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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of temporal and spatial variability of atmospheric CO_2 concentration within Paris from the GreenLITE^{TM} laser imaging experiment" *by* Jinghui Lian et al.

Anonymous Referee #1

Received and published: 5 August 2019

Review of Lian et al. (2019) Analysis of temporal and spatial variability of atmospheric CO2 concentration within Paris from the GreenLITETM laser imaging experiment

Lian et al. describe the application of a long open-path spectroscopy technique for the measurement of CO2 mixing ratios above a complex urban canopy, which could influence existing emissions estimates at the city scale. They compare the data measured using the GreenLITETM system with fixed-site CO2 measurements within the same urban environment, and contrast the results against two urban canopy schemes within the WRF-Chem model.

It is a well written paper which I would recommend for publication in ACP. The content

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Discussion paper

of the paper, which covers greenhouse gas measurements with a possible climate change impact, is relevant to the journal and its readers.

General comments:

The authors acknowledge that calibration of long open-path spectroscopy techniques is difficult. A separate paper (Zaccheo et al., 2019), detailing a new calibration procedure applied to the GreenLITETM data, is referenced by the authors here. This calibration procedure appears to use the fixed-site installations within the city to calibrate the open-path data. Whilst the authors state this "has no significant impact on chord-to-chord variations", they do not discuss the potential implications of using point-source measurements to adjust area/path averaged measurements. Zaccheo et al. (2019) does go into more detail but considering this is a key element of the calibration procedure, I believe it needs some more attention here.

Font sizes in some figures could be larger. Some of the text is hard to read on a computer screen without zooming in.

The authors should address the following points in a revised manuscript:

Page 3, Line 30: What is meant by 15/100 m above ground level? I assume there are two sampling inlets? This is not made clear.

Page 4, Line 23: What is meant by "no significant impact" – significant in what way?

Page 4, Line 27: Why is a threshold of standard deviation < 10 ppm CO2 applied to the hourly data? Is this because CO2 is not expected to change by more than 10 ppm over the course of one hour? Is this justifiable?

Page 5, Line 19: Can you quantify "much larger differences"?

Page 5, Line 29: Typo - "details" should be "detail".

Page 6, Line 5: Consider "accounting for" rather than "taking up"?

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Page 11, Line 9: Rephrase “city surrounding” to “areas surrounding the city”, or similar.

Table 3: What are the colour scales showing? Better or worse values? This needs to be made more clear particularly because high correlation coefficient (red) is good but high RMSE (also red) is bad?

Figure 1: Some text is very small – a possible solution would be to refer the reader to the panel in Fig 2 in the caption and remove the chord labels. Also the caption refers to Figure S1 but this doesn’t appear relevant to the text – the authors might mean Figure S2?

Figure 2: Does the caption need to state that these emissions are taken from an emissions inventory i.e. not measured or modelled.

Figure 3: See Figure 2.

Figure 4b: Is there some way of better highlighting that this is not a continuous time series of data? Perhaps either thicker/bolder lines or a gap between each monthly diurnal cycle.

Figure 5: The blue (observation) line is quite difficult to see on these plots.

Figure 7: y-axis titles should probably read “CO2 difference (ppm)” as in Figure 6.

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