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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Application of positive matrix factorization to on-road measurements for source apportionment of diesel- and gasoline-powered vehicle emissions in Mexico City" *by* D. A. Thornhill et al.

Anonymous Referee #2

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This paper presents the quantification of emissions for diesel and gasoline powered motor vehicles in Mexico City. They use the well-established Aerodyne Mobile Laboratory to make their measurements. To apportion pollutant measurements between diesel, gasoline, and background sources, they apply positive matrix factorization (PMF) receptor modeling, which is an established technique but has never been applied in a study of this type. The paper is well written, polished, novel, and clear. I recommend it for publication.

My only criticism of the paper is that the dataset is small. The measurement period

is only 3 $\frac{1}{2}$ hours and thus vehicles measured may not be representative of the fleet in Mexico. Given the novelty of the author's approach, I don't see this as a barrier to publication. The study represents a first attempt at using PMF to this end. But using results as a standard of comparison for the official emissions inventory for Mexico is probably not justified. A comparison to the official emissions inventory is a good idea, but I think it should be written in a more neutral way rather than presenting their results as the standard. The authors generally do have sufficient caveats in the text, but I would add additional caveats on this limitation of the data set in the abstract and conclusions.

More detailed notes follow:

Abstract and conclusions: as discussed above, I would mention that this data set represents a sample period of 3 $\frac{1}{2}$ hours and thus comparisons to the emission inventory should be interpreted with care (i.e. your sample may not be representative of the vehicle fleet in Mexico).

Nice introduction. Well written and sets the stage nicely.

Pg 27573 line 26. Though not required, it would be interesting for the reader if you'd provide just a little more detail on "autobuses" and "microbuses"

Pg 27575 line 4. The distinction you make about gasoline vs diesel emissions being caused by differences in the Otto and Diesel cycles is not totally correct. These are idealized thermodynamic cycles. The distinction between gasoline and diesel engine emissions has more to do with the fact that gasoline engines combust premixed fuel/air mixtures (with a spark plug), and diesel engines use compression ignition of non-premixed fuel and air (i.e. fuel is sprayed directly into the cylinder). Diesel combustion is hotter (i.e. more NOx) and has more fuel-rich unmixed pockets of fuel (i.e. more soot).

Pg. 27578 line 13. The 3953 data points are per instrument, correct? You might want to note this here. The text on PMF makes this point clear, but the text might read easier

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if you add this detail here.

Pg. 27579 line 18. I don't understand your method for BC given this explanation.

Pg. 27582 line 19. You have plenty of discussion of G-space scatter plots but never show one. Would it help to add such a plot to the text?

Pg. 27583 line 15. Fuel-lean conditions of diesel engines do not maximize NOx. NOx emissions are generally at a maximum at stoichiometric conditions (or just lean of stoichiometric). Diesel engines have high NOx because the non-premixed flame positions itself at a stoichiometric position (even though the overall fuel-to-air ratio is "lean"). I find this discussion to be unnecessary in the text.

Pg. 27585 line 26. You should add a citation to the statement "3.7 times more gasoline than diesel fuel is consumed in the MCMA"

Pg. 27586 line 14. Does the fact that pollutants may be confounded by secondary sources point to a limitation of this study? It seems that such a statement should be further discussed.

Pg. 27590 line 1. Could the high formaldehyde emissions be biased high because of the inclusion of idling in this study? I agree that inclusion of idling is actually realistic, but adding this point once again here when comparing to tunnel and remote sensing studies might be important.

Pg. 27591 line 29. Again, I would add a brief statement here at the end of the statement ". . .AML's drive are representative of the MCMA's fleet". Something to the effect of . . . "and thus our estimates are approximate"

Pg. 27592 line 20. In this section, I would compare your results to the official inventory without suggesting which one is correct. A more neutral comparison is probably appropriate given the short duration of your data set.

Pg. 27593 line 21. Since you are now discussing a new dataset (2003), it would help

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to write one sentence describing what was measured (i.e. is this comparison of vehicle exhaust, ambient background, or ?).

Pg. 27595 line 3. I would add a sentence about interpreting your results with caution since it's a 3 $\frac{1}{2}$ hour dataset.

Line 12. Again, using your results as the standard for comparison may be unjustified.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 27571, 2009.

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Interactive Comment