

Thesis Summary

In this study, the sources of ambient aerosols in the urban atmosphere of Prague, Czech Republic are apportioned using bilinear Positive Matrix Factorization (PMF2). Prior to this work, limited use of PMF technique has been applied to Prague aerosols while elsewhere around the world, it has been actively used by aerosol scientists to reap the benefit since its first introduction in the year 1993.

In the current study, the combined particle number size distributions and readily available gaseous concentration data were used in apportioning winter sub-micron particle sources in the urban atmosphere of Prague. The ambient Particle Number Concentrations (PNC) were obtained using a Scanning Mobility Particle Sizer (SMPS) in the size range between 14.6 and 736.5 nm (midpoint diameters) along with the ambient gaseous concentrations of CO, SO₂, NO_x (NO + NO₂), O₃, CH₄, and Non Methane Hydrocarbons (NMHC) at the receptor site, a well-equipped rooftop sampling station (at height about 25m above street level, 225m ASL) belonging to the Institute for Environmental Studies, Charles University (latitude-50° 4' 17.46" N; longitude-14° 25' 14.92" E). It is situated inside the university botanical garden (area 0.035 km²). The receptor site is shielded from direct sources of pollution and there are no street canyon conditions that might affect the sampling conditions.

The meteorological data concerning wind direction, wind speed, temperature, relative humidity and the UV-A and UV-B solar radiance were also obtained. The Conditional Probability Function (CPF) plots were used for directionality analyses, in determining the likely locations of the source emissions. In addition, diurnal patterns of factor contributions, the correlations of the factor contributions with gaseous pollutants (O₃, NO_x, SO₂, CO, CH₄ and NMHC) were used to assist in the interpretation of the sources.

For the sampling period-I (17th February to 10th April 2007), the PMF2 deduced 5 factor solution. They were assigned to as mixed source-1, traffic, heating, mixed source-2, and O₃-secondary particles, respectively. Out of 5 sources, 2 sources were assigned to as mixed sources-1 and 2 with CPF directionality from all sectors. Repetitive PMF2 run with different seeded value failed to resolve these two mixed sources. Often, some of the factors appear to be a mixture of several sources that cannot be further separated. These two sources may be coming from background or long range transport not known due to lack of chemical tracers.

For the sampling period-II (7th to 23rd January, 2008), the PMF2 analysis, identified 4 possible sources. The sources were identified as ozone-rich (transported ozone/ozone precursors, mixed down from above boundary layer associated with high wind speed and temperature), NO_x-rich (diesel emissions), traffic and heating sources.