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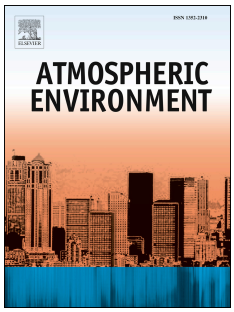

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A small, lightweight multipollutant sensor system for ground-mobile and aerial emission sampling from open area sources

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Abstract

Characterizing highly dynamic, transient, and vertically lofted emissions from open area sources poses unique measurement challenges. This study developed and applied a multipollutant sensor and time-integrated sampler system for use on mobile applications such as vehicles, tethered balloons (aerostats) and unmanned aerial vehicles (UAVs) to determine emission factors. The system is particularly applicable to open area sources, such as forest fires, due to its light weight (3.5 kg), compact size (6.75 L), and internal power supply. The sensor system, termed "Kolibri", consists of sensors measuring CO_2 and CO, and samplers for particulate matter (PM) and volatile organic compounds (VOCs). The Kolibri is controlled by a microcontroller which can record and transfer data in real time through a radio module. Selection of the sensors was based on laboratory testing for accuracy, response delay and recovery, cross-sensitivity, and precision. The Kolibri was compared against rack-mounted continuous emissions monitoring system (CEMs) and another mobile sampling instrument (the "Flyer") that has been used in over ten open area pollutant sampling events. Our results showed that the time series of CO, CO_2, and $PM_{2.5}$ concentrations measured by the Kolibri agreed well with those from the CEMs and the Flyer, with a laboratory-tested percentage error of 4.9%, 3%, and 5.8%, respectively. The VOC emission factors obtained using the Kolibri were consistent with existing literature values that relate concentration to combustion efficiency. The potential effect of rotor downwash on particle sampling was investigated in an indoor laboratory and the preliminary results suggested that its

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