

# **Applying Research-Grade Low-Cost Sensors for PM<sub>2.5</sub> and PM<sub>1</sub> Exposure Assessment and Health-Impact Evaluation in Two Asian Countries**

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## **Abstract**

With the newly-upgraded research-grade low-cost sensors, we are able to assess peak levels of PM<sub>2.5</sub> and PM<sub>1</sub> in a time-resolution of minutes. Combining with biosensors, the impacts of PM<sub>2.5</sub> and PM<sub>1</sub> exposure on cardiovascular systems can be evaluated. This presentation will show results of applying these sensors with the objective of assessing the peak exposure, exposure sources, and immediate health impacts of PM<sub>2.5</sub> and PM<sub>1</sub> in Indonesia and Taiwan. AS-LUNG and medical-certified RootiRx<sup>®</sup> sensors are the chosen PM and health microsensors, respectively. AS-LUNG were calibrated in the laboratory with a FEM instrument; observations were converted to be research-grade data. RootiRx<sup>®</sup> sensors were deployed to obtain heart-rate variability (HRV). About 50 subjects in 2018 and 2019 in Bandung, Indonesia and 55 subjects in 2019 and 2020 in Kaohsiung, Taiwan were recruited to carry these sensors with the same methodology. They also recorded the time-activity diaries to specify their activities and PM sources encountered. The 5-min means of PM<sub>2.5</sub> and PM<sub>1</sub> exposure were  $30.4 \pm 20.0$  and  $27.0 \pm 15.7$  in Indonesia and  $14.9 \pm 11.2$  and  $13.9 \pm 9.8 \mu\text{g}/\text{m}^3$  in Taiwan, respectively. Peak exposure levels and the sources responsible for such peaks were identified. It was found that mosquito coil burning was the most important exposure source, resulting in, on average, 5.82 and 9.82  $\mu\text{g}/\text{m}^3$  higher PM<sub>2.5</sub> exposure increments for Indonesian and Taiwanese subjects, respectively, compared to non-exposure periods. Community factories were also important sources. Incense burning was another important exposure source, but only in Taiwan. Furthermore, immediate impacts on the HRV indices and heart rates of all subjects in Taiwan and the scooter subjects in Indonesia were found to be associated with PM exposure with statistical significance. The microsensors used and methodology demonstrated in this presentation can be applied in resource-limited countries to conduct PM and health research.

## **Early Career Scientist**

NO, I am not an early career scientist.

## **IGAC Activities**

Allin-Wayra: Small Sensors for Atmospheric Science

## **IGAC Regional Working Groups**

MANGO: Monsoon Asia and Oceania Networking Group