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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of the potential of near ground measurements of CO_2 and CH_4 in London, UK for the monitoring of city-scale emissions using an atmospheric transport model" *by* A. Boon et al.

Anonymous Referee #1

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General Comments:

Overall, I think the methods and analysis are strong and recommend this paper for publication.

It seems unnecessary to spend so much of the paper discussing the model applied individually to the measurement sites when it is clear that that method does not work as well as analyzing gradient between sites. Other studies have also demonstrated the benefit of using gradients (McKain et al., PNAS, 2015), to the point where many

studies start with that method. You should focus on demonstrating that the gradient method is best and then on the results using that method, rather than giving a thorough explanation of a method that does not work well.

Measurement methodology appears to be thorough and designed to attain comparable measurements across the various sites, which is essential.

For sites without local sources of CH4, does the model do better? If not, why?

Conclusions: What tests could you propose in order to be assured that other sites (perhaps at higher altitudes, etc.) be useful for inversion analysis and improving upon bottom-up inventories? You vaguely state that the large model-data misfits mean that your network is not up to that task, but could be more specific about how you came to that conclusion. What would be necessary to achieve an adequate network, and how would you verify that the network is good enough?

Specific Comments:

P. 8, Ln. 6: Is the Picarro air stream dried? If not, I question the 0.021 ppm uncertainty in CO2 using the Rella correction. The Rella correction has an uncertainty of >0.1 ppm at water levels greater than 1%, and I have found in lab tests that a water correction specific to each Picarro instrument is necessary to achieve 0.1 ppm accuracy in undried air streams.

P. 10, Ln 28: For summer, the biosphere is very important to the CO2 flux. It would be nice to have a few more sentences describing the biosphere model, including how emissions in the city are treated (are they non-zero?)

P. 13, Ln. 25: Specify "bottom-up emission inventory" for clarity

P. 14, Ln 25: You describe the modeled mixing layer height a 13% lower than that measured with the lidar. In our experience, the agreement between model and measurement varies significantly day to day and month to month – if that is true for your data it would be useful to state that, and to indicate that the 13% is an average.

P. 15, Section 3.3: How would you expect these wind errors to impact the modeled concentration? How much error would you expect them to introduce and in what direction?

P. 16, Ln 12: “We have also excluded data from 29th August and 23rd to 24th September since the model simulated very large GHG peaks on these days which do not occur in the data.” Why does the model produce these large GHG peaks? Can you use that to gain insight into the model?

P. 16, Section 3.4: What strikes me in Figure 4 is that the modelled CO2 is often very similar to the background CO2, and you don’t address that at all. Could you give some explanation of why that is and what it says about the model that you have virtually no emissions added from the boundary? It would also be useful if you included separate lines for biosphere and anthropogenic emissions so we could see if in fact there is an impact of anthropogenic emissions, but they are being negated by the biosphere. We have actually seen a pattern similar to this in a WRF-STILT model of Boston emissions, and found that it was an artifact of using the model in the city, which we are working to fix.

P. 17, Section 3.5: How is it that you see so little enhancement in CO2 when modeling the sites individually, but so much greater of an enhancement when modeling the difference between 2 sites?

P. 20, Ln 9: How many data points are included when you filter for wind speed? Are there enough points for reliable statistics?

P. 20, Section 3.6: Could you show a time series of model and observations for the wind filtered data? Or instead you could you markers or shading to show which portions of the time series in Figure 6 were used.

Figure 5: It would be useful to show the background concentration (even if it is constant).

Figure 6 e,f: It is hard to make sense of this. I would rather see separate plots as for CO2.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 33003, 2015.