Comparison of Rochester aerosol sources at two periods of time using combined size distribution and air pollutant data

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Sources contributing to the submicron particles (11–500 nm) measured between January 2008 and December 2013 at the New York State Department of Environmental Conservation (NYS DEC) site in Rochester, NY were identified and apportioned using positive matrix factorization (PMF). To examine changes in the sources over time, two time periods, 2008-2010 and 2011-2013, were analyzed. These periods were divided into three seasons (i.e. winter [December, January, and February], summer [June, July, and August), and transition [March, April, May, September, October, and November] given the seasonal differences in atmospheric chemistry. Therefore, the seasons were analysed independently for possible sources. Further, each season's data was analysed with different sets of variables to determine if our results were robust.

The new version of EPA's positive matrix factorization (EPA PMF) software, 5.0, includes displacement (DISP) of factor elements as an error estimation method for analyzing factor analytic solutions. This method captures the uncertainty of PMF analyses due to rotational ambiguity. DISP diagnostics are consistently robust, indicating its use for understanding rotational uncertainty and as a first step in assessing a solution's viability [1]. To demonstrate the utility of the DISP method, results are presented for the submicron particles. The particle number size distribution (PNSD) of airborne particles not only provides information about sources and atmospheric processing of particles, but also plays an important role in determining regional lung depositon and dose [2]. Besides the PNSD, some gaseous species and black carbon (2 wavelenghts) were measured in this study. The resolved sources were identified using information from number and mass contributions from each source (source profiles), as well as meteorological data. The profiles of winter season for both periods along with their DISP bands (red error bars) are shown in Figure 1.

PMF was successfully employed in comparing the sources contributing to the concentrations of the measured submicron particles and species at two different periods in Rochester, NY.

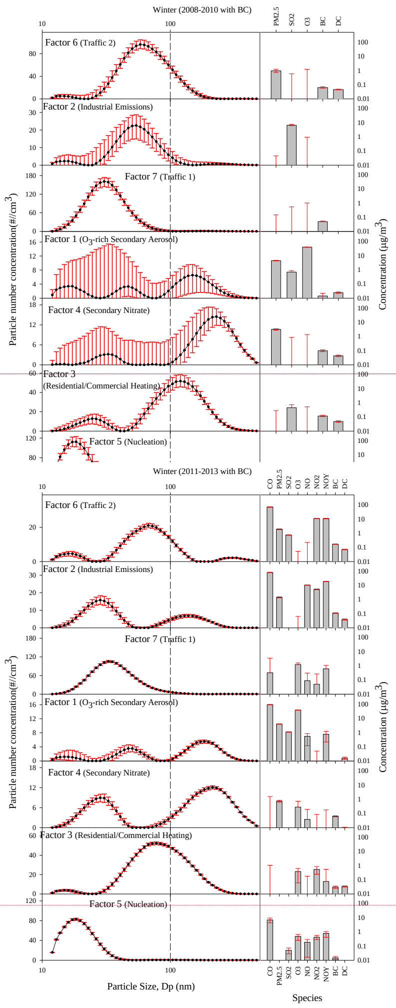

Figure 1. Profiles of the resolved sources for the winter season; (Top) the period 2008-2010 (Bottom) the period 2010-2013

References:

[1] Brown, S. G., Eberly, S., Paatero, P., Norris, G. A. (2015) *Sci. Total Environ*. **518**, 626-635.

[2] Vu, T. V., Delgado-Saborit, J. M., Harrison, R. M. (2015) *Atmos. Environ.* **122**, 114-132.

Commented [RDQ1]: What variables?

Commented [RDQ2]: Say why you used different sets of variables.

How does using different variables for each season impact stability and accuracy unless you are comparing several different analyses with different sets of variables included?

Commented [RDQ3]: Can you say, even shortly what your results are, besides just presenting the figure? Why are you showing only winter here? I suggest you describe in a few sentences what the results are.