Atmos. Meas. Tech. Discuss., 5, C1779–C1782, 2012
www.atmos-meas-tech-discuss.net/5/C1779/2012/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Usability of optical spectrum analyzer in measuring atmospheric CO_2 and CH_4 column densities: substantiation with FTS and aircraft profiles in situ" *by* M. Kawasaki et al.

D. G. Feist (Referee)

dfeist@bgc-jena.mpg.de

Received and published: 14 August 2012

This article describes measurements of total column CO_2 and CH_4 with a small and cost-efficient optical spectrum analyzer (OSA). In two field campaigns, the measurements were compared to TCCON FTS measurements at the University of Wollongong, Australia, and to FTS as well as aircraft in-situ measurements over Tsukuba, Japan.

Major comments:

1. Sect. 3.2: The information about the aircraft measurements is very weak. The authors should provide a lot more information on
    - what aircraft was used?
    - what was the vertical coverage and what were the limiting factors?
    - what instrument(s) were used for the in-situ measurements?
    - how close in time and space were the flights and ground-based measurements?
2. Sect. 3.2.2: How is this section related to the aircraft measurements?
3. In general, the structure could be improved. Aircraft and FTS intercomparisons at Tsukuba would probably be clearer if they were divided into separate subsections.
4. The weakest point in the whole measurement technique is that only the slant columns for CO_2 and CH_4 are measured. To derive column-averaged dry-air mole fraction (xCO_2, xCH_4), one has to rely on pressure measurements and make several assumptions about the atmosphere (e.g. small horizontal gradients). The deficits of this method vs. the TCCON method of using total column O_2 as a proxy for dry air have long been discussed by Washenfelder et al. In the TCCON community, deriving the dry-air column from pressure has been dismissed because of the much larger errors. Still, I see no discussion of these problems - neither in the main text nor in the conclusions. Under these circumstances, at least detailed information about the pressure measurements (sensor, precision, accuracy) and some error discussion would be appropriate.

Minor comments:

- p. 4101, l. 5: please correct "Duetscher et al." to "Deutscher et al."

AMTD

5, C1779–C1782, 2012

- p. 4101, l. 8-10: I disagree with the statement that operation of TCCON-type FTS in a remote location requires an highly-educated operator. Several TCCON instruments run fully automated for many months without a specially-trained operator on site. Besides, the parts that typically require maintenance are the ones that are exposed to the elements (like the solar tracker) - not the FTS itself. Other spectroscopic instruments would suffer from the same problems.
- p. 4101, l. 10: Please define "portable use under severe climate conditions" better. Geibel et al., Atmos. Meas. Tech., 3, 1363-1375, 2010, describes an FTS that has proved to be very portable for a TCCON instrument (operation in Germany, Australia, Ascension Island). This instrument has been operated in temperatures between -20 and +36 °C and has survived extreme rainfall and wind speeds of more than 30 m/s with no problems. How would you rate your instrument compared to this one?
- Sect. 2: Please give some information about the environmental conditions that the solar tracker can sustain. How is it protected from the elements?
- Sect. 3: Do I understand correctly that your solar tracker was not used for these measurements and that the solar signal was fed from the FTS solar tracker instead?
- p. 4103, l. 5-7: Please provide the extact version of the TCCON software that was used for the retrievals.
- p. 4103, l. 21: Please provide more information on the 3% discrimintaion procedure.
- Sect. 3.2: What sondes were used for the meteorological profiles? What was the upper limit for the relative humidty measurements?

AMTD

5, C1779–C1782, 2012

- p. 4106, l. 14-17: By what definition do you derive the tropopause altitude? What are the lapse rates above and below derived tropopause heights?

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 4099, 2012.