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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Characterization of near-highway submicron aerosols in New York City with a high-resolution time-of-flight aerosol mass spectrometer" *by* Y. L. Sun et al.

**Anonymous Referee #2**

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This paper presents field studies of traffic-influenced sub-micron particles at a roadside site in New York City. Results and discussion focused on the data collected by a high-resolution aerosol mass spectrometer (HR-AMS) and a fast mobility particle sizer (FMPS). During two morning rush-hour periods, fast changes in organic mass concentration were observed and were explained by traffic emissions. The authors found that traffic emissions mainly influenced the hydrocarbon-like organic aerosol (HOA) component. Correspondingly, elevated ultra-fine modes were found in both organic mass size distributions and particle number size distributions due to traffic emissions. Average emission ratios of HOA and BC from the highway vehicles were estimated. This paper is well organized and details are mostly well explained. The results will be a useful

reference to the atmospheric research community. I suggest publication in ACP after my major comments are addressed.

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General comments:

(a) I think it is better not to show results for July 27 in Fig. 2, 3, 5, and 9. In page 30729, the authors stated that the data discussion was focusing only on the other three observations because the measurements on July 27 were largely influenced by generator exhaust (explained in detail in the supplementary). The presentations of contaminated data set in those figures parallel to the other observations are therefore unnecessary and would somewhat mislead the readers.

(b) The definitions of LV-OOA and SV-OOA imply a reverse relationship between volatility and O:C (Jimenez et al., 2009). With only information of O:C and m/z 43-to-44 ratios, it is not enough yet to conclude that one OOA is more volatile than the other. For example, Hildebrandt et al. (2010) identified two OOA factors in their study. Although the O:C ratios were estimated to be 0.9 for OOA-1 and 0.6 for OOA-2, OOA-1 were not found to be less volatile than OOA-2 (perhaps both are LV-OOA). Therefore, the identification of LV-OOA and SV-OOA in this study needs additional evidence to support. Moreover, the spectra of "LV-OOA" in the literature typically have more prominent m/z 44 and higher O:C (Jimenez et al., 2009). The LV-OOA spectrum shown in Fig. 7 for this study is indeed more similar to that of "SV-OOA" in DeCarlo et al., 2010 compared to typical "LV-OOA" spectra. Despite the lack of information about volatility, it seems that the two OOA components identified in this study could be both SV-OOA.

(c) Multiple aspects of the data on July 28, including the similar average bulk composition for less and more traffic periods (page 30730), the elevated HOA and ultrafine-mode organics (page 30730) and the spikes in organic mass concentration (page 30731) during more traffic periods, and the weak correlation between HOA and BC (page 30735), were explained by the emissions from the MTA buses rather than from



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the vehicles in the LIE highway. The MTA bus stop, however, is in the north of the sampling site C (Fig. 1). The explanation of MTA bus emissions seems not supported by the wind direction that was stated by the authors as "persistent from the campus".

(d) In section 3.2, the authors showed that elevated concentrations due to traffic emissions were peaked at $\sim$ 120 nm (Dva) and $\sim$10 nm (Dm). While the 10-nm particles are too small to explain the elevated mass concentrations at 120 nm (Dva), the decrease of number concentrations in 30-70 nm (Dm) (Fig. 6b) seems to imply an opposite trend in mass size distributions. Additional discussion is therefore needed regarding to this point for data consistency, perhaps on the basis of the FMPS volume distributions, particle density, and shape factor.

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Specific comments:

(1) P30723, Line 14-16: This statement is misleading. It needs to be clarified that such "dominant" or "small" contributions are relative to the total vehicular emissions not the total emissions.

(2) P30727, Line 15-18: Because the meteorology data were not directly measured at Site C, it is important to evaluate the potential bias, especially in wind direction, on the basis of sampling height and topography etc. Also see the general comment (c).

(3) P30727, Line 19: A recent understanding on the AMS mass concentrations is that the measured values correspond to the temperature and pressure conditions for the flow-rate calibration (personal communication with Jose Jimenez, CU). Also, because instruments were installed inside the ASRC-ML, sampling temperature might be different from ambient values. The authors should state clearly that how the various data sets were treated when converting the data to ambient conditions and provide the ranges of ambient temperature and pressure.

