

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 #1

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This paper and its companion (hereafter: P2), present the method and data from a field campaign taking place in and around Berlin, where a network (namely 5) of portable FTIR spectrometers are deployed to measure greenhouse gas columns and detect emissions from within the city. The papers (together) are within the scope of AMT, and relevant as a potentially important means of quantifying/validating city/urban scale greenhouse gas emissions, which future satellite missions such as CarbonSat hope to

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measure.

The instrument(s) that are used to measure greenhouse gas columns have been introduced previously by the lead group at KIT. Their field application is somewhat novel.

This paper is reasonably well written and structured. The contents, however, do not seem sufficiently novel to merit publication on their own. Indeed, it seems that the work within this part of the paper would suffice to create one section within P2, and that the two papers would have better impact as a combined paper with less padded out detail.

I would therefore recommend simplification, and publication with P2 as one single paper.

In addition, below are further more specific comments for the authors' consideration.

p2737, l5: within what? (or one another). or would 'smaller than' be more appropriate here?

p2737, l11: these values are loosely tied to the WMO scale. TCCON is a secondary calibration at best. Given that different spectroscopy, different apriori assumptions and different spectral retrieval software are used, there are potentially other sources of further difficulty in tracing to the WMO scale. It is perhaps too strong to say that the measurements are 'compatible' to the WMO in situ scale. Traceable might pass.

p2738, l6: as far as I am aware, a TCCON instrument can be moved (see e.g. Geibel et al, 2010, and the system now at Manaus). They are, however, definitely not easily portable.

p2738, l6: comma after 'developed'

p2738, l10: leightweight → lightweight

p2738, l11: platforms SUCH as ships?

p2738, l11: is it appropriate to have a manuscript in preparation in the official list of

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references?

p2738, l16: 'since long' does not make sense. 'for a long time'?

p2738, l16: spectroscopy → spectroscopic

p2738, l18-19: commas before 'which' and after 'vicinity'

p2738, l21: spectrometer → spectrometers

p2738, l22: 'conurbation' is not a word that most would be familiar with. Consider replacing with 'metropolis' or something similar.

p2740, l10: This sentence 'Bruker recently...' sounds like a sales pitch.

p2740, l17: as → because

p2741, l9: the 'O' in H₂O should not be subscripted

p2741, l10: needed → necessary

p2741, l12 'the MHB-382SD data logger'. This has not been introduced anywhere. Replace 'the' with 'a'. Does it have a brand name?

p2741, l19-20: Suggest removing 'One can see'

p2741, l23: how did you arrive at the figure of 0.04% for XCO₂?

p2742, l3: a instrument → an instrument

p2742, l7: include the year. It might be obvious now, but won't be some time in the future

p2742, l16: what do you mean by 'considerably reduced'?

p2742, l20: insert a comma after 'Additionally'

p2742, l21: do you have a reference or details for the tall tower?

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p2743, l1: remove 'really'

p2743, l3: insert the year again

p2743, l10: what constitutes 'a long time series'?

p2743, l11: data was → data were

p2743, l11: how were these data used to calculate the altitudes? Why was this not obtained directly?

p2743, l12: the concept of a model atmosphere has not been introduced.

p2744, l9: ascent → increase ?? Otherwise this needs clarification

p2744, l14: stations → stations'

p2744, l17: consider replacing 'proper' with a more appropriate word.

p2744, l22: parenthesis location around the reference needs to be fixed

p2745, l5: why do you expect large linelist errors because of the variability? Is it not rather because of the difficulty in measuring H₂O line parameters in the first place?

p2745, l8: Section title needs rewording. Maybe "Results of calibration measurements" or "Calibration measurement results"

p2745, l22: consider a different date format

p2746, l3: 'for the largest part' → rephrase. Maybe 'can be mostly attributed...'

p2746, l11: minimize the residuum w.r.t. what? The mean? And how? By scaling each site? All sites???

p2747, l1: perfect is too strong a word

p2747, l4: with → at

p2747, l9: date format

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p2747, I13: But the SZA variation is higher during summer because the sun can get to lower zenith angles. So shouldn't this be easier to see?

p2747, I18: parenthesis location with reference

p2748, I2: This → These

p2748, I3: shows → show (the word 'data' is a plural)

p2748, I3: Consider rephrasing the sentence starting 'It turned out...'

p2748, I4: How do the SZA-dependences compare to those derived for TCCON? From what I remember, it is O₂ that shows the airmass dependence within TCCON data, in contrast to what you see here.

p2748, I17: how many significant figures are appropriate here? 5 seems to be too many. This is also true in other places (e.g. Table 3)

Section 6: The point of doing this is not very clear. What do you mean by the 'slope' when referring to Figure 9? Also in Figure 9, you seem to ignore the fact that the instruments see larger variability at, and just after, the time of the maximum surface pressure.

Multiple locations: When referring to the higher spectral resolution instrument, the use of the term 'TCCON instrument' is not entirely accurate. The instrument is independent of TCCON. TCCON refers to more than the instrument - the measurement parameters, retrieval setup etc. If you have, as I suspect, not applied the standard TCCON analysis procedure to the retrievals from this instrument, then these are not TCCON measurements, nor should it be referred to as a 'TCCON instrument'

p2750, I1: How do you reach the conclusion of applicability to source/sink measurements? To me, that is too strong of a jump from what is presented in this paper, which deals with the stability and inter-instrument consistency.

References: Geibel, M. C., Gerbig, C., and Feist, D. G.: A new fully automated FTIR

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system for total column measurements of greenhouse gases, *Atmos. Meas. Tech.*, 3, 1363-1375, doi:10.5194/amt-3-1363-2010, 2010.

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