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Atmospheric Measurement Techniques Discussions

# *Interactive comment on* "Use of portable FTIR spectrometers for detecting greenhouse gas emissions of the megacity Berlin – Part 1: Instrumental line shape characterisation and calibration of a quintuple of spectrometers" *by* M. Frey et al.

**Anonymous Referee #2**

Received and published: 30 April 2015

This is part 1 of 2 papers in which five portable solar FT spectrometers were deployed around Berlin to measure total column CO2 and CH4 in the atmosphere over a 3 week campaign in summer 2014. In part 1 the intercalibration of the spectrometers before and after the campaign is described in detail. Part 2 describes the campaign measurements and their interpretation through a relatively simple Lagrangian dispersion model to estimate city-wide emissions of the target gases. This is an valuable piece of



research and the papers are suited to publication in AMT. The work is thoroughly presented and I recommend publication, however I suggest a re-structuring of the work into a single, more concise paper. The splitting into two papers makes the publication longer than necessary and awkward to read either paper without referring to the other. Some material must be repeated in each paper, and some material in one paper better belongs in the other. While the need for tight intercalibration is essential for the purposes of the field campaign and is well justified, it does not justify a standalone paper as it does not have clear relevance without the context of the measurement campaign. Part 1 contains introductory material that better belongs to part 2 (e.g. 1. Introduction, and 3.2 describing the Berlin campaign). Part 2 relies heavily on part 1 to follow the measurements. I therefore recommend combining the two papers into one, merging the duplicated material in introductions campaign descriptions and conclusions, with a single introduction to the importance of the work, followed by (existing) sections on the instrumentation, (calibration, ILS determination, spectrum analysis and processing to total columns), Berlin campaign description, results and modelling. This is mostly a matter of reorganising existing sections rather than rewriting new material. The authors might consider placing some of the calibration material from part 1 into an appendix to the combined paper. It is important that this material be included, but for the less interested reader it can be summarised in the main text with details in the appendix to enhance readability.

Technical corrections – part 1

Abstract – rewrite to reflect the combined single paper

P2737 L13: . . .from the total column measurements of O2 and barometric records.

L18: "In the last years" => "recently"

L24: Caltech => spell out in full.

P2738 L10: lightweight

L17: The review of relevant previous work is quite minimal - there are many more relevant studies of boundary layer emissions measurements around GHG and urban sources than the two selected – they should be briefly reviewed or referenced, for example: - the entire INFLUX experiment around Indianapolis (Shepson and co workers, many publications), - Utembe et al Estimating CO2 emissions from point sources: a case study of an isolated power station, Atmos. Chem. Phys. Discuss., 14, 31551-31601, 2014, - Wunch, D., et al.: Emissions of greenhouse gases from a North American megacity - Geophysical Research Letters, 36, 15810-15810, 2009, - Wong, K. W., et al.: Mapping CH4 : CO2 ratios in Los Angeles with CLARS-FTS from Mount Wilson, California, Atmos. Chem. Phys., 15, 241-252, 2015.

L24: clarify meaning of “signal” here

P2739 L21: It would be helpful to mention the FOV of the sun’s disk here

L23: use “interferogram” not IFG (also in several places later

P2741 L4: Justify this selection of H2O spectrum used for ILS

L10 “Neded” => “required”

L14: SD - spell out standard deviation, remove “very low” – let the reader decide if it is low, just give the value.

L26: “in a Transporter” => “by road”

P2742 L4: . . . is of utmost importance to avoid bias between stations.

Section 3.2 would belong in the second paper if separated, it is out of place here

L24: relatively isolated from what? – please clarify.

P2743 L2: is favourable for modelling/transport/dispersion studies

P2744 L10: use 24 hour clock times 00:00 and 18:00 to avoid ambiguity

P2744 L27: subsume => combine



P2745 L3: residuum => residual – also in several places later in the paper.

L5: “larger linelist errors” what is meant here? Do you mean larger errors due to the variable actual vertical profile?

L6: “very good” - in general, please avoid such subjective judgements and leave them to the reader, or put the value in context so the reader can decide for him/herself. eg 0.2% in comparison to the random noise component of the residual of ??%

L11: DMF – use dry air mole fraction or define DMF at first use. Please check ALL abbreviations and acronyms for definition at first use.

L17: “Calibration factors” Please clarify, are these the factors taken straight from TCCON, or of the EM27 relative to TCCON?

L20 It is clear that the lineshape of all the spectrometers. . .

L22: briefly describe the hardware problem.

P2746 L18: rationing => ratioing

P2747 L1: agreement is never perfect! Quantify – eg obtain agreement within measured noise or precision

L17: . . . similar to the implemented by Wunch et al in TCCON (implemented, not simply proposed)

P2748 L13: Please comment on the relative scatter between TCCON and EM27 – the EM27 scatter is lower, presumably due to lower resolution, but this will not be obvious to many readers who might expect the higher quality TCCON instrument to be better.

P2749 L26: as above, “excellent” please avoid such value judgements and leave them to the reader.

Table 1: Please specify that the modulation efficiencies quoted are at max OPD ie 1.8 cm

Figure 9. As I read the paper I would have found this figure, the O2 vs pressure comparison, better placed and discussed earlier in the paper. This could be accommodated in the re-organisation.

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Interactive comment on Atmos. Meas. Tech. Discuss., 8, 2735, 2015.