3.063 Emperical characterization of residential solid fuel burning in South Africa's low-income urban areas .

Early Career Scientist

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Abstract:

Solid fuel burning in low-income urban areas is South Africa's biggest air quality problem. Between 40% and 50% of its 53 million people live in areas where solid fuel burning is prevalent. Particulate matter (PM) concentrations are typically between 50% and 100% higher than adjacent urban areas. These emissions are not well represented in current global emission databases and ambient concentrations are poorly sampled using remote sensing due to strong spatiotemporal variability. A struggling economy and large coal-fired power stations that provide more than 90% of electricity create a challenging environment to find solutions to high PM levels in urban areas. Power stations have no SOx, NOx, and aging PM control technologies, nevertheless, regulators are contemplating emission offsetting as a strategy to fund efforts to improve air quality in urban areas. This paper reports on field campaigns that explored different interventions to lower PM emissions in two low-income urban areas where coal burning is reported in 60% to 80% of households. Interventions included thermal insulation, low-emission stoves, electricity subsidies and LPG. The suite of instruments included standard meteorology (Vaisala and RM Young), criteria air pollutants (TEI, Teledyne, Horiba and PICARRO), PM samplers (MetOne E-Bams, MetOne E-samplers, an AE31 7-wavelength Aethalometer MAAP-CBC and a GRIMM), volatile organic compounds (Syntech GC), indoor and household air quality (TSI DustTraks, TSI SidePaks, Meshguard SO2 and CO), as well as indoor and stove temperatures (Thermocron iButtons). Source apportionment was performed in different seasons and sites using coarse and fine nucleopore filters in Stacked Filter Unit samplers and analyzed with energy dispersive X-Ray Fluorescence (XRF) and Ion Chromatography (IC). Drivers of solid fuel burning are identified in order to inform ongoing efforts to design and optimize strategies to reduce emissions.