

Developments in Emission Measurements Using Lightweight Sensors and Samplers

An abstract for poster submittal to the

OAQPS-Hosted
Emissions Inventory Conference
Baltimore, MD
August 14th thru 18th

<https://www.epa.gov/air-emissions-inventories/2017-international-emissions-inventory-conference-applying-science-and>

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Lightweight emission measurement systems making use of miniaturized sensors and samplers have been developed for portable and aerial sampling for an array of pollutants. Shoebox-sized systems called “Kolibri”, weighing 3-5 kg, have been deployed on NASA-flown unmanned aerial systems (UASs, or “drones”) to characterize plume emissions from open combustion sources. A larger instrument system (20+ kg) called the “Flyer” is lofted into pollutant streams using a tethered, helium-filled aerostat or balloon. The Kolibri and Flyer use sensors to measure CO and CO₂ and miniature samplers for PM_{2.5/10}, PAHs, VOCs, SVOCs, carbonyls, black/elemental/organic carbon (BC/EC/OC), inorganic halogens, and real time BC. New capabilities are being added including NO_x sensors and a real time sampler for particle size distributions. Both the Kolibri and Flyer use telemetry to send data to the ground crew to enable flight and sample monitoring. The Flyer has been used to determine emission factors from a variety of open burning sources including oil burns, waste pile burns, agricultural field burning, prescribed wildland fires, and open burning/open detonation of military ordnance. The Kolibri has been successfully and safely deployed in four efforts to determine emission factors from open burning and detonation processes.