

Interactive comment on “The ToF-ACSM: a portable aerosol chemical speciation monitor with TOFMS detection” by R. Fröhlich et al.

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Reply to:

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Anonymous Referee 1

Minor comments:

1. Correct the orders of the figures in this manuscript

revised

C2970

2. Page 6792, line 8-9, subscript for the numbers

revised

3. Fig. 3 caption: Should “There is a good correlation between Q- and ToF-ACSM ($R^2 = 0.80$)” be “There is a good correlation between scattering coefficient and mass concentration of ToF-ACSM ($R^2 = 0.87$)”?

Yes, description of graph (c) was wrong. Sentence changed to: “There is a good correlation between the scattering coefficient and the mass concentration of the ToF-ACSM ($R^2 = 0.87$)...”

4. The aerosol species measurements correlated very well between ToF-ACSM and Q-ACSM (Fig. 8). I suggest the authors to have some discussions on the differences of slopes. Particularly, the slope of nitrate comparison is overall lower than sulfate and ammonium. Because the quantification of nitrate from Q-ACSM might be overestimated due to organic interferences at m/z 30 and 46, while ToF-ACSM appears not have such issue. This might have important implications for many Q-ACSM measurements, especially in the environment with high organics.

We do not believe nitrate to be overestimated by the Q-ACSM significantly. The reasons for the higher slope of the NH_4 and SO_4 , i.e. the lower NH_4 and SO_4 concentrations in the Q-ACSM more likely are the relatively large uncertainties ($\sim 15\text{--}20\%$) in the determination of the RIE_{NH_4} in both instruments, which also propagate into the RIE_{SO_4} . Additionally the NH_4 signals experience a significant interference of air and water molecules. This is also reflected in the worse correlation of the NH_4 ($R^2 = 0.74$). Lines 13 to 19 on page 6788 address these issues in the same context.

5. The mass spectra comparison in Fig. 7 is interesting. It should be noted that the OA mass spectra in the case 1 also shows differences for some m/z 's in addition to the naphthalene-related m/z 's. For example, the ratios of m/z 43/44 or 41/44, 42/44 between Q-ACSM and ToF-ACSM appear to be quite different. While such differences

C2971

didn't have a large impact on organic mass quantification, it might significantly affect the future organic aerosol source apportionment analysis. Actually, I am very curious on the comparison of PMF results between Q-ACSM and ToF-ACSM in the authors' future work.

Indeed, there are significant differences in the spectra also at m/Q 's other than the ones influenced by naphthalene. But to some extent, this difference is even expected since short-lived plumes may not be measured by the Q-ACSM (cf. Page 6785, line 15-25). In addition, owing to the scanning of the quadrupole through mass space, the relative abundances of different ions in the MS can be expected to be different from those in a TOF, which co-incidentally measures the entire mass range. During the two hour averaging period (14:00 to 16:00) the spectra were calculated from, two such short-term plumes occurred. It is noted that the yellow circle in Fig. 2 indicating that period was actually erroneously indicated at ~ 15:00 to ~ 17:00. This will be corrected in the updated figure. Therefore the observed differences most likely are real and the short lived plumes are either missed or underestimated with the Q-ACSM. To clarify this, one sentence is added on page 6786, line 17: "Additional differences in the spectra originate from two short-lived plumes observed during the averaging period (cf. Fig. 2(a)), not being captured by the Q-ACSM, owing to the scanning of the quadrupole and lower temporal resolution." Additionally it is noted that a difference in the vaporiser temperature or a small difference in the ioniser geometry can affect the organic fragmentation (e.g. a higher T will result in a higher f_{44}). In a PMF source apportionment this will result in slightly different factor profiles but not in different factor concentrations. This difference also exists between different instruments of the same type, like different AMSs. A comparison of PMF/ME-2 results between the two instruments is in the works and subject to future publications.

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C2972

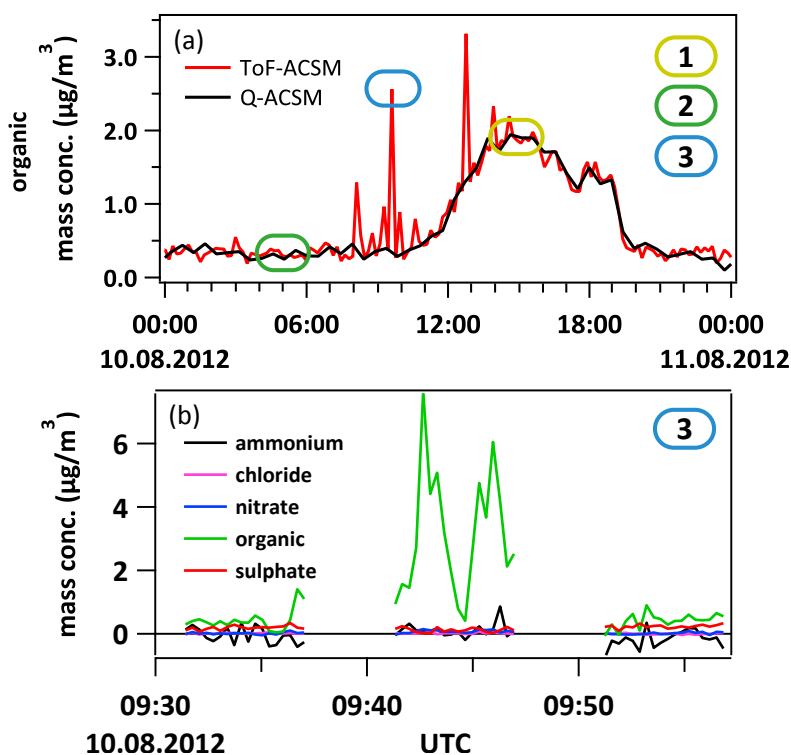


Fig. 1.

C2973