

***Interactive comment on “Submicron particles influenced by mixed biogenic and anthropogenic emissions: high-resolution aerosol mass spectrometry results from the Carbonaceous Aerosols and Radiative Effects Study (CARES)” by A. Setyan et al.***

**Anonymous Referee #2**

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General comments

The manuscript presents HR-ToF-AMS results from the T1 site of the CARES campaign in June 2010. AMS mass spectra, size distributions, time series and PMF analysis are used together with ancillary data to show that SOA formation is enhanced during periods with mixed high anthropogenic and biogenic emissions. While the data set seems to be promising in terms of information content, the analysis shows signif-

C1467

icant weak points which need to be addressed. I therefore recommend a thorough revision before resubmission of the manuscript, both content- and language-wise.

Main points:

1. The interpretation of the size distributions (section 3.1.2) is too speculative and the data seem “over-interpreted”, and references are missing. It cannot be concluded from the data at hand that sulfate and organics were externally mixed. In addition, a “droplet mode” usually refers to wet particles and aqueous phase reactions, can this be confirmed using the data at hand? It is mentioned in the text, but can fog and low clouds in the bay area during the time of the study be confirmed?
2. The PMF solution needs more justification. A discussion of the Figs. S3-S4 should be placed in the main text. Were different SEED values investigated? Why was the solution using  $f_{\text{peak}}=0$  chosen? And how can the 3-factor solution be justified based on the similarity of mass spectra and time series of MO-OOA and LO-OOA. More information should also be given on the PMF input matrices. How many ions were removed, were the isotopes constrained or fitted, were they included in the PMF matrix, what was the mass range, etc.? The high correlation of primary traffic tracers with OOA suggests urban transport as a possible source as opposed to/in addition to local sources.
3. The main conclusion of the paper, that SOA formation is enhanced when anthropogenic emissions interact with biogenic precursors, are presented in a confusing and non-consistent manner. This also goes back to the fact that the periods dominated by northwesterly winds and therefore low concentrations for all species (as shown in Fig. S2) are interpreted as dominated by PMF-biogenic-SOA, which a) is not clearly shown and b) depends on the interpretation of the PMF result. The interpretation of the high mass and number concentrations during the afternoon should be made more carefully, especially in terms of urban transport/advection of pollutants and new particle formation (how are these processes related/distinct/dependent, see also comment on

C1468

PMF).

#### Specific comments

The short title reads as “submicron particles influenced by emissions” and should be changed to something more meaningful.

P. 5608: More details should be given on the sampling inlet, such as diameter, length, and material of the tubing, and/or residence time of particles in the inlet

P. 5608, l. 24: The  $D_{va}$  corresponds to the electrical mobility diameter times the particle density assuming sphericity, please correct

P. 5608, l. 26: To what stage of the instrument does the pressure value given refer to? The sizing region usually has a pressure of 10<sup>-5</sup> Torr

P. 5610, l. 6-9: I would usually recommend regular, short filter measurement intervals (e. g. every week) during a field campaign

P. 5610, l. 21-23: Why “adjusted”? And why where the changes proposed in Aiken et al. (Env. Sci. Technol., 2008), not implemented?

P. 5610, l. 25: Cite DeCarlo et al. (Anal. Chem., 2006) and compare to detection limits reported there

P. 5611, l. 1: I suggest changing “most” to “many” and giving some references

P. 5611, l. 8-9 and Fig. 2a: Fig 2a. just confirms relative agreement of AMS+BC and SMPS, but not absolute. Since, as seen in Fig. 3, the correlation is nice and the slope is known, why not scale the SMPS volume to “SMPS apparent mass” using the slope in Fig. 3 as a measure for the density and show this comparison in Fig 2a?

