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Interactive comment on "Characterization of ambient aerosols in Mexico City during the MCMA-2003 campaign with Aerosol Mass Spectrometry – Part II: overview of the results at the CENICA supersite and comparison to previous studies" *by* D. Salcedo et al.

Anonymous Referee #2

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This manuscript is astonishing, not for what it presents, but for what is lacking. The Aerosol Mass Spectrometer (AMS) is one of the newest and most sophisticated research tools that the aerosol community has for measuring the fine details of particle composition at small time resolution; however, the authors choose to utilize the AMS as a very expensive cascade impactor. The reader is left no more the wiser as to the

physical processes that govern the production and evolution of aerosols in Mexico City.

It is ironic that in the opening paragraph of the second section of the introduction, the authors state “There are several published studies on particulate pollution in the MCMA. However, most of these studies lack highly time and size resolved data, or the compositional data needed to investigate the chemical and physical processes that lead to the pollution episodes (Raga et al., 2001).” The authors are wrong on a number of accounts. First of all, had they actually read the referenced article, they would have noticed that there are not just “several” articles on particulate pollution in MCMA, but there have been many publications. In addition, the authors fail to acknowledge those articles that do discuss highly time and size resolved measurements. It is true that there are not that many, but those that have been published are careful analyses of particle processes with respect to the meteorological conditions, known precursor gases and possible sources - an analysis that is seriously lacking in the present manuscript. Either the authors have not researched the existing literature or they have chosen to ignore the previous studies. In either case, if they would have studied the previous investigations and gleaned from them what is currently understood about particle dynamics and chemistry in Mexico City, they would have understood the gaps in our knowledge about particle processes in this megacity and might have analyzed their data in a truly meaningful way rather than giving us a rehash of what is already known.

As it is written at the moment, the only information to be taken from this paper is: 1) The measurements are kind of consistent with previous studies and 2) everything that is known about how particles form and grow can probably be applied in Mexico City. These conclusions follow after 39 pages of text, tables and figures. Is this all that we can learn about “chemical and physical processes that lead to the pollution episodes” from “highly time and size resolved data”? It is this reviewer’s opinion that quite a lot more can be learned and the current manuscript falls disappointingly short of a submission worthy of ACP.

Specific questions and concerns

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1) Why was the Cenica site chosen? Does it represent a geographically important site in MCMA? Has this site ever been used previously? The majority of measurements that have been published were made in areas specifically selected because they represented different types of local sources of emissions, e.g. CCA and Merced. How can comparisons be made between measurements at the Cenica site and those at Merced or CCA unless you can argue that the sources of emissions are similar?

2) What is the point of presenting average masses over entire periods when you are using an instrument with the response time and resolution of the AMS?

3) What is the advantage of the AMS over other techniques? What information is being obtained that is not possible with other techniques? Why are the pros and cons of the AMS not discussed in this article? What is the objective of this paper?

4) Can the AMS differentiate externally mixed from internally mixed particles? If so, what are the implications and if not how important is it that we can't know how the mass is chemically distributed?

5) What happens to volatile material on particles, such as water or semi-volatile organics when they are introduced into the high vacuum of the AMS?

6) In comparisons with techniques that sort particle size by aerodynamic diameter, how does the vacuum aerodynamic diameter from the AMS compare? Does this explain differences in the size distributions comparing AMS with MOUDI?

7) The aethalometer, contrary to what the manufacturer advertises, does not measure BC. The aethalometer is nothing but a measure of light attenuation from which BC is derived using a conversion factor, the specific absorption coefficient, that is highly variable depending on the type of BC being measured. This has been already evaluated for Mexico City in one of the papers that the authors chose not to review.

8) If you are going to compare with results from other cities, then you have to convert the measurements to sea level equivalents.

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9) Why are the data not analyzed with respect to the local meteorology? Previous papers, for example, have shown that the relative fractions of sulfate and organics are highly sensitive to the relative humidity. Was there no weather station at this "supersite"? The Cenica site is located in an area where the measurements are likely to be very sensitive to wind direction. The "highly time and size resolved" measurements are averaged into intervals where any useful information on smaller scale variations is lost. This is an opportunity to look at how size distributions of the chemical constituents change with temperature, RH, wind direction, wind speed and radiation at small time scales. Surely a research site that was as highly instrumented as the one for this experiment had a complete set of meteorological measurements, including radiation and rain rate. How can you discuss secondary organic aerosol production with no associated correlations with the UV radiation?

10) The period of April-May, 2003 was unusually disturbed, weather-wise, with an abnormally high number of cloudy and rainy days. How did this affect the results? When comparing the results from 2003 with other years, were these cloudy and rainy days excluded? If not, how can you interpret any differences that are found in the comparisons? It seems that only measurements of Chow et al and Moya et al were used in the comparisons and these not only were from different areas of the city but under very different meteorological conditions. What useful information can one glean from comparisons under such disparate conditions?

11) Why are the gas measurements not used in this study? The RAMA station at CES, while not co-located, would offer valuable insight into the variations in the particle distributions. Other published studies, for example, have shown that the amount of sulfate in particles is inversely correlated with the SO2 and directly correlated with the RH. It is very strange that the authors are unaware of these previous studies and don't take advantage of the RAMA measurements of SO2, CO, NOx and O3 since these are gases are precursors or surrogates of precursors for particle production and growth. For example, the CO has been shown in previous studies as a very good tracer of the

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boundary layer growth, as well as the intensity of primary emissions.

12) Figure 4 is incomprehensible. The legends are unreadable and the symbols and lines are blurs.

13) Figure 6c. The fraction of organics in this figure is meaningless. All it does is fill the remainder of the graph to get 100%.

14) Figure 6 b. What do the different shapes mean? How does this relate to the processes that produced these curves? What is the point of displaying these normalized curves?

15) The size distributions in this study are only being compared with those from cascade impactors whose 50% size cuts are broad and extend down to only 0.18 μm. If the authors look at the references in the Mexico City review paper that they only briefly mention, they will find that particle size distributions (PSD) have been made with high resolution by a number of other investigators. At least one of these studies was a detailed analysis of the concentration of particles in different size ranges as a function of relative humidity and time of day. That same study also has size distributions of sulfate with the MOUDI. Perhaps a comparison with the measurements in that study would be more relevant than those that are currently provided.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 4183, 2005.