Title:	Understanding the Influence of Meteorology and Emission Sources on PM2.5 Mass Concentrations Across India: First Results From the COALESCE Network
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Abstract:	The Carbonaceous Aerosol Emissions, Source Apportionment and Climate Impacts (COALESCE) is a multi-institutional Indian network project to better understand carbonaceous aerosol induced air quality and climate effects. This study presents time synchronized measurements of surface PM2.5 concentrations made during 2019 at 11 COALESCE sites across India. The network median PM2.5 concentration was 42 μg m−3 with the highest median value at Rohtak (99 μg m−3) and the lowest median value at Mysuru (26 μg m−3). The influence of six meteorological parameters on PM2.5 were evaluated. Causality analysis suggested that temperature, surface pressure, and relative humidity were the most important factors influencing fine PM mass, on an annual as well as seasonal scale. Further, a multivariable linear regression model showed that, on an annual basis, meteorology could explain 16%–41% of PM2.5 variability across the network. Concentration Weighted Trajectories (CWT) together with the results of causality analysis revealed common regional sources affecting PM2.5 concentrations at multiple regional sites. Further, CWT source locations for all sites across the network correlated with the SMoG-India emissions inventory at the 95th percentile confidence. Finally, CWT maps in conjunction with emissions inventory were used to obtain quantitative estimates of anthropogenic primary PM2.5 sectoral shares from a mass-meteorology-emissions reconciliation, for all 11 pan-India network sites. These estimates can help guide immediate source reduction and mitigation actions at the national level.
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