1.094 Application of PM2.5 Micro-sensors in Taiwanese Communities.

Presenting Author:

Shih-Chun Candice Lung, Research Center for Environmental Changes, Academia Sinica, Nankang, Taipei, Taiwan., sclung@rcec.sinica.edu.tw

Co-Authors:

Tzu-Yao Wen, Research Center for Environmental Changes, Academia Sinica, Nankang, Taipei, Taiwan.

Wen-Cheng Wang, Research Center for Environmental Changes, Academia Sinica, Nankang, Taipei, Taiwan.

Chun-Hu Liu, Research Center for Environmental Changes, Academia Sinica, Nankang, Taipei, Taiwan.

Shu-Chuan Hu, Research Center for Environmental Changes, Academia Sinica, Nankang, Taipei, Taiwan.

Abstract:

Asian residential communities are usually dotted with various pollution sources, such as restaurants and home factories, resulting in higher intra-urban variability than western communities. Thus, it is important to characterize pollution spatial variability in order to assess accurately residents' exposures. The objectives of this study are to evaluate the applicability of low-cost $PM_{2.5}$ micro-sensors in the field and to assess $PM_{2.5}$ levels in high tempo-spatial resolution with micro-sensors.

$PM_{2.5}$ micro-sensor devices, AS-LUNG, were used for this work, including sensors for $PM_{2.5}$, CO_2, temperature, relative humidity, and GPS. Wireless transmission plus SD-card is available to avoid data loss. AS-LUNG-outdoor (AS-LUNG(O)) with a solar panel and water-proof housing is suitable for outdoor usage. Ten AS-LUNG(O) devices were placed at 2.5 meters above ground in Taiwanese communities to assess spatial variability and one AS-LUNG(O) at 10 meters above ground to assess ambient levels (high-level site). The monitoring duration was July 1-28 (25.5-30.0℃) and December 1-31 (14.0-22.0℃), 2017, with one-minute resolution. In addition, sensor devices were evaluated against GRIMM in the laboratory and fields; the measurements were converted accordingly.

During the monitoring periods, the mean $PM_{2.5}$ levels in near-by EPA stations were 16.3±8.9 and 40.7±17.5μg/m^3 for July and December, respectively, showing higher ambient levels in the winter. Data of AS-LUNG(O) had R^2 of 0.81-0.99 with those from EPA stations, showing high consistence of AS-LUNG(O) observations. The monthly mean ratios of community observations over those at the high-level site ranged from 1.05-1.29 and 1.08-1.63 in July and December, respectively. Moreover, the highest 1-min level at a site near vendors and traffic was 100 times of that at the high-level site, with 5-min average 35 times higher than that at the high-level site. Our results demonstrated the applicability of $PM_{2.5}$ micro-sensors in summer and winter and high spatial variability of $PM_{2.5}$ levels due to community sources.