

FORMES: Fraction ORganique de l'aérosol urbain : Méthodologie d'Estimation des Sources

Coordinateur : Jean-Luc Jaffrezo - LGGE

The objectives of the program FORMES (Organic Fraction of urban Aerosol : methods for source apportionment) were to assess several source apportionment methods in urban environments and to define the requirements for these methods. A very large effort was put into 2 field campaigns for the physicochemical characterization of PM, one in Marseilles during summer, and another in Grenoble during winter.

The concentrations of more than 120 chemical species in PM_{2.5} were measured in each campaign with a time resolution of 12hr for periods of 15 days. These also included measurements of EC, OC, 14C, HULIS, and functional groups of organic matter. These off line measurements were completed by on line investigations conducted with AMS, VHT-DMA, aethalometer, and SMPS.

Several methods were tested : CMB (« Chemical Mass Balance ») using concentrations of chemical tracers; deconvolution of the AMS signal with a PMF (Positive Matrix Factorization) approach ; deconvolution of the aethalometer signal.

Among the main results, one should note :

- A rather good agreement between the different methods, despite their very different bases,
- The evidence of the large impact of photochemical production in summer in Marseilles, together with the impact of industrial sources (particularly when particle number is concerned),
- The very dominant impact of biomass burning sources in winter in Grenoble,
- The application of the CMB method is possible with a limited set of tracers (about 15), that can be measured on the same sample ; however, the extension of the method will require the development of a dedicated set of source profiles,
- The optical method using an aethalometer seems effective, providing further validation, in simple winter situations for the apportionment of biomass combustion,
- The efficient synergy between the CMB and AMS-PMF method for the apportionment of the secondary organic fraction, including the distinction between "actual AOS" and aging of a primary fraction,
- A real interest in the association of such studies in receptor sites with aerosol modelling.

Key words: aerosol, PM_{2.5}, organic aerosol, sources, tracers, AMS, PMF, CMB, VHT-DMA, AETHALOMETER