

Interactive comment on “Size-resolved aerosol emission factors and new particle formation/growth activity occurring in Mexico City during the MILAGRO 2006 Campaign” by A. J. Kalafut-Pettibone et al.

Anonymous Referee #2

Received and published: 21 April 2011

General comments

This manuscript provides size resolved emission factors between 11 nm and 494 nm for a polluted urban area in Mexico City. The emission factors are based on a correlation between particle number and CO₂ concentrations during the MILAGRO field campaign in March 2006. Size resolved emission factors for Mexico City is an important contribution to both climatic and health related research areas. The method used for calculating the emission factors in this manuscript is likely associated with large uncertainties, in particular due to the large separating distance between the particle and

C2147

CO₂ measurements. However, the authors are aware of this issue when discussing the results. The emission factors are applied to a plume measured from aircraft above the city with some interesting results, even though this section needs to provide some more information. The manuscript is clearly organized and in general well written. However, I have some comments that need to be addressed before the manuscript can be considered for publication.

Major comments:

1. The first comment concerns the data used for calculating the emission factors. Figure 4a illustrates that the correlation between particle number and CO₂ concentration is high in the morning between 04:00 and 12:00. This period also has most significant CO₂ peaks and therefore this time period dominates in amounts of data used for calculating the factors, according to Fig. 8. However, a relatively large amount of data is used also from other periods of the 24 hours when the correlation is not very impressive. Why are data from these other periods included when calculating the emission factors? Would the emission factors have significantly different numbers if only data measured between 04:00 and 12:00 were included?
2. Figure 4 gives no information on variation of the correlation coefficient with particle diameter. Since the presented emission factors are size-resolved, some information on this issue would be valuable. That might provide information on whether primary aerosol emission is absent in any particle size range. A contour plot showing the average correlation coefficient as a function of particle diameter and time intervals (as in Fig. 4a) would be an interesting addition to Fig. 4.
3. Does the correlation between particle number and CO₂ concentration break down in the afternoon also on days with no ultrafine growth events, and if so, do the authors have any explanation for this pattern?
4. Section 4.6 is interesting but needs some more clarification. First of all, some information on the boundary layer depth during the flight is necessary. The aircraft mea-

C2148

measurements were performed "at an altitude of ~2.5 km a.s.l., or <1km above ground". It should be stated that these observations were made in the boundary layer, if this was the case. What information is available of the mixed layer depth during the flight, either from direct measurements during this campaign or from earlier studies of the mixed layer in Mexico City at a similar time of day and time of the year? In this section, the authors speculate that "there is a source of particles during plume aging that significantly increases particle number while leaving CO₂ unchanged." Did particle number increase with increasing photochemical age in the plume or did the particle number decrease less than CO₂ did? Was new particle formation observed at the T0 site on this day? It says on page 6677 on lines 2-3 regarding Fig. 11c that "The photochemical ages, calculated by the measured benzene/toluene ratio, are shown". It is not obvious to me from Fig. 11c (or the text) how I can read that information from the plot.

Minor comments:

Page 6653, line 11: "The uncertainty of the number emission factor" sounds better to me.

Page 6653, line 20: it is a bit unclear here what "this" refers to in "this emission factor was applied to". I would suggest "the determined emission factor was applied to".

Page 6653, same line: In my opinion the abstract must give information that can be understood by the reader without looking things up in the manuscript. If the authors want to use the expression "MCMA plume" in the abstract, there must be some very brief information on what the MCMA plume is.

Page 6656, line 8: Remove ' from "3 of 10'days sampled".

Page 6656, line 15: Please write "The mass size distribution", if that is what you mean.

Page 6656, line 18: The first time "MILAGRO" is mentioned it should be written that it stands for "The Megacity Initiative: Local and Global Research Observations".

Page 6668, line 24: "has a potential error of approximately 1.5" is better.

C2149

Page 6671, line 23: change "21:000" to "21:00".

Page 6672, line 1: What point do the authors want to make with "These directions correspond to an industrial area with many SO₂ point sources ", when discussing wind directions with combined number and CO₂. Since SO₂ is closely associated with sulfate and secondary aerosol, the sentence above is a bit confusing for the reader.

Page 6673, line 3: There should be a space between "colleagues" and "2005" in "Geller and colleagues(2005)".

Page 6674, line 25: add "a.s.l." to "2530 m altitude". Otherwise one might get the impression that the measurements took place in the free troposphere.

Page 6675, line 13: The reference Warneke (2007) must be added to the reference list.

Page 6676, lines 18 and 27 and Fig. 11a-c: Why are the authors suddenly expressing time in UTC after been using CST on page 6675?

Page 6676, lines 20-21: Change to "measured particle concentrations are well. . ."

Page 6677, line 25: Add a space between "Kleinman et al.," and "2009".

Page 6679, line 4: "uncertainty of the number emission factor" sounds better to me.

Page 6679, line 12: "parameters of N 1.65 x. . ." sounds strange. "parameters of N equal to 1.65 x. . ." would be better.

Page 6703: Please mark the two subplots in Fig. 9 with a) and b), respectively, and use these notifications in the figure caption to describe the two cases.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 6651, 2011.

C2150