EGU23-13319, updated on 15 Apr 2024
https://doi.org/10.5194/egusphere-egu23-13319
EGU General Assembly 2023

Towards a better understanding of fine PM sources: online and offline datasets combination in a single PMF

Marta Via[1,2], Jesús Yus-Díez[1,2], Francesco Canonaco[3,4], Jean-Eudes Petit[5], Philip Hopke[6,7], Cristina Reche[1], Marco Pandolfi[1], Matic Ivančič[8], Martin Rigler[8], Xavier Querol[1], Andrés Alastuey[1], and María Cruz Minguillón[1]

[1]IDAEA-CSIC, EGAR, Spain (marta.via@idaea.csic.es)
[2]Department of applied physics, Faculty of Physics, University of Barcelona, Barcelona, 08028, Spain
[3]Laboratory of Atmospheric Chemistry, Paul Scherrer Institute, 5232 Villigen PSI, Switzerland
[4]Datalystica Ltd., Park innovAARE, 5234 Villigen, Switzerland
[5]Laboratoire des Sciences du Climat et de l'Environnement (CNRS-CEA-UVSQ), Gif-sur-Yvette, France
[6]Center for Air Resources Engineering and Science, Clarkson University, Potsdam, NY13699, USA
[7]Department of Public Health Sciences, University of Rochester School of Medicine and Dentistry, Rochester, NY14642, USA
[8]Aerosol d.o.o., Kamniška 39a, 1000 Ljubljana, Slovenia

Source apportionment (SA) techniques allow matching the measured ambient pollutants with their potential source origin. Hence, they are a powerful tool for assessing air pollution mitigation strategies. The Positive Matrix factorization (PMF) model is one of the most widely used SA approaches, and its multi-time resolution add-on (MTR-PMF), which enables mixing different instrument data in their original time resolution, is the focus of this study.

Co-located one-year measurements of non-refractory submicronic particulate matter (NR-PM_1), black carbon (BC) and metals, obtained respectively, by a Q-ACSM (Aerodyne Research Inc.), an Aethalometer (Aerosol d.o.o.) and offline fine PM samples collected on quartz-fibre filters, were combined in a single PMF in two different resolutions (30 minutes for the NR-PM_1 and BC, and 24h every 4 days for the offline samples). The multi-time resolution PMF (MTR-PMF) was run varying both the time resolution (averaging the dataset) and the uncertainty weightings of both datasets in order to assess the impact of these variations on the model output. The resolution assessment revealed that averaging the high-resolution data was disadvantageous in terms of model residuals and environmental feasibility. Regarding uncertainty weightings, overweighting the uncertainties of the 24-h dataset dividing them by two provided the most optimal scaled residuals adjustment.

The MTR-PMF was run with the optimised time resolution and uncertainty weightings retrieving eight PM_1 sources: ammonium sulphate (AS) + heavy oil combustion (24%), ammonium nitrate (AN) and ammonium chloride (15%), fresh SOA (15%), traffic (14%), biomass burning (11%), aged SOA + mineral dust (8%), urban mix (7%) and cooking-like organic aerosol + industry (6%). The MTR-PMF technique allowed the identification of two more sources respect a dataset containing the same species at a 24h time resolution (base case) and four more respect to the conventional offline and PMF, proving that the combination of both high and low time resolution data through

MTR-PMF is significantly beneficial for SA. This is especially true for those sources which have been disentangled with respect to the conventional and base case PMFs.