Atmos. Chem. Phys. Discuss., 8, S3423–S3428, 2008
www.atmos-chem-phys-discuss.net/8/S3423/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparison of emission ratios from on-road sources using a mobilelaboratory under various driving and operational sampling modes" *by* et al.

Anonymous Referee #2

Received and published: 5 June 2008

Zavala and coauthors present emission ratios of various gaseous and particulate pollutants relative to exhaust CO2 concentrations for low-duty gasoline vehicles (LDGVs) and heavy-duty diesel trucks (HDDTs) in Mexicali, Mexico. The emission ratios were calculated from highly time-resolved measurements of pollutant concentrations using a mobile laboratory both in stationary sampling mode probing bypassing vehicles and from mobile sampling of individual vehicle emission plumes and fleet-averaged emissions. While fleet-averaging measurements provide information on emission ratios for different driving conditions, probing of individual vehicles with the other two sampling modes provides information on different vehicle types. In addition to these data emission ratios are compared to values obtained in an earlier measurement campaign in

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

Mexico City and to a limited number of measurements collected in Austin, Texas.

The strongest point in these measurements is the use of a large variety of highly time-resolved measurement techniques for parallel determination of emission ratios for a broad variety of relevant pollutants. This - together with comparisons of emission ratios for different vehicle types and driving conditions - has the potential to extract detailed information not only on average emission characteristics, but also on the variability of these parameters and on factors affecting these values.

Unfortunately this information is not provided in the paper and likely cannot be extracted from the dataset due to the very limited statistics of probed vehicles and the large variability in the individual emission rates. Within some of the categories (e.g. driving conditions, vehicle types) presented, not much more than a handful of measurements were performed, resulting in limited information about typical emission behavior within this category. As a consequence, these variability-dominated results do not show clear differences between different driving conditions or measurement locations such that an in-depth analysis of the variability of emission ratios and their causes cannot be performed.

Another weak point in the manuscript is that the literature on emission factors or emission ratios is largely ignored. Besides the results of a former measurement by the same group in Mexico City no other measurements were presented and no comparison to other values is made. This leaves the reader without information where to locate the presented values within other measurements.

Finally another major point of criticism is the broad absence of a self-critical assessment of the values presented in the manuscript. For example no discussion of a potential bias of measured emission ratios towards those of "dirty" vehicles in the measurement modes where clear plume signatures are needed to identify an emission plume is made. No discussion of uncertainties in the extracted emission ratios due to co-measurement of other emissions during the plume measurements is presented. In

ACPD

8, S3423–S3428, 2008

Figure 7 emission ratios for NOy are presented for Austin, Mexico City and Mexicali. Here the statement is made that the Austin ratios are "significantly" (p8077, L17) lower than the other ones while the error bars in Figure 7 (1 sigma) show that the values agree within their uncertainties. In Figure 2 "linear" (log) relationships are found in data points that appear more like a point cloud with some trends. Here and at several other places in the manuscript results are presented without critical assessment and leave the impression that not much information on emission ratios and their dependence on external factors can be extracted from the data set. At the end the reader wonders what the implication of the results presented here are. I suggest that the implications of the results as well as the uncertainties within the measurements and calculations are presented more clearly.

Detailed minor comments:

A large fraction of the abstract is spent on the MCMA campaign and the methods developed there. This would fit better in the introduction. Also the duplicate use of the whole name of the campaign (Border Ozone Reduction and Air Quality Improvement Program for the Mexicali-Imperial Valley in 2005) should be avoided in the abstract.

In the introduction statements are made about the variability of emission factors due to driving conditions or vehicle parameters. Here it would be helpful to provide an overview over this variability due to these factors as presented in the literature. Later in the introduction a statement about the difficulty of inter-comparisons of mobile measurements due to a variety of differences in the measurement process is made. Does this imply that the results obtained in such measurements are more a question of the measurement setup than of the actual emission? Here it would be helpful if it is made clearer what kind of solid information (which is not dependent on the measurement setup) can be extracted from such measurements.

In the introduction the three measurement modes are described three times, in the abstract they are described another time and in the methodology as well as in the

ACPD

8, S3423–S3428, 2008

results sections they are again described in detail. I suggest reducing this redundant information to a minimum.

