Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-796-RC1, 2018

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Estimating vehicle carbon dioxide emissions from Boulder, Colorado using horizontal path-integrated column measurements" *by* Eleanor M. Waxman et al.

Anonymous Referee #1

Received and published: 5 October 2018

The open-path dual-comb spectrometer measurements are novel and could be of interest to numerous urban greenhouse gas (GHG) researchers. However, I see two major problems that preclude this paper from being publishable.

My major criticisms of the paper fall into two main categories: 1) Quality of measurements For a relatively new measurement technique, the paper is lacking in demonstration of measurement quality. Can these measurements be compared against nearby in-situ CO2 observations? I believe the National Center for Atmospheric Research is carrying out CO2 measurements on one of its buildings in Boulder (PI: Britton B. Stephens). NOAA-Earth System Research Laboratory (just next door to NIST, where

the authors are based) is the world leader for in-situ CO2 measurements, managing a wide network of CO2 measurement sites. Perhaps there are suitable measurement sites managed by NOAA-ESRL (e.g., a nearby tall tower) that can be used to compare against the horizontal column measurements shown in this paper?

The observational time series shown in Fig. 6 is quite noisy, it appears. The authors claim that the noise in the XCO2 reference path is associated with wind gusts of clean air, but no evidence is shown for this claim. Moreover, if the noise is due to gusts of clean air, why are there no such patterns showing up in the XCH4 time series? It is also concerning that the Q(t) time series does not appear to indicate a peak during the rush hour even on a weekday (10/25/2016).

Furthermore, the description of uncertainties associated with this technique is limited. There are scattered mentioning of the uncertaintiesâĂŤe.g., in Sect. 3.3.6. Instead, I believe a more substantial amount of text needs to be devoted to measurement uncertainties in the measurement section (Sect. 2.1). For instance, how does the uncertainty depend on path length and time resolution? Why?

2) Calculation of city-wide CO2 emissions The calculation of city-wide emissions is highly unsatisfactory. The authors attribute the CO2 signal as solely due to transportation, while multiple bottom-up inventories (e.g., Vulcan, Hestia) indicate that building emissions (mainly due to heating and cooking) are non-negligible. The building emissions are neglected entirely in this paper.

OTHER COMMENTS

What is the significance of the H2O and HDO measurements? They were shown, but no discussion is available for these species. What does HDO tell us? Are there any, say, meteorological events that can explain the variations in H2O and HDO?

Lines 34∼36: recent high profile papers published in PNAS for the cities of Boston (Sargent et al., 2018) and Salt Lake City (Mitchell et al., 2018) should also be men-

tioned

Lines 40∼41: another key limitation for urban eddy covariance measurements is the violation of horizontal homogeneity assumptions

Lines 69∼73: a reference for the CLARS instrument should be added

Line 127: typo; should be “turbulence”

Figure 1: The satellite map of Boulder is hard to decipher. Perhaps it would be better to use a road map instead, and zoomed in more? Also need to spell out “TMC” in the caption.

Figure 4: Variations in all 4 species are hard to discern. Are all 7.5 weeks needed? And could the y-axis range be reduced to show more variations? And is it necessary to show all 4 species in a single panel?

Figure 5: There are two different copies of this figure in the PDF file. Is the first one supposed to be deleted? Here the same problem existsâĂŤthe variations in XCO2 and XCH4 are hard to figure out. I believe the variations in the median values are the most important for the reader. Currently the differences between the blue and red symbols indicating the median values are hardly visible. The y-axis ranges can be reduced considerably to highlight variations in the medians. Are the raw data really necessary here?

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-796, 2018.