Source apportionment analysis applied to aerosol eddy-covariance fluxes in Delhi

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Introduction

The adverse effects of particular matter on human health and climate has seen air pollution move rapidly up the political agenda. With an increasing global population, the focus is on growing megacities. Understanding the local sources and sinks affecting these environments is key to the implementation of air quality policies. In this study, multi-factor analysis was combined with eddy-covariance flux measurements of chemically resolved non-refractive submicron (NR-PM_1) aerosol. The application of Positive Matrix Factorization (PMF) to the flux data provides a powerful tool to investigate local emission and deposition processes and source contributions to the total observed organic aerosol flux.

Methods

Flux measurements made by the eddy covariance (EC) technique were taken at two different locations in Delhi in October/November 2018. Aerodyne Aerosol Mass Spectrometers (AMS) were used to measure NR-PM_1 concentrations at several Hz. One site was located in an affluent leafy residential / institutional area (Lodhi Road) and the other one was located in a more densely populated urban area on the edge of Old Delhi.

Conclusions

At the Old Delhi site NR-PM_1 aerosols were mostly emitted (positive fluxes) with an average diurnal flux peaking at mid-morning and early evening (Fig. 1). At the Lodhi Road site, measurements showed both emission and deposition (negative fluxes) of aerosols with the largest deposition around noon (Fig. 2).

PMF results showed that the NR-PM_1 emissions were dominated by local traffic sources at both sites with the second biggest contribution coming from solid fuel burning. At the Old Delhi site some emissions of low volatile organics and inorganics were also observed. At Lodhi Road, the large deposition fluxes, suggested that the tree covered area acted as a net sink for inorganic aerosol and secondary organics.

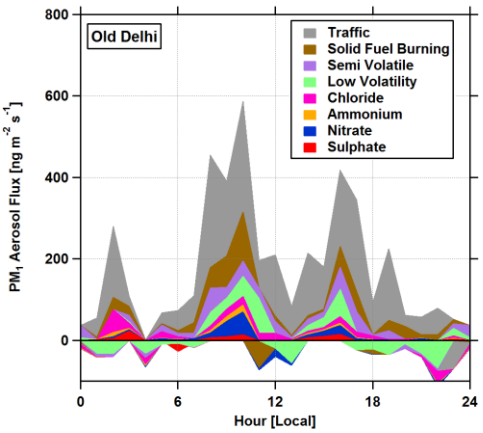

Figure 1. Average diurnal cycle of NR-PM_1 fluxes at the Old Delhi (preliminary results)

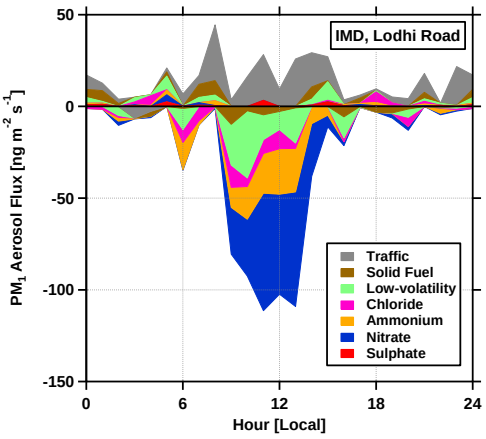

Figure 2. Average diurnal cycle of NR-PM_1 fluxes at the Lodhi Road site (preliminary results)

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