

“Airborne Particulates in Uganda: Levels and Source Attribution”

Beth Parks, Ph.D.

Department of Physics and Astronomy
Colgate University

Abstract:

Airborne particulates are a major component of air pollution. Ambient particulates are estimated to cause 3 million premature deaths annually worldwide, with an additional 4.3 million deaths due to the indoor environment. Particles with aerodynamic diameters under 10 microns (PM10) can reach the lungs, and those under 2.5 microns (PM2.5) can reach the bloodstream. Exposure to airborne particulates is linked to a wide range of cardiovascular problems.

In developed nations, particulate levels are routinely monitored, and when they exceed threshold levels, warnings are issued and activity restrictions are implemented to reduce them. However, in most developing countries, there is no government monitoring, and a lack of data will hamper future efforts to study the effects and mitigate the most important sources.

During the 2015-16 academic year, I was a Fulbright scholar at Mbarara University of Science and Technology in Uganda, where I initiated a program to monitor PM10 concentrations in three distinct environments: an urban center (Kampala), a small city (Mbarara) and a village location (Rubindi), both in the wet season and the dry season. These measurements are still underway through the PhD project of a Ugandan student I am supervising. The only previously published studies from Uganda were short-term measurements in the two largest cities (Kampala and Jinja). Since the majority of Uganda's population is in rural areas, it is important to measure levels outside of urban areas. These concentrations were measured using co-located gravimetric (filter-based) collectors and real-time optical instruments.

The results so far show that particulate levels are high in all three locations, with average PM10 levels measured gravimetrically of 157 mg/m^3 in Kampala; 124 mg/m^3 in Mbarara; and 188 mg/m^3 in Rubindi. (WHO guidelines for maximum PM10 levels are 20 mg/m^3 ; US EPA levels are somewhat more lenient.)

We have attempted to correlate the gravimetric measurements (which are slow and expensive) with optical measurements, so that future measurements may be made at less expense. However, the measurements are not well correlated, which may imply that the mixture of particle sizes changes from day to day. We hope to explore this discrepancy further.

Biography:

Beth Parks completed a PhD in physics at UC Berkeley. Following post-doctoral research at MIT, she joined the physics department at Colgate University. She spent the 2015-16 year in Mbarara, Uganda, as a Fulbright fellow at Mbarara University of Science and Technology. Her research involves THz spectroscopy of condensed matter systems, as well as less traditional topics including measuring building insulation, developing inexpensive solar tracking, and monitoring particulate pollution in Uganda.