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A SOURCE APPORTIONMENT EXERCISE OF A SMALL DATASET OF PM10 AND PM2.5 USING POSITIVE MATRIX FACTORIZATION IN A RURAL SITE IN SOUTH ITALY

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Airborne Particulate Matter (APM) is used by the World Health Organization (WHO) as a proxy indicator for ambient air pollution. For this reason the identification as well the quantification of the different sources influencing PM levels at a receptor are essential for the estimation and improvement of Air Quality. The Source Apportionment at receptor site is reliable using receptor modelling techniques [1, 2]. Receptor models, relying on multivariate statistical methods (such as Positive Matrix Factorization – PMF), require the inputting of a matrix composed of a relatively large number of samples to function correctly [3]. A number of publications have sought to define objective criteria aimed at establishing the minimum number of samples for use with these receptor models. However, the issue is far from settled. Results of a source apportionment exercise using positive matrix factorization (PMF) for PM10 and PM2.5 are reported. This study is based on a small dataset of 29 PM10 and 33 PM2.5 samples for a receptor in a rural setup in Apulia (Southern Italy). Running PMF on the two size fractions separately resulted in the model not functioning correctly. We therefore, augmented the size of the dataset by aggregating the PM10 and PM2.5 data. The 5 factor solution obtained for the aggregated data was fairly rotationally stable, and was further refined by the rotational tools included in USEPA PMF v5. These refinements include the application of constraints on the solution, based on our knowledge of the chemical composition of the aerosol sources affecting the receptor. Additionally, the uncertainties associated with this solution were fully characterised using the improved error estimation techniques in USEPA PMF v5. The results of the error estimation techniques in PMF (BS, DISP and BS – DISP) show reasonable uncertainties in the tracer species. Five factors in all were isolated by PMF: ammonium sulfate, sea salt, mixed carbonaceous aerosol, crustal/Saharan dust and total traffic. These results obtained by PMF were further tested *inter alia*, by comparing them to those obtained by two other receptor modelling techniques: constrained weighted non-negative matrix factorization (CW – NMF) and chemical mass balance (CMB). The PMF results were confirmed by CW – NMF, while the

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CMB estimates show some explainable deviations in PM10 and in PM2.5. The results of this comparison suggest that the solution obtained by PMF is valid, indicating that for this particular airshed PMF managed to extract most of the information about the aerosol sources affecting the receptor – even from a dataset with a limited number of samples.

References

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