

Interactive comment on “A fully automated FTIR system for remote sensing of greenhouse gases in the tropics” by M. C. Geibel et al.

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Received and published: 20 September 2010

We thank the anonymous Referee No.2 for his helpful comments. Since there were no general forming comments, we respond to the specific suggestions as follows:

Abstract - The authors refer to seasonal and diurnal cycles observed, but in fact the observations are for only part of one year, and the mornings of individual days. They have not really observed these cycles, only a time of day and time of year dependence.

The Referee is right, the statement was clarified (here and in the results sec-
C1505

tion) to diurnal variation and part of a diurnal cycle.

Introduction. The consensus and more consistent naming convention for “XCO₂” is I believe *capital < X > –subscript < CO₂ >*

This was changed for the whole article. Introduction in general: Misleading statements were corrected and the paragraph rephrased. The missing reference to the Darwin station (Deutscher et al. 2010) as currently only existing tropical TCCON station was added.

2.1 Container - From here I believe there should be more details given of the actual construction, components used etc. I make some suggestions but the authors might flesh out the details further than just these suggestions: - Container manufacturer/adapting it as a laboratory - Power system - Power consumption/requirements – Airconditioning

We appended additional information about our individual concept and details of the automation software structure. Also detailed information about the chosen components (manufacturer, model) were added in the text and corresponding tables.

To the referees comments on the FTS section

The paragraph was restructured, missing information about the HCl cell was added. Since we are using the same settings that were used by Messerschmidt et al., the section about the measurement parameter was rephrased to:

The atmospheric measurements are performed with the same settings that were used by (Messerschmidt et al. 2010): a 0.014 cm⁻¹ resolution (corresponds to an optical path difference of 65 cm with an aperture of 1 mm diameter and a scanner velocity of 10 kHz. The electronic low pass filter is set to 10 kHz (corresponds to 15798 cm⁻¹).

The high folding limit for the Fourier transformation to 15798 cm^{-1} . Two individual scans, one forward and one backward, are made per measurement.

2.3.2 shutter and Figure 4. Figure 4b is not needed, I find it quite hard to visualize, while 4a and 4c (elevation and plan) are clear.

We keep Figure 4 as it is. Front, side and top view are common for technical drawings and illustrations.

2.4.1 Weather station, and Table 1. Please list make and model of all sensors, this is essential and useful information. The thesis by Zoepfel is probably not readily available.

We added all information about the sensors to the table.

2.4.2 PLC and 2.4.3 Dual PC

Missing information was appended in the form of an additional table, the section was restructured and details about the automation concept were added.

Line 17 - what is “high availability applied to a RAID system?”

High availability is a widely used technical term for the ratio of time that a system can be accessed vs. the time it is operating. We expect less than one RAID-related failure in 10 years of operation.

3.1 Instrument line shape Figure 9 needs explanation, particularly the lower panel – what is the x-axis?

C1507

Explanation of the figure was clarified in the corresponding paragraph: *The figure illustrates the symmetry of the ILS. The top plot shows both ILS measurements plotted over the difference of the wavenumber $\tilde{\nu}$ and the center peak wavenumber $\tilde{\nu}_0$. The lower plot shows the difference of the positive part ($\tilde{\nu} > \tilde{\nu}_0$) and the negative part ($\tilde{\nu} < \tilde{\nu}_0$) as a measure of symmetry. The observed deviations from symmetry are very small as one should expect from a well-aligned FTIR.*

3.2 Column measurements at Jena.

The missing citations were added and the meaning of the wavenumber figures of the analyzed windows was clarified,

There does not seem to be a reference to Figure 11 in the text. This figure also has a single logarithmic scale for all species which does not allow variability to be seen or assessed, it has very little information, and could be replotted with independent yaxis scales for each species.

The figure was replaced by a more detailed version that illustrates the variation of the single species better.

Line 12 – the use of O2 column to calculate XCO2 minimizes systematic errors, but probably doesn’t eliminate them.

The sentence was rephrased to specify that systematic errors are not necessarily eliminated.

I do not think the averaging kernel plot (Figure 12) is needed in the context of this paper.

C1508

Going along with the suggestions of both Referees, the figure and the corresponding paragraph were deleted.

The referees comments on diurnal and seasonal variability:

This section was rephrased and the discussion of the results extended. Difference of in-situ surface measurements and total column measurements: We added results of high-resolution model simulations to illustrate the agreement of expectations and measurements.

Figure 16. The TM3 model results seem to slightly underestimate the seasonal change from the measurements. Similar results have been seen at Park Falls. A brief discussion would be appropriate.

Since no model analysis is yet available for 2009, this is only a qualitative plot to illustrate the temporal variation of the FTS measurements. The estimated seasonal cycle does not necessarily represent the upcoming 2009 analysis in detail. Thus, the statement that TM3 underestimates the seasonal change would not be appropriate.