Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
https://doi.org/10.5194/acp-2021-1042-RC1, 2022

Comment on acp-2021-1042

Anonymous Referee #1

Referee comment on "A method for using stationary networks to observe long term trends of on-road emissions factors of primary aerosol from heavy duty vehicles" by Helen Lorraine Fitzmaurice and Ronald C. Cohen, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-1042-RC1, 2022

Review comments on “A method for using stationary networks to observe long term trends of on-road emissions factors of primary aerosol from heavy duty vehicles by Helen L. Fitzmaurice and Ronald C. Cohen”

This paper presents a method for determining emissions factors (EF) of primary aerosols from heavy-duty vehicles (HDV) using long-term stationary monitoring data of PM2.5, and CO. Authors combined traffic count/composition, and air pollution concentrations measured at several monitoring sites in the Bay Area to determine emission factors of PM2.5. Authors reported that estimated EFs vary substantially with time and space. The research topic is important and well suited to the scope of the journal. However, I think that the estimated emission factors using the proposed method are highly uncertain, rely on many assumptions (some of them are not very realistic, in my view). The paper is not very well written; discussions are very short; conclusions are not well substantiated by uncertainty analysis. Some of my specific comments are below.

- The paper used ambient air pollution measurements from various sites to estimate the emission factors. They said, “We include all BAAQMD sites that are within 500 meters of one major highway and use traffic count data from the PeMS measurement site closest to each air quality site”. The distances from the highway for various sites are not reported. Previous studies have used on-road or near-road ambient measurements to determine emission factors for traffic-related air pollutants. The main challenge in this process is to isolate the traffic signals from ambient measurements. Since the traffic pollution signal decay exponentially with distance from the roads, within a few meters (usually 50-100 m), traffic signals become very close to ambient/background level. If one goes away from the roadway, the decoupling of traffic and background signals becomes more and more challenging, and resulting estimates become highly uncertain. Since the roadway signals get highly diluted with downwind distance, a small error in isolating traffic versus non-traffic signals can impact emission factor estimations. This is a major limitation of this paper since they used data within 500m from the roadway.
- The near-road signals depend on wind speed and direction and other meteorological

factors. While the authors used a subset of monitoring data from morning and wind speed > 0.5 m/s, (it appears that) they did not consider wind direction. While a period with high wind speed but opposite direction, the monitoring locations will not see much highway signals. To get a good highway signal, one needs to consider wind speed and direction (and data from within a few meters of the highway).

- Authors assumed that only HDV contributes to PM2.5. I do not fully agree with this assumption. In the current US scenario, tailpipe and non-tailpipe traffic emissions are comparable (even non-tailpipe could be higher than tailpipe) in many locations. Both HDV and LDV contribute to non-tailpipe PM emissions. Since the number of LDV in a typical highway fleet is much higher than HDV (typically 90-95% are LDV), the LDV might largely contribute to overall vehicular primary PM2.5. Also, tailpipe PM2.5 from LDV is not negligible. Therefore, when total PM2.5 is the concern, I think the assumption that only HDV contributes to PM2.5 is a wild guess.
- Looking at Fig. 2, the estimated background PM2.5 signals (assuming 10th percentile as background) seem very uncertain. In some cases, the background PM2.5 is close to zero. As per the existing literature, the majority of PM2.5 is background. These background estimates (or decoupling highway versus roadway signal for PM2.5) are uncertain. Therefore, the resulting EFs using these data also would be highly uncertain. If they underestimate the background PM2.5 (means overestimation of traffic PM2.5), the resulting traffic EF would be higher. This could be the reason behind their estimated higher EF than other recent studies shown in Fig.1. Also, they said, "We observe an average EF of 0.11 g 145 PM / kg fuel, for 2018-2020, more than 2-3 times larger than expected for an HDV fleet compliant with current regulations". This higher estimation could be due to uncertainty in isolating traffic and background signals.
- EF's spatial variability could also be due to the problem of isolating traffic versus non-traffic signals. If the location of a site is far away from the roadway, a small error in isolating traffic versus non-traffic signals could have a huge impact on the estimated EF. The authors tried to explain the high EF at one site based on parking lot influence. This is not very convincing. Because if one compares the number of cars on a parking lot versus a highway over a day, one expects much higher cars on a highway.
- Equation 1 is hard to understand (it has some formatting issues). I think the details derivation of Eq. 1 is needed.

Please also note the supplement to this comment:
https://acp.copernicus.org/preprints/acp-2021-1042/acp-2021-1042-RC1-supplement.pdf