P8064, L8-11: The measurements with same techniques provide information on actual differences in fleet emission characteristics of Mexico City and Mexicali. Can you discuss the influence of environmental differences in the two measurement locations like ambient pressure, RH or temperature?

P8064, L11-12: How does this point measurement (several hours on a single day - or a few days?) presented in this manuscript provide information on the evolution of the characteristics of the emissions of the vehicle fleets?

P8064, L12-15: What is the point of comparing the emission ratios of Mexicali with those of Austin, Texas? This seems somewhat arbitrary.

P8064, L21ff: Information on the time resolution and detection limits of the instruments would be valuable.

P8065, L11: 98 valid mobile emission periods seem to be a very limited number, especially when these periods are further divided into different driving, vehicle and measurement mode categories.

Methodology section: Only very limited information is given on the measurement locations (highways, city streets, etc.) and their environments (free field, city, etc.). Also no information on the weather conditions is provided. In addition I am wondering how other sources of various pollutants are considered in the calculation of emission ratios. It is explained that the excess CO2 (CO2 above background) was used to calculate the ratios and likely this was also done for the other pollutants. However, how are variations in the background or advection of pollutants from other sources considered? This could be important especially for "clean" plumes.

P8066, L19: What was the distance of the mobile laboratory to the sources?

P8067, L18-20: Since individual plumes have to be detected in the stationary sampling

ACPD

8, S3423–S3428, 2008

mode (and in the chasing mode, see P8069, L8-11) does this generate a systematic bias towards dirty (easy-to-detect) plumes?

P8068, L3-8: This explanation is hard to understand. It should be clearly stated that for the inorganic compounds measured with the AMS no correlation to the CO2 concentration is seen, because these particulate compounds are not from the vehicle.

P8069, L23-27: Could you provide clearer information on how the data were separated into the various driving conditions? Is "vehicle speed" the average speed over a sampling interval of $>$5 min or are the given speed ranges the ranges between the highest and smallest vehicle speed within this interval? In line 26 the CRU speed has to read "56 km/hr".

P8070, L25-28: In the fleet average sampling mode the emissions are dominated by gasoline vehicles. Can you give an estimate of the fraction of HDDTs in these data sets? Would it be possible to split these data into data sets with high and low HDDT contribution?

Results section: A large amount of information about emission ratios is given in this section and the reader might wonder what the relevance or implication of the individual bits of information is. This would be easier to digest (and avoid repetitions of results) if this section would be merged with the discussion section.

P8073, L17ff: The data presented in Figure 5 show typically lower emission ratios determined with the fleet-averaged measurement mode compared to those modes where individual emission plumes have to be identified. This could be an indication that the latter measurements are biased towards "dirty" vehicles. This potential bias as well as the observed differences in the emission ratios should be discussed.

P8074, L9ff: This sentence is a repetition of a sentence a few lines before.

P8075, L3ff: Table 2: What is the point of listing emissions for San Diego or Mexico City if these results are not mentioned or discussed in the text? How are the emissions

ACPD

8, S3423–S3428, 2008

calculated for those cities where the numbers were taken from the literature and how are they comparable to the values calculated from the measurements presented here? There is a detailed comparison of Mexicali and Calexico emissions for NOx and CO for which the concentrations turn out to reflect nothing else than the size of the vehicle fleet (at least within their uncertainties). So what is the purpose of this comparison?

P8077, L5-6: In Figure 6 not the NOy emissions as a function of driving speed are shown, but the NOy emissions are presented as a bar chart in order of increasing NOy emission ratio. I suggest generating the plot that is described in the text: NOy emission ratio plotted versus driving speed.

P8077, L7: What means that the trucks "were identified by their license plates"?

P8077, L15-19: Here it is claimed that the Mexicali and MCMA NOy emission ratios were "significantly" higher than those in Austin. In Figure 7 one can clearly see that within the uncertainty of the measurements the emission ratios agree with each other!

Table 1: In this table everywhere 3 digits are presented for the emission ratios while in many cases the uncertainty of the values exceeds tens (up to ˜80) of percent. For values with such a degree of uncertainty it does not make sense to present numbers with so many digits.

Table 2: Since in the text it was shown that the emissions of Mexicali and Calexico mainly reflect the vehicle fleet size of the two cities I recommend adding information on vehicle fleet size, population and area of all four cities to the table.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 8059, 2008.

ACPD

8, S3423–S3428, 2008

Interactive Comment