Measuring PM and related air pollutants using low-cost sensors

Karoline Johnson[1], Michael Bergin[1], Armistead Russell[1], Gayle Hagler[2]

[1]*Georgia Institute of Technology, Atlanta, GA*

[2]*U.S. EPA, Office of Research and Development, Research Triangle Park, NC*

Emerging air quality sensors may play a key role in better characterizing levels of air pollution in a variety of settings including near sources and in communities. There are a wide range of low-cost (< $500 US) sensors on the market, but few have been characterized. This new generation of inexpensive sensors would allow larger fleets of monitors to be deployed to better study the spatial and temporal variability of pollutant concentrations if they prove to be accurate and durable. The small size and light weight of these sensors provides the opportunity for wearable applications that could play a key role in future estimates of human health impacts of PM and other pollutants). The sensors can also be deployed on various mobile and stationary measurement platforms to better characterize pollutant sources and source regions.

We will present measurements from an assortment of sensors, costing $20-$700, that have been used to measure air pollution in the US, India, and China with a focus on estimating PM concentrations. The pollutant levels in these three countries ranges from low concentrations seen in the US (up to approximately 20 ug m^{-3}) to much higher concentrations measured in India and China (up to approximately 300 ug m^{-3}). Based on the evaluations in these very different pollutant settings, the optimal concentration ranges of these sensors have been determined. Used in conjunction with data from a carbon dioxide sensor, emissions factors were estimated in some of the locations. In addition, temperature and humidity sensors can be used to calculate corrections for the sensors. These sensors have been evaluated against reference methods with promising results.