Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2021-1042-RC2, 2022
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Comment on acp-2021-1042

Anonymous Referee #2

Referee comment on "A method for using stationary networks to observe long-term trends of on-road emission factors of primary aerosol from heavy-duty vehicles" by Helen L. Fitzmaurice and Ronald C. Cohen, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-1042-RC2, 2022

In this manuscript, the authors calculated the on-road emission factors of heavy-duty vehicles (HDV) in the San Francisco Bay area using BAAQMD's ambient monitoring data. The results show that the HDV emission factors decreased by a factor of 7 in the past decades, which is in line with other near-road and tunnel observations in the US. And the authors also found that the HDV emission factors have large spatial variations. The monitoring data from BAAQMD's monitoring network was also used to estimate people's exposure to primary PM2.5 from HDV emissions in this study. Overall, I think the method developed by the authors is potentially useful and can be applied to other EPA near-road stations to estimate HDV emission factors around the US. However, the emission factors estimated by this method are highly uncertain, and the authors haven't fully characterized the uncertainty associated with this method.

1. Since the time resolution of the monitoring data is very low (1-h), it is challenging to separate the HDV emissions from the background, and the choice of background concentrations can significantly affect the results. In this study, the authors used the 10th percentile of all measurements collected within a 5-hour window across the entire San Francisco Bay area as the background, which seems arbitrary. The authors need to run more sensitivity tests about the background concentration. How different would the emission factors be if another percentile was chosen as background? For each near-road station, if you only use concentrations measured at the closest station or the lowest concentration measured at stations within a closer distance (like 10 km), how different would the calculated HDV emission factor be?

2. For the background-corrected PM2.5-to-CO ratio shown in Figure 3, the authors should do the fitting using the original data instead of binning the CO concentration. By binning data, a tiny portion of data in the high delta_CO range (>0.8 ppm) is dragging the overall fitting. The authors should also estimate the uncertainty associated with this fitting and propagate it to the overall uncertainty range.

3. The authors need to thoroughly discuss uncertainties associated with all terms in Equation 1 and 2 and propagate them to the results.

4. The emission factors in Figure 4 should have uncertainty bars. Because the method has large uncertainties from the choice of background concentrations, the spatial variation estimated using this method may not be real. How were the traffic speed and slope of the road at those near-road stations? The spatial variation may also be caused by traffic speed and road slope.

5. Did the authors try analyzing the monitoring data around noontime? The HDV traffic is usually the highest around noontime.

6. The wind speed and wind direction data are also measured at BAAQMD's monitoring stations. Why did the authors use wind data from the reanalysis product instead of the measurements at monitoring stations?

7. The authors should be more careful about using parameters derived from the EMFAC model to calculate on-road HDV emissions. The emission factors estimated by the authors are under the situation when HDVs are driving on-road at a certain speed with a particular road slope. However, the emission factors modeled by EMFAC consider the entire driving cycle, different seasons, different types of fuels, and all driving conditions. The authors should provide more details about how they ran the EMFAC model.