(4) Page 30728, Line 8-9: The authors stated that the four measurements were com-



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bined into one data set for the PMF analysis and the retrieved profiles were hence forced to be identical for all four experiments. Did the authors run PMF for each data set and obtain similar results? The question behind is in what ranges the factor profiles would change (e.g., in Fig. 7).

(5) Page 30728, Line 13: The authors showed a careful diagnosis about the large silicone contamination on July 27 in the supplementary. A component representing the contaminated OA was resolved from the UMR PMF analysis (Fig. S7). However, only four components (HOA, LV-OOA, SV-OOA, and NOA) were identified from the HR PMF analysis. Why is the exhaust component missing in the HR PMF analysis? Did the authors exclude ions like CxHy at m/z 73 in the analysis (seems not shown in Fig. 7)? Clarification is needed and the unsolved exhaust contribution to other factors (e.g., HOA) should be speculated in the main text.

(6) P30730, Line 27: The wind direction plotted in Fig. 2 for July 28 is 120-240 degree, indicating an origin of wind from the south not the north.

(7) Figure 5b: I can hardly see light gray lines on my screen.

(8) P30733, Line 8-15: It seems not appropriate to describe the “less traffic (i.e., before 7:30 a.m.)” distribution has a bimodal structure and the “more traffic (i.e., after 7:30 a.m.)” distribution has 3 modes. The two distributions (Fig. 6b) show at least 4 modes at 10, 18, 30, and 50 nm (and perhaps 120 nm). The mode structures are similar, although the relative height of each mode is different for the two distributions.

(9) The works of Klems et al. 2010, 2011 are highly relevant to this study and could be cited perhaps in section 3.2.

(10) The analysis in Page 30732, Line 23-25 is somewhat conflicting with the statement in Page 30734, Line 17-20.

(11) P30736, Line 19-20: The suggestion of greater exposure to particle pollution of people living nearby the highways than living upwind or far from the highways is over-



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stated. Exposure assessment strongly depends on living style. Living close to the highway does not necessarily mean breathing more toxic air pollutants from the highway surroundings. Individual's indoor and outdoor activities and the toxicity of the pollutants are important aspects for the exposure assessment. I suggest deleting this statement from the conclusion.

(12) P30737, Line 7: Be more explicit about "upwind areas".

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Technical corrections:

P30722, Line 1: A missing space between "(FMPS)" and "measurements".

P30723, Line 9; P30724, Line 25 and 28: Missing comma for the use of "e.g.", "i.e." and "however" in a sentence.

P30723, Line 17: "Most of previous studies" of what?

P30723, Line 21-22: Remove "(> 10 nm)". In a previous sentence, the authors just stated that the particles at 30-m downwind were already greater than 10 nm (i.e., before growing up).

P30723, Line 26: Does "particle numbers" mean "particle number concentrations"?

P30724, Line 21: Be more explicit what "hydrocarbon characteristics" are.

P30724, Line 16-17: Does "diesel aerosol particles" mean "particles from diesel emissions"?

P30726, Line 11-13 and P30727, Line 14: Provide year for sampling periods.

P30727, Line 4: Delete the extra word "spectrometer".

P30730, Line 2-3: Redundant "and". Perhaps just say "which reflects ... in traffic flow, traffic type, and meteorology."



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P30731, Line 7 and 11; P30732, Line 4; P30735, Line 22: Incorrect and redundant use of “also”.

P30733, Line 5: Delete the extra comma after “(r2=0.53)”. Otherwise, the last part is confusing.

P30737, Line 11: Insert a comma between “vehicle types” and “and traffic flow”.

P30752, figure legend: + signs for the ions are misplaced.

A general technical comment is that there are some ambiguous statements throughout the manuscript that need to be polished in the revised manuscript. Here are some examples: P30723, Line 8-10: ““driving modes, e.g., ... measurements, ... studies, ... sampling...”; P30723, Line 21-22: “number distributions ... to larger particles...”; P30730, Line 3: “The variation ... is flat ...”; P30731, Line 9: “compared ... measurements ... and the site A ...”

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References:

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