

Assessing the Efficacy of Low-Cost Air Monitors in Measuring Particulate Matter Concentrations on New York City Streets

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Air pollution is starting to be recognized as one of the most pressing public health threats faced by populations around the world, with millions of premature deaths per year attributed to it. As interest grows in monitoring and improving air quality, governments, scientists, and citizens have found that price is a barrier, with equipment that costs up to hundreds of thousands of dollars per unit. In response, lower cost air monitors are rapidly being developed to make air pollution monitoring more widely accessible. To assess if low-cost air monitors are comparable as alternatives to traditional, high-cost monitors, I deployed expensive microPEM monitors alongside the cheaper and newer AirBeam monitors to six bike riders in New York City as part of a larger air pollution epidemiology study. An outside software company, Multitude, then used their software to process and correct for deficiencies in the low-cost AirBeam data, including for known confounding variables such as temperature and humidity. The Multitude-processed AirBeam data were compared against the microPEM data to determine if the processing made the data significantly closer to the microPEM standard. Results show that the processed AirBeam data are still significantly different from the microPEM data, with a root mean square error decrease of just 24% after the Multitude processing. This signifies that the low-cost monitor must continue to be tested before it can be used as a viable alternative to traditional equipment. This report systematically assesses the errors from the AirBeam, microPEM, Multitude processing, and study setup, and makes recommendations to help influence the future development and use of low-cost air monitors such as the AirBeam and correction software such as Multitude.