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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 #3

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Review of "Application of Positive Matrix Factorization to On-Road Measurements for Source Apportionment of Diesel- and Gasoline-Powered Vehicle Emissions in Mexico City" Author(s): D. A. Thornhill et al. Submitted to ACP MS No.: acp-2009-763 Special Issue: MILAGRO/INTEX-B 2006

This paper describes PMF analysis of high time resolved data of motor vehicle emissions collected by a suite of instrumentation mounted on a mobile laboratory that was driven around Mexico City as part of the MCMA-2006 campaign. The results of the analysis are used to derive emission data and test emission inventories.

I enjoyed reading the paper. It is a novel application of PMF and an interesting approach for evaluating emission inventories. Since datasets of this sort are becoming more common, this paper has value from a methodological perspective. In addition, given all of the effort studying Mexico City air quality, this particular application is important. I would recommend publishing the paper in ACP after the authors address the following comments.

There have been other evaluations of the Mexico City Inventory. My read of the literature is that others have suggests that, for example, VOC emissions are underestimated (Molina, L. T. and Molina, M. J. (Eds.): Air Quality in the Mexico Megacity: An Integrated Assessment, Kluewer Academic Publishers, 384 pp., 2002 or Lei et al. ACP 2007). It would be good to compare your results to these previous evaluations of the Mexico City Inventory (the authors do present some comparisons to other receptor modeling studies). My sense is the biases in VOCs are similar to those estimated by others. Presumably there also have been assessments of CO, NOx and other emissions considered in this paper. Although the authors focus on mobile sources, these are the dominant sources in the Mexico City inventory for many of the pollutants considered here (page 27574).

Uncertainty analysis – The paper needs a more comprehensive discussion of uncertainty, including adding quantitative estimates to various source apportionment values that appear throughout the text. For example in the discussion section, the paper states gasoline engine exhaust accounted for 12% of the NOx. There needs to uncertainty estimates added to these sorts of values. In Table 4 some confidence intervals are presented. It is not clear where these came from. Based on the sensitivity studies performed with PMF described on page 27579? How the confidence intervals are estimated need to be described and the results of the analysis need to be added to the discussion.

The approach indicates that the official inventory overestimates PM2.5 mass from diesels by a factor of almost 5 with wide uncertainty limits. However, PM2.5 is mainly

ACPD
9, C10907–C10909, 2010

background. One might expect that there are significant uncertainties in the estimated mobile contributions to PM2.5 because small changes in background apportionment would have disproportionate effects on the residual available for mobile sources. This issue should be discussed a bit more in the text. Ambient concentrations of several other pollutants are also dominated by the background factor (Figure 2). Do similar issues apply to those?

Minor comments

Abstract – You compare relative gasoline and diesel apportionment. For example, you state that 26% of PM2.5 is apportioned to gasoline. This is 26% of the motor vehicle PM2.5 which is only 11% of the total PM2.5 based on the text. You should considered rewording this to make sure the basis of comparison is clear.

Abstract – You use qualitative words like “overstated” and “understated” in the abstract, but in the discussion section (page 27592) you are quantitative about bias. CO is 25% low, VOC are off by a 50%, etc. It would be good to be quantitative in the abstract too. My perception is the errors do not seem that large given the uncertainty in the inventory.

Page 27574 – I thought the statement that gasoline powered vehicle emissions vary by day of the week was confusing? Certainly gas-diesel split varies. Maybe reword.

Given the limited extent of the dataset (one 3.5 hour drive) one could present this as an initial application or test of the idea.

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

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9, C10907–C10909, 2010

Interactive Comment