P. 5611, l. 13: Add Lanz et al., (Atmos. Chem. Phys., 2007), as reference

P. 5613, l. 9-10: Even though you give information on the gas phase instruments here, it should also be given on p. 5608 where they are mentioned for the first time

C1469

P. 5613, l. 15: repeat again what size of particles you are referring to

P. 5617, l. 3-5: Drawn conclusion not fully clear; rephrase

P. 5619, l. 1-2: Seems to be too much interpretation for this very small difference in the size distributions of Org 43 and Org 44

P. 5619, l. 9: Is Fig. 6a really necessary? It doesn't add a lot of new information

P. 5619, l. 9-10: For this interpretation, more information should be given on the interpretation of the whole time series – why were organics low then? Why was sulfate high? Are clean air masses due to meteorology? Do high organics mean high local organics, or advected organics? Sulfate is usually high during transport from T0 to T1. And there is no linear correlation between organic mass fractions and PM1

P. 5619, l. 20: Does Fig. 7 show campaign averages?

P. 5619, l. 26: Show SO<sub>4</sub>- size distribution for afternoon only

P. 5620, l. 19-20: I don't see that in Fig. 7 (“ultrafine mode”?)

P. 5621, l. 27: Aren't you seeing a droplet mode, and aren't you mentioning aqueous phase processes earlier? Seems contradictory

P. 5622, l. 25-26: See comment above; this statement is not quantitative. Can you show comparisons, report r values?

P. 5623, l. 2: which OOA factors are you referring to? Unclear

P. 5623, l. 9-11: That is not only the case for biogenic SOA

P. 629, l. 6-7: the assumption that OC = WSOC should be justified

Figures should be ordered according to their appearance in the text

I suggest moving Figs. 3, 4, 10, and 13 to the Supplement, since they don't add substantially more information

C1470

Technical corrections

- P. 5604, l. 13: the ecological balance
- P. 5604, l. 15: better “consist” than “are constituted”
- P. 5604, l. 17: better “Analyses” than “However, the analysis”
- P. 5604, l. 23: better “can also be classified” than “are classified”
- P. 5605, l. 3 -4: Partitioning “into”, not “onto”
- P. 5606, l. 26: Give full name of HR-ToF-AMS since it is mentioned here for the first time (abstract doesn't count). Abbreviation used later (p. 5608, l. 21) is inconsistent, please check
- P. 5606, l. 28: Inconsistencies in capitalizing “positive matrix factorization” throughout manuscript, please check
- P. 5608, l. 25: on average
- P. 5609, l. 25: “allows the determination of the particle diameter  $D_{va}$ ”
- P. 5609, l. 7-9: Strange sentence
- P. 5609, l. 15, 20, 21: better “in V- and W-mode”
- P. 5610, l. 12: “for” Igor
- P. 5610, l. 12: check throughout manuscript for inconsistencies in giving company information (e. g. name and state or just name, etc.)
- P. 5610, l. 21: “to” instead of “into”
- P. 5611, l. 23: Better “the PMF solution”
- P. 5612, l. 2: Since it is used here for the first time, say what  $D_m$  is
- P. 5612, l. 15-18: Strange sentence

C1471

- P. 5612, l. 28: “the” drift tube
- P. 5613, l. 4: an SP2
- P. 5613, l. 9: concentrations
- P. 5613, l. 15: “The” spatial distribution
- P. 5614, l. 11: “in” Fig 2.
- P. 5615, l. 20: better “of the measured  $NH_4^+$  concentration vs. the predicted  $NH_4^+$  concentration assuming. . .”
- P. 5615, l. 27: “is present” instead of “presents”
- P. 5616, l. 9: corresponds
- P. 5616, l. 12: report
- P. 5616, l. 29: “was present” instead of “presented”
- P. 5617, l. 1: “contributed to”
- P. 6717, l. 2: “roughly” instead of “around”
- P. 5617, l. 24-27: Rephrase
- P. 5618, l. 25: Really Fig 8a?
- P. 5620, l. 9: typo (pin)
- P. 5620, l. 19: spherical particles
- P. 5620, l. 21-22: strange sentence, rephrase
- P. 5620, l. 25: observed
- P. 5620, l. 26: Finnish
- P. 5620, l. 29: Sierra Nevada foothills

C1472

P. 5621, l. 24: "than during a field campaign"  
P. 5622, l. 7: "We performed PMF analysis on"  
P. 5622, l. 11-12: Cite Lanz et al., 2007  
P. 5622, l. 18: Difference "in" volatility  
P. 5623, l. 16: different levels  
P.5623, l. 20: sources and processes  
P. 5623, l. 28: "the sum"  
P. 5626, l. 7: tight correlations  
P. 5626, l. 8: are consistent  
P. 5626, l. 27: were compared  
P. 5627, l. 19-22: Remove "frequent" or "frequently"  
P. 5629, l. 22: We noticed  
P. 5630, l. 13-14: remove one "average"

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 5601, 2012.

C1473