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Atmospheric Chemistry and Physics Discussions

Interactive comment on "PM speciation and sources in Mexico during the MILAGRO-2006 Campaign" *by* X. Querol et al.

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We appreciate Dr. Miranda's comments, and we would like to submit our answers to the two issues referred to:

1. I find this work original only from the point of view that the authors use different analytical methods to those used in previuos papers, and other sampling sites. In this regard, it surprises me that the authors do not mention at all the works carried out by other groups that have spent more than a decade analyzing trace element contents in the atmosphere of Mexico City, v. gr., Aldape et al., Miranda et al., and Mugica et al. My personal opinion is that the inclusion of these results as a reference frame for their discussions might be very helpful.

Reply: We agree about the added benefit of the manuscript including more references

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to past work on the atmosphere of Mexico city. As a consequence we have added the following references which we feel are most directly relevant to our manuscript:

Aldape, F., Flores M.J., Flores A.J., Retama-Hernandez, A., Rivera-Hernandez, O. 2005. Elemental composition and source identification of PM2.5 particles collected in downtown Mexico City, Int. J. PIXE, 15, 263-270.

Miranda, J., Andrade, E., Lopez-Suarez, A., Ledesma, R., Cahill, T.A., Wakabayashi, P.H. 1996. A receptor model for atmospheric aerosols from a southwestern site in Mexico City, Atmos. Environ., 30, 3471-3479,

Miranda, J., Barrera, V.A., Espinosa, A.A., Galindo, O.S., Meinguer, J. 2005. PIXE analysis of atmospheric aerosols in Mexico City, X-Ray Spectrom., 34, 391-401.

Mugica, V., Maubert, M., Torres, M., Muñoz, J., Rico, E. 2001. Temporal and Spatial Variations Of Metal Content In TSP and PM10 In Mexico City during 1996-1998. Journal of Aerosols. 33/1, pp 91-102.

Vega, E., Mugica, V., Reyes, R., Sánchez, E., Chow, J., Watson, J. 2001. Chemical Composition of Fugitive Dust Emitters in Mexico City. Atmos. Environ., 35, 4033-4039.

2. Finally, I would like to say that, although the authors claim that their PCA is used only qualitatively, Henry et al. (Atmospheric Environment 18 (1984) 1507-1515), clearly explain that, in order of havin statistically significant results with PCA, it is necessary to have at least a number of samples larger than 30 + (V+3)/2, where V is the number of elements or compunds used. This way, in this work N should be at least 45, as the authors seem to use 27 elements and compounds. I would suggest revising the correponding results.

Reply: The ratio between the number of cases and variables when applying PCA-MLRA is indeed essential in order to obtain statistically significant results, and we agree with Dr. Miranda that this issue should be taken into account when performing source apportionment analyses. This ratio is especially important when we intend

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to quantify the contribution of each of the sources to the bulk PM mass (by multi-linear regression analysis, MLRA), and in this case significant results may only be obtained when n>30+(V+3)/2 as stated by Henry et al. (1984).

In our study, our aim was not to quantify source contributions (as stated before, we would have then used PMF or CMB) but instead we were interested in identifying emission sources and comparing the presence or absence of such sources at the different study sites (T1, T0 and CENICA). To this end, only PCA was used (not MLRA), and therefore the ideal ratio of cases-to-variables is not as restrictive given that PCA is a straightforward factor analysis. We are aware that the number of cases was lower than the ideal especially at T1 (25 samples), but at CENICA and T0 the number of samples (38 and 35) was close to the 45 cases expected according to Henry et al. (1984). In order to confirm the validity of our results a pooled analysis of the CENICA and T0 samples (73 samples, >45) was carried out, and no significant differences were obtained with respect to the separate T0 and CENICA analyses. We believe this test confirmed the robustness of our solution, and therefore we stated this in the manuscript.

In order to clarify this issue, the manuscript has been modified to state: "These findings were confirmed by performing a statistical analysis of the different datasets, by means of Principal Component Analysis (PCA) with the software STATISTICA v.4.2. This kind of factor analysis requires a minimal internal variability, and therefore it was only applied to the datasets containing >25 samples (CENICA, T0 and T1). However, the number of samples (25, 35 and 38 at T1, T0 and CENICA, respectively) was lower than the minimum number of cases required according to Henry et al. (1984) (n>30+(V+3)/2, where n is the number of samples and V is the number of variables). Consequently, in order to confirm the validity of the results PCA was applied separately to the PM10 datasets from T0, CENICA and T1, and it was also applied to a larger dataset made up of the combination of the CENICA and T0 samples, with similar results. This confirmed the robustness of the solution."

The reference was also added: Henry R.C., Lewis C.W., Hopke P.K., Williamson H.J.

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(1984) Review of receptor model fundamentals. Atmospheric Environment 18, 1507-1515.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 10589, 2007.