1.218 Source apportionment of particulate matter using a low-cost multi-pollutant air quality sensor in an Indian megacity.

Early Career Scientist

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Abstract:

The past several years have seen the emergence of many low-cost commercial devices for measuring particulate matter (PM) and gaseous species for the monitoring of indoor and outdoor air quality. Although our understanding of their operation and quantification of their performance has improved substantially over this period of time, they are mostly used only to measure the concentrations of individual pollutants, or to monitor air quality generally (and often in a qualitative sense only). However, other potential applications of such sensors, such as the identification of major pollutant sources, has received considerably less attention. Here, we use a new multi-pollutant air quality sensor (MPAQS) comprised of an optical particle counter (for measuring PM) and four electrochemical sensors (for measuring SO_2, NO_x, O_3, CO) to perform source apportionment of fine particulate matter in a megacity (New Delhi) and to enhance source apportionment efforts derived from real-time particle characterization instruments. Research-grade particle characterization instruments including an Aerodyne Aerosol Chemical Speciation Monitor (ACSM), an Aethalometer (BC), and a TSI Scanning Mobility Particle Sizer (SMPS) are used to validate results as well as to understand how the source apportionment abilities of such atmospheric-chemistry measurements can be enhanced through the addition of low-cost sensors. Various time-series deconvolution techniques (e.g., k-means clustering, Positive Matrix Factorization) are used to derive a meaningful source apportionment across a multi-season data-set (September 2017 – March 2018) in a complex urban environment using low-cost sensors.