4$  from a single portable, low-resolution near infrared solar absorption EM27/SUN Fourier transform spectrometer at the Rikubetsu and Burgos total carbon column observing network (TCCON) sites with in situ aircraft measurements.

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The presented work represents one of the first documented examples of in situ validation of greenhouse gas measurements from a portable spectrometer of this type and therefore contributes significantly to the value of such measurement techniques.

The Authors have taken rigorous steps to ensure the robustness of the comparisons by demonstrating the stability of the portable instrument in terms of its instrument line shape and comparison of retrievals to the Tsukuba TCCON site, and by choosing which aircraft data to compare to, informed by the effect of large scale dynamics on the tropopause height in the case of the Rikubetsu comparison and by transport of regional emissions for Burgos.

The manuscript is well written and follows a logical narrative. All important steps are outlined, and assumptions appropriately justified. I would strongly recommend publication of the manuscript subject to some minor alterations outlined below.

### **Specific comments**

At the end of sections 3.1 and 3.2, and elsewhere in the manuscript particularly Table 2, the terms uncertainty and error are used interchangeably. The error in a measurement should refer to the difference between that measurement and the true value of the measurand whereas the uncertainty describes the range about the measurement in which the true value most likely lies. In the context of this work, the term uncertainty should be used. For further information I refer the authors to the BIPM Guide to the Expression of Uncertainty in Measurement.

To aid with the understanding of the choice of aircraft profile used for the Rikubetsu comparison it would be helpful if the radiosonde lapse rate derived tropopause heights (or a subset thereof) and the GGG derived value were plotted on Figs 1 (b) and (c) or Fig 2 (a), and the GGG determined tropopause height included in Table 1.

Figure 1 (b) seems to be missing data from the ascent profile between just above the surface and approximately 3 km. It would also aid the interpretation if Figures 1 and

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2, (b) and (c) included an indication of the transition from aircraft data to a priori in the composite profile.

It should be made clearer that the EM27 results presented in Table 4 are before the derived air mass independent correction factor has been applied.

Has the GGG2014 air mass dependent correction factor also been applied to the EM27 retrievals presented?

Past and present tenses are used inconsistently through the manuscript, this should be rectified.

Page 6, line 195 insert CO<sub>2</sub> before profiles when referencing figure 2 (a).

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-170, 2020.