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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Elucidating determinants of aerosol composition through particle-type-based receptor modeling" *by* M. L. McGuire et al.

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The authors thank Z. Wang for valuable comments. The responses to your comments are marked in italic.

General Comments:

This paper uses PMF method to successfully separate nine factors from the ATOFMS data (33 particle type). This is a quite interesting, creative and important research.

Specific Comments:

(1)The ATOFMS single particle mass spectra are clustered into 46 particle-types when

using a vigilance factor of 0.3, and among them 33 were used for PMF analysis. Can the authors explain more why the rest 12 types are not employed? Is it because the number of particles for these categories are not insufficient? And if a higher vigilance factor is used, with more clusters of particle, does it will influence the solution significantly?

The commenter is correct with the assumption that there is an insufficient number of particles in the remaining 12 categories for PMF analysis. To clarify this point, we have added the following sentence to P9841, L22 of the manuscript:

"Particle-types 34 through 46 each contained an insufficient number of particles per hour for analysis."

A higher vigilance factor was used as a starting point in the analysis, and the results are summarized in the manuscript on P9841, L10:

"For instance, using a vigilance factor of 0.8 produced 606 particle-types, which was not only far too many for interpretation, but each one also contained an insignificant number of particles for a robust PMF analysis (i.e., too few particles per hour). While manually recombining the particle-types based on their spectral, temporal, and particle size similarities is a common method for reducing their number, for this study this technique yielded PMF solutions without global minima. This is probably caused by the sensitivity of PMF towards small errors in the recombination process from subjective comparisons between particle-types: re-combining the time-series of particle-types inherently changes the co-linearity between particle-types in the PMF matrix. It follows that inaccurately recombining particle-types directly affects the extent to which useful factors can be extracted using PMF. Hence, errors in the subjective manual recombination process, which cannot be easily accounted for in the PMF error model, likely result in undue errors in the PMF analysis."

Further discussion on the effects of manually recombining particle-types for subsequent PMF analysis is provided in the response to Anonymous Referee 2.

(2) I am also interested in the correlations of the particle types identified with some particle signatures from Prather's group. Specially, a recent summary by Wexler group (Atmos. Environ., 2011, 524-546 and 561-577) may assist the interpretation of amine type particles.

Per the recommendation of Anonymous Referee 1 more comparisons to source signatures (where applicable) have been added to the Supplement, where the particle-types were discussed in detail.

The amine-related particle-types measured by ATOFMS during the BAQS-Met campaign have been interpreted and discussed in significant detail in another study by Rehbein et al. (2011).

(3) Can the authors provide some technical details about PMF analysis, likely some plots about other solutions (10 factors, 8 factors), variation with different fPeak values, etc.?

PMF solutions of lower and higher order than the chosen 9 factor solution have been discussed in the manuscript. Section 3.3 of the manuscript provides a summary of how the PMF solution changes with the addition of factors, from 4 to 12 factor solutions, and both Table 3 and Figure 4 from the manuscript summarize the influence of these additional factors upon existing ones.

The effect of fPeak variation upon the 9 factor PMF solution was not found to be significant within the range of recommended fPeak values. This analysis was summarized in the manuscript on P9849, L16-22:

"Rotational freedom was investigated by varying the FPeak parameter from −2.5 to 2.5 in increments of 0.5. All solutions in this range were examined, although the solutions for FPeak of −0.5 and +0.5 were investigated most closely as they only resulted in a Qrobust/Qexp difference of 5 and 15

References

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