

Interactive comment on “Spatial and temporal variability of urban fluxes of methane, carbon monoxide and carbon dioxide above London, UK” by Carole Helfter et al.

Anonymous Referee #1

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1 Introduction

This study presents a rather unique data set of multi-year in situ measurements of urban fluxes for CO, CO₂ and CH₄. Considering the quality, multi-year duration and large footprint of the eddy-covariance observations carried out in the city of London, this data set is very valuable to assess GHG budgets in cities and to evaluate bottom-up inventories. Continuous flux measurements above cities as developed for this study should provide very useful insights on the spatial and more importantly temporal variability of urban emissions.

This work is very relevant for publication in ACP regarding the addressed topic, the

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state-of-the-art and cautious methods used to analysed the data and the general scientific quality of the manuscript. It should be published with revisions after treating the remarks and comments below.

2 General comments

2.1 Structure and presentation

The general scientific quality of the work is somehow mitigated by the structure and presentation of the manuscript.

First, the use of bullet points should be avoided as much as possible. In particular, in its current state, the conclusion looks very like a draft.

Second, and maybe partly explaining the extensive use of bullet points, the authors have the difficult task of presenting a very rich data set, with various species, temporal variability and spatial patterns. In the present manuscript, this attempt leads to very long paragraphs (1.5–2 pages each) in the “Result and discussion” part, with very general titles (Diurnal patterns, seasonal trends, ...). In my opinion, the results and discussion section would greatly gain in readability and attractiveness if reorganised. There is no specific need of rewriting entire parts, but splitting sections into subsections would help the reader following the argumentation of the author and remembering the key message of the manuscript.

2.2 Uncertainty quantification

The uncertainty issue is shortly commented in Sect. 2.4. However, I couldn't see an explicit definition of the uncertainties given later on the manuscript. Moreover, regarding

the quite large scatter in figure 3 between the reference closed path and the open-path fluxes, the errors presented in the other figures and in the text seems relatively small (especially if you add some uncertainty on the footprint). Regarding uncertainties, it would also be interesting to show some uncertainty and variability shades in figure 4.

All the uncertainty discussion probably does not critically change the conclusion of the manuscript, but this slightly dampens the strength of the manuscript.

2.3 Use of supplementary material

Any material in the supplement should not be used in the scientific argumentation. Some figures in the supplement (e.g. figure S1, S3–5, S7–9) seems very critical in the manuscript. On the other hand, if choosing to put something in the supplement (which has no length limitation), why not showing figures for all the different data sets (open and close path) in the supplement? I suggest the author should reconsider the use of the supplement; figures could be transferred to the main text (at least for one chosen species) and other figures could be added in the supplementary for a comprehensive presentation of the work.

2.4 Wind sector analysis

A large part of the discussion is relevantly based on different wind sectors to deduce any possible spatial pattern in the fluxes. A map showing the different land use types around the two sites would make the text much easier to understand for a reader not knowing the city of London. Such a map could be presented side by side with the footprint analysis in figure 1.

Regarding the definition of the wind sectors, what would be the impact on the analysis of changing the sector width? For sources nearby the observation site, the 45°-wide

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sectors may be too narrow and then sensitive to uncertainties in the definition of the footprint?

3 Technical and specific comments

The following points are mostly technical points that need reformulation or some clarification.

- Some acronyms are used before being defined. Please check over the text.
- “) (“: in my opinion, closing brackets should not be directly followed by opening brackets; please check the editorial guidelines about this point.
- p. 2 l. 14–15: This is a very long list of references without comments. Please remove some, or provide some information on the relevance of each reference.
- p. 4 l. 28: “averaged into monthly means”: are the errors directly averaged, or some temporal correlations are taken into account?
- p. 6 Sect. 3.2.1: why only one day was used in figure 2 for the computation of the co-spectra? How this day was chosen? Will the result be different if taking a longer period?
- p. 6 l. 23–32: the scientific argument explaining the dependence with u^* seems very reasonable; however, as it is presented here, it remains very speculative; couldn't one find some additional material to convince the reader? if not available, a very small discussion to explain how one could close this issue should be proposed

- p. 9 l. 9–10: I might miss something, but I don't understand the pressure argument; the leak rate is related to the pressure inside the pipe, but this pressure is itself related to the flow rate; so, wouldn't increased flow rate (related to gas consumption) generate higher emissions? thus leading to a diurnal cycle of emissions?
- p. 11 l. 3–18: this discussion is also partly valid for the diurnal variability of CH₄ emissions; both could be rearranged as they relate to similar arguments?
- p. 12 l. 16–17: what data was taken for the correlation with the population; if sewerage emissions are a significant contribution, office buildings would contribute significantly as houses

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