EGUsphere, referee comment RC1
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Comment on egusphere-2022-956

Anonymous Referee #2

Referee comment on "Pandemic restrictions in 2020 highlight the significance of non-road NO_x sources in central London" by Samuel J. Cliff et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-956-RC1, 2022

General comments:

This manuscript presents eddy covariance NOx and CO2 fluxes measured in central London during the COVID pandemic and shows by comparing to pre-pandemic measurements that NOx emissions significantly decreased due to reductions in traffic load. While a number of studies have revealed NOx reductions during COVID from regional to global scales using satellite observations or surface monitors coupled with models, this study offers insight from another angle with the eddy covariance technique and delves into source attribution of NOx and CO2 reductions. The study draws attention to urban power and heat generation, which was identified as the major source of NOx in the area during the lockdowns. My overall comment is that the authors should discuss the extent to which their findings relate to and differentiate from existing studies in the field, and highlight the fact that this is the first evidence using eddy covariance measurements in a megacity. The only other eddy covariance measurements I am aware of that looked at this topic were made in Innsbruck, Austria (Lamprecht et al., 2021. doi: 10.5194/acp-21-3091-2021). Aside from this, I also have concerns regarding the method used for comparing the two periods and the conclusions drawn, mainly the lack of discussion on other factors that may vary between the two periods. Please see below the details.

Specific comments:

L65: Can you provide an estimate of lag time of your measurements for each species?

L71: I understand that many technical details were described in Drysdale et al. (2022) for

the 2017 measurements so only a summary is provided, but please at least cite the relevant work(s) here for those who would like to read further on the instruments and methodologies. For example, how exactly do you achieve "NOx free air"? What are the accuracies and precisions of your instruments?

L87: The NOx, CO2, and meteorological measurements all have different sampling rates. How did you synchronize the measurements to calculate the hourly fluxes?

L93: Please specify the sampling period of your 2017 measurements because this is an important detail. Based on my understanding the 2017 fluxes were only available from March to August, whereas your 2020/21 data covered a full year. Some of your comparisons between the two periods included only those in the same months (Figure 5) but the others compared the full year of 2020/21 to the six months of 2017 (Figure 2 and 5). How much bias would these comparisons of unequal lengths cause?

Besides, the potential influence of meteorology between different times of the year/between different years was never discussed. If your argument is that the emissions decreased due to anthropogenic reasons you need to prove that the meteorological effects were negligible or at least provide an uncertainty estimate. Can you show some meteorological data from your anemometer such as the average temperature diurnal profile for each of the two periods, or the average boundary layer height from ERA5?

In addition, did you compare the instrument performance in 2020/21 to 2017 to make sure the measurements were not affected by any system degradation such as long-term drifts?

L133: Can you also mark the date of full removal of lockdown restrictions on Figure A3?

L137: Can you describe in more detail how you calculated the reduction percentages from the diurnal profiles?

L176: What is the rationale behind the assumption that CO2 emissions reduction scales linearly with traffic load reduction?

Figure 2: Interesting that the CO2 and NOx flux diurnal profiles both show a bimodal pattern peaking around noon and again around 3-4 pm. I thought the peaks would appear closer to the morning and evening rush hours, especially in the case of NOx given that Figure 3 suggests transport was the main source of NOx emissions. Can you explain why they display this pattern?

Also, are the error bars on the diurnal profiles the 1σ standard deviation of fluxes? Is the greater variability of fluxes in 2020/21 mainly due to the difference in temporal coverage?

Figure 5: While the differences between the 2020/21 and 2017 fluxes are noticeable, it is difficult to get a sense of how the data actually correlate with traffic flow from the figure. Can you calculate the correlation coefficients statistically? This will also aid your argument "The greatly reduced correlation with traffic load for the easterly 2020/21 data in Figure 5 is further evidence that the dominant source in this direction is heat and power generation." (L235-236)

Technical corrections:

L20: has additional

L44: other external stimuli

L46: surface-atmosphere exchange

L69: was converted into

L113: artic lorries?

Figure 2: Consider moving this figure to a different place. It is currently placed awkwardly between the "Results and Discussion" section title and the first paragraph.

Figure 4: Check equation labels on the figure: CO2 Eq. (2) and NOx Eq. (3)?