Atmos. Chem. Phys. Discuss., 11, C13455–C13460, 2011
www.atmos-chem-phys-discuss.net/11/C13455/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Automated ground-based remote sensing measurements of greenhouse gases at the Białystok site in comparison with collocated in-situ measurements and model data" *by* J. Messerschmidt et al.

Anonymous Referee #2

Received and published: 20 December 2011

The authors submitted a manuscript describing technical details of a FTS system that is located in Bialystok, Poland. It is part of the TCCON and the easternmost European station. Further, the authors compare measurement results of this instrument with low-altitude aircraft profiles, measurements of a tall tower and results of model simulations.

General Comments:

The manuscript contains a high level of information and is an important contribution to the Bialystok special edition. However, for the presented amount of information

(description of the FTS system and comparison between FTS, aircraft, tower and model data) the paper is probably too short.

The data analysis part should be extended. The authors mention several times variations on diurnal scale but a comparison of measurements and model simulation in for of a diurnal cycle is not presented. It would be good if the authors would illustrate this with one or two figures (mean diurnal cycles for summer/winter) and text. Besides, Bialystok is one of a few sites that combine FTS, tall tower and aircraft measurements on a regular basis. In my opinion, the authors should put an emphasis on that and illustrate the capabilities of such a super-site and critically argue how those measurements can help to improve model simulations and the understanding of the carbon cycle.

The authors submitted the paper to ACP. Hence, the technical details of the FTS might be better placed in the Appendix and the content of the manuscript itself should focus on the second part (data analysis).

The level of the technical details lacks consistency. For some parts, manufacturer and model details are presented, for most parts – even important parts (e.g. PLC, computer system) - they are missing. I suggest, the authors come up with a clear and consistent level of detail. Personally, I'd prefer a high level of technical details (for all components!) since this information can be very helpful for others. Especially the solar tracking device – which seems to be home made and very interesting – should be better explained.

The information content of the presented figures should be revised. Many figures with high level of information are too small and hard to read. Others have only little information.

The manuscript should be thoroughly revised in terms of language and understandability.

Specific Comments:

Introduction:

ACPD

11, C13455–C13460, 2011

capabilities of FTS measurements should be better clarified (total column measurement, sensibility to local sources/sinks, link between in-situ and satellites,...) Why is the TCCON not mentioned?

Section 2 .1.:

in general: sub-points much too short and hard to understand. Important technical information missing

2.1.2.: role of the lamp cooler unclear in this context

2.1.3, p.32250, line 22: How does the fan prevent condensation? Is there an additional heater?

2.1.4. This section is just a combination of part numbers, component-names and a link to a company. It does not help to understand the solar tracking device. A simple schematic drawing of the solar tracker and hutch, for instance, would increase the understandability of the working principle dramatically. How is the actual tracking of the sun realized?

2.1.5. Line shape: why is it necessary to monitor it? Does it change? If yes, why? Is it sufficient to do this once a month? How does it influence the data?

2.1.6. Why do the authors state details about the tape drive and the backup software but not for the NAS? Can the tape only be read by the specific software? Why is the data not transferred via Internet?

Section 2.2. /2.3. :

in general: The description of automation concept and software needs to be revised so it can be better understood. There should also be an illustration of the instruments (long-term) stability and precision.

2.2, automation concept: Which parts of the system run automated, which have to be remote controlled? The meaning of the transition state has to be clarified. There are

ACPD

11, C13455–C13460, 2011

four modes of transition that are mentioned but not explained. What happens during these modes? How long do they take? What causes the system to automatically reset? A figure illustrating a typical daily routine (in terms of changing the modes) could help.

2.2.1. should be merged with 2.2.

2.2.1., p.32253, line 26: what causes errors or alarms and how is that dealt with? Is there an automated error handling?

2.3. The authors state the software that is used for programming the PLCs – why is that more important then the PLC hardware (which is not mentioned)? Is the number of subroutines important? The authors should rather focus on the main functions. Figure 2 completely lacks information. Do the individual fields interact, is the position/size of a field important? It should be left out.

2.3.1., p.32254 ,line 20: is only the opening of the hutch controlled by the master program?

2.3.1, Figure 3 lacks information. Do the right and the left part run simultaneously? What is the Bruker loop, what is the HMI loop? Is the loop time of the loops on the left different from the loop time of the master loop? Do the boxes in the master loop run at the same time, or from left to right? In terms of understandability, this figure needs major revision (axis, arrows, colors...).

2.3.1., p.32255, line 9: The authors should try to better illustrate the function of the matrix-system. Maybe Fig. 3 can be replaced by a figure that helps understanding this.

2.3.2. Is the FTS module collecting the measurement data in form of full interferograms or raw data (see 3, line 20)? What is the difference between this raw data and a “real” interferogram?

2.3.3., p.32256, line 8: what are the criteria to start a measurement? How many measurements are typically made on one day? Is one measurement follow directly by the next? 2.3.4. Tracker module/software should be described in more detail since it

ACPD

11, C13455–C13460, 2011

seems to be a non-commercial system.

Section 3:

3 , p.32258, line 9: how can the outliers and the huge variations (350-420ppm) be explained? Is there an error budget?

Section 4:

The authors mention the diurnal scale but do not show a diurnal cycle. A mean diurnal cycle for summer and winter for the tower levels and FTS would be interesting and would also illustrate the sensibility of the FTS to variations in the planetary boundary layer.

Fig. 6. Explain the big variations (more than 30ppm in the 5m level) shortly before the gap in the tower measurements – is this an artifact? It would be interesting to see the diurnal cycles for this period.

Section 5:

Fig. 7: legend for the axis on the right is missing. The corresponding profiles for CO2 would be helpful.

Fig. 8: Way too small. A correlation plot (FTS vs. model) would illustrate the comparison better.

5.3., p.32264, line 11: What can be learned from the different results of the comparison of FTS/model and FTS/aircraft+model? The authors should give a conclusion on how the FTS and aircraft measurements can improve the model (as stated in the introduction). So far the numbers (p.32264, line 11) show an offset between model and FTS ($\sim$0.8ppm) but a rather good precision (+/- 0.5ppm). If more "truth"(aircraft data) is added to the model, the precision gets worse (by almost 62%) but the offset is reduced by $\sim$40%. Is that good / bad? Should every FTS station have aircraft profiling? Does every tower need a FTS? Since Bialystok is one of the few sites that has all of the

ACPD

11, C13455–C13460, 2011

three, the authors should really focus on those questions.

Conclusion:

p.32664, line 16. The statement of low maintenance, safeness and robustness was not sufficiently illustrated in the previous text. How is this achieved? If this were main points designing the system there should be an emphasis on this in the description.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 32245, 2011.