

Interactive comment on “Mexico City aerosol analysis during MILAGRO using high resolution aerosol mass spectrometry at the urban supersite (T0) – Part 1: Fine particle composition and organic source apportionment” by A. C. Aiken et al.

Anonymous Referee #1

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Summary.

The manuscript by Aiken et al. provides a comprehensive review of the fine aerosol particle composition measured during the MILAGRO field campaign at the T0 supersite in March of 2006. The prominent feature of the work is the analysis of data obtained with the High- Resolution Aerosol Mass Spectrometer (HR-ToF-AMS). The AMS results are presented in the context of results obtained with other co-located measurements

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at the T0 site. The measured aerosol composition is also compared with composition measurements obtained during previous field studies in Mexico City. In addition to instrument inter-comparisons, the manuscript describes organic aerosol (OA) apportionment through the use of Positive Matrix Factorization of the high resolution mass spectra obtained with the AMS. Separated OA results are compared with results obtained through PM_{2.5} chemical mass balance methods. The mass loadings measured during the campaign are also used to evaluate existing emission inventories in Mexico City. Overall, the manuscript provides a concise, thorough, and comprehensive review of the fine aerosol composition measurements obtained at the T0 site during MILAGRO and with minor revisions (as outlined below) is suitable for publication in ACP.

General Comments:

Page 8384, lines 21-24: The authors state that a CE of 0.5 was used for the non-refractory data obtained with the AMS and that this is verified with the inter-comparisons presented later in the paper. The AMS CE is not explicitly addressed in the text describing the inter-comparison plots (Fig. S3) and is only mentioned later in the manuscript on p. 8402 in connection with the CMB-OMM, PMF-AMS comparison.

Obviously inter-comparing measurements in a complex urban environment like Mexico City is extremely challenging. The authors do a good job describing the various considerations necessary (mainly differences in size cut-offs) to effectively compare measurements obtained from different instruments but fail to tie the observations directly back to a verification of the AMS CE. The authors are correct to point out the fact that none of the instruments are a 'true' PM₁ mass measurement. One striking feature in Fig. S3 is the difference between the SMPS mass and AMS (with CE of 0.5 applied to NR) + refractory mass as displayed in (b), (f), and (g). The plots show that the AMS+refractory is ~ 32% higher than the SMPS mass. As stated by the authors, the maximum size cut of the SMPS (as operated at T0) was 436 nm (mobility diameter) or ~ 654 nm dva [assuming a sphere with a density of 1.5 (Fig. S2)]. In Figure S11,

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the dm axis for the SMPS measurement is converted to dva using a bulk composition density and assuming spherical particles. In this plot the ‘missing’ mass is more clearly illustrated, but Figure S11 is not used for this purpose, instead it is only used to compare 2003 and 2006 size distributions. I think that a more detailed discussion of Figure S3 (b) is warranted in connection with the application/confirmation of the 0.5 CE used across the NR AMS data. For example, the authors could color S3 (b) by hour of day to show that, when the size distribution of particles is smaller (early morning rush hour) the mass measurements compare more favorably. This is shown on average in Fig S3 (f) with relatively higher SMPS/AMS+R ratios in the overnight and early morning. Overall, I think that the manuscript would benefit from a more explicit ‘verification’ of the 0.5 CE in the section describing Fig S3.

Minor Comments:

page. 8381, lines. 19-26: The authors indicate 6 references that show the importance of SOA as a fraction of total PM and then provide examples of how 5 of the 6 references apply. Either include an example of how the DeCarlo reference applies or don’t include the DeCarlo reference in the list.

Page 8384, line 1: Including the residence time (16s) in the drier seems unnecessarily complicated and is confusing. Is the 0.6 Lpm that goes through the drier then sent to your instruments? Perhaps you could reformulate the sentence to clarify this.

Page 8390, line 26-27: “when nitrate is also higher at the ground (Fig.2)” I believe that the authors meant to say when nitrate is ‘lower’ at the ground given the temporal trend in nitrate that they are referencing in comparison to the nitrate measured aloft.

Page 8392, line 15-16: The sentence - “2/3 of organic oxygen is part of the OOA component and 1/3 of the nitrogen from the LOA component.” Is confusing and needs to be re-written. You should try and avoid starting sentences with numbers as well.

Page 8393, line 3-4: “. . . . and possibly also some of lightly oxidized SOA. . .” Get rid

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