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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observing local CO_2 sources using low-cost, near-surface urban monitors" *by* Alexis A. Shusterman et al.

Anonymous Referee #2

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General comments:

Shusterman et al. present and analyse results from the low-cost, high-density CO2 monitoring network BEACO2N to demonstrate that such a network allows investigating hyperlocal sources e.g. highway traffic and to track emission changes due to mitigation measures. Key findings, like an experimentally determined correlation length and the strong correlation of local CO2 enhancements with traffic are important results for the urban GHG research community. Overall, the manuscript is very well written, nicely structured and concise. 1.) However, some further detail on the methodology would be instructive for other (and future) researchers attempting to use similar approaches, which would ensure that the paper has the best possible impact. The methods applied are properly referenced, but e.g. the work of de Foy is very recent and some more

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information might be useful for the reader. 2.) Furthermore, the authors do not clearly define the terms used for spatial scales e.g. “regionwide” (see specific comments). As different groups/communities use different definitions of “regional” it seems imperative that this is added to the manuscript to avoid confusion. 3.) The authors refer to MRV and that this network would/could be useful. While the work described here echoes the concept of MRV, MRV itself, as introduced by the Bali action plan (UNFCCC), seems not to be the best goal. I would argue that providing atmospheric-based constraints on emissions would be very valuable by itself and can enormously help (local) stakeholders without the complications of being integrated into a MRV framework. After addressing these comments I would fully recommend this work for publication in ACP as it is an important advance in the field and will be of great interest to the community.

Specific comments:

P1L9: consider adding “at subnational scale” as national CO2 emissions are usually fairly easy to report based on consumption data compared to e.g. CFCs, N2O or CH4 and MRV frameworks exist under UNFCCC (e.g. https://unfccc.int/sites/default/files/non-annex_i_mrv_handbook.pdf). For cities MRV has also been developing (e.g. the GHG protocol), but the authors could highlight the added/complementary value of atmospheric information.

P4 L19: Please give an estimate of what scale “regionwide” refers to.

P4 L25: Why did you choose the 10th percentile to define “regional” and not e.g. the 5th or 20th percentile?

P4 L33: Please correct to “Figure 4”

P5 L3: The daily cycle is mainly driven by boundary layer height dynamics – the local traffic flux is the superimposed fluctuation here, in my opinion. It surely causes a modification e.g. by causing the morning and evening peaks to be more pronounced. However, different studies in rural regions have largely similar diel cycle shapes (e.g. Garcia

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et al. 2012 https://www.tandfonline.com/doi/abs/10.3155/1047-3289.58.7.940, Perez et al. 2012, https://www.sciencedirect.com/science/article/pii/S0048969712007498)

P5 L6: It seems counter-intuitive that the PBLH changes earlier in winter (also compared to other studies) as more energy is introduced into the system during summer months to break the NBL (as the solar insulation is stronger and the sun rises earlier). Please provide additional data e.g. PBLH or other atmospheric proxy information in the appendix to support your interpretation.

P5 L32: Why is the other methodology not shown in the supplement and why is this sentence in brackets? Seems to be an interesting finding/information.

P5 L34: You could also refer to the large amount of traffic tunnel studies that have similar findings and are very straightforward (no other source besides traffic) (e.g. references in https://www.atmos-chem-phys.net/14/12871/2014/acp-14-12871-2014.pdf)

P5 L35: One question raised would be how long would you have to observe confirm this 17% trend? Which is answered at P7 L4 for 11-30% emission changes. Consider removing the discussion of the 17% here.

P6 L15: How exactly are the wind speed quartiles subdivided (and why)? See general comment 1.)

P6 L26: Why are Mondays and Saturdays not shown in the supplement?

P6 L29: Could you quantify to which degree the atmospheric dynamics has been controlled for. Claiming that it is "partially controlled for" does not automatically mean that the residual only/primarily reflects emission changes.

P7 L4: What is your confidence of the reported detection of such a trend within 2-3years? 95%? How was this calculated?

P7 L17: The assumption that plumes can be detected within an urban area should be supported e.g. by citations. At scales below 1 km2 it seems that street

canyon effects, building disturbances, etc. could play an important role and hinder the application of concepts such as “plumes”, see e.g. Lietzke and Vogt 2013 (https://www.sciencedirect.com/science/article/pii/S1352231013002069) that also investigated traffic emissions at street scale.

P8 L5: I would suggest reconsidering the wording here, especially as you refer to MRV earlier in the manuscript. This work strongly supports the conclusions of Turner et al. 2016, but it seems you have validated and not verified them.

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