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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Determination of particulate lead during MILAGRO/MCMA-2006 using Aerosol Mass Spectrometry" *by* D. Salcedo et al.

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We thank the referee for the useful comments that allowed us to improve the manuscript and are grateful for the positive evaluation of our work.

We also note that the reviewer did not refer to the page numbers of the ACPD version of the paper, but rather to those in the PDF document that we originally submitted to the journal.

Specific comments:

R1.1) The title is not really consistent with the work presented as results in Mexico city

are not shown until page 13: I would change it focusing more on the technique applied.

We have changed the title to: "Determination of particulate lead using Aerosol Mass Spectrometry: MILAGRO/MCMA-2006 observations" to better reflect the contents of the paper.

R1.2) Line 30: T0 has not been defined.

We have clarified the text to read "at the T0 urban supersite". We cannot be more specific in the abstract.

R1.3) Line 52: specify what are very low concentrations".

We have changed the 1st sentence of the Introduction to "Lead is considered a criteria air pollutant with a wide range of health effects depending on the level of exposure."

R1.4) Line 230: explain for Figure 2 and 3 which ambient aerosol is being measured.

We have added to the text and the Figure captions that the spectra shown are from "the HR-AMS located at T0."

R1.5) Line 410: the section on "sources of Pb impacting the T0 site" does not describe at all any type of possible sources present in the area. Some information on which industrial and urban emissions could be responsible for these Pb particles would be useful.

We have changed the title of section 3.6 to "Locations of particulate lead sources impacting the T0 site", to better reflect the contents of that section.

We have changed the last paragraph of the Conclusions section in order to provide a list of possible sources. Given the large variety of small industries located in and around the MCMA, it is not possible to be more specific on the possible Pb sources.

"As mentioned before, possible Pb sources include mining, smelters, foundries, industrial fuel combustion, solid waste incineration, unpaved road dust, and emissions from

ACPD

10, C2229–C2233, 2010

some types of aircraft and race cars that continue using leaded gasoline (Harris and Davidson, 2005; Heal et al., 2005; Lough et al., 2005; EPA, 2006; Murphy et al., 2007; Kummer et al., 2009; Reff et al., 2009). In the MCMA, With the exception of the Tula refinery, located Northwest (see Fig. S1), there are no obvious large facilities that could be identified as Pb sources. A close analysis of the wind patterns and time series of Pb and SO2 plumes from Tula (deFoy et al., 2009b) observed at T0 suggests that Pb plumes do not have their origin at the refinery. From CFA and RWP analysis, a strong particulate lead source is estimated to be located S/SW of T0 within the MCMA basin and another one (or more) between T0 and PEMEX site; an additional source may be located north of the PEMEX site and east of T0. AMS measurements of various particulate lead closed/open signals and HR-AMS measurements behind an aerosol concentrator indicate that the observed particulate lead sources likely generate particulate Pb with different compositions (i.e., observed different likely sources for PbS+ and PbCl+ ions). Given the large variety of small industries located in and around the MCMA, it is not possible, from the information at hand, to identify specific sources of Pb. In fact, the variable composition of the Pb plumes observed at T0 (sometimes correlating with HOA, LOA, chloride or Zn+) suggests the presence of more than one source emitting lead to the atmosphere. This should be the focus of future research.

R1.6) Line 450: explain what do you consider as “variable winds” to know which winds have been included in the analysis.

"Variable winds" refers to rapid local wind shifts in the afternoon due to the passage of convective cells. These are typically storm clouds producing bursts of precipitation on the temporal scale of less than one hour and the spatial scale of roughly 10 km. We have changed the text to better explain this fact to:

"The analysis time period was limited to March 11 - 26 inclusive, as the period after March 26 had highly variable winds due the passage of convective cells, which are not captured accurately by the model and thus reduce the ability of the model to adequately represent wind transport."

ACPD

10, C2229–C2233, 2010

R1.7) Paragraph 465: how do you link results in figures 13 and 14? in figure 13 (A) Pb seems to be higher in the north (Tula) and SW of T0.

As explained in the text, figures 13A and 14 are consistent; both showing possible sources of Pb S/SW and N/NW of T0. The CFA analysis is more sophisticated and uses three-dimensional wind trajectories, while the RWP analysis only uses local wind direction. Wind direction does not stay constant away from T0, and e.g. periods of time with different wind directions may point to the same source location in the CFA analysis. Figure 13 is the main result, while Figure 14 is shown as additional, simpler evidence of the northerly and southerly wind directions during high PM Pb measurements, in general agreement with the more detailed northerly and southerly locations determined by CFA.

R1.8) Line 482: which other Pb compounds could be contributing?

As explained in the Introduction and at the beginning of section 3.5, common Pb compounds found in aerosols include PbS, PbCl2, PbSO4, PbO, PbCO3, PbNO3 and PbSe. The ions observed in our study could arise from PbS or PbSO4, and PbCl2, however other species may also be possible. Moffet et al. (2008a) suggest that Pb(NO3)2 may also be present in Mexico City, although we do not have evidence to support or disprove this observation from our data. We do not have specific evidence about the other possible species mentioned above.

R1.9) Paragraph 513: how does this relate to figure 13?

This is explained in the text, where we mention that the source located south of the PEMEX site is probably the same source that produces the PbCl+ signals at T0. We have added a reference to Fig. 13 in the text.

R1.10) Line 549: Pb source seems to be located south of T0 in figure 14.

We corrected the sentence to indicate the general direction S/SW because CFA and RWP show slightly different results.

ACPD

10, C2229–C2233, 2010

R1.11) Figure 8:ICP-MS analysis seem to be wrong on the 30th of March

Corrected.

R1.12) In general there is a lack of discussion on possible Pb sources in the area and on the integration of all results obtained.

See response to R1.5.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 2581, 2010.