



Air Quality Monitoring Network with low-cost sensors in Recife - Brazil.

Carlos Eduardo Menezes da Silva and Anselmo César Vasconcelos Bezerra

Federal Institute of Pernambuco, Campus Recife, Environmental Management and Urban Sustainability, Brazil
(carlosmenezes@recife.ifpe.edu.br)

Air pollution is one of the main environmental risks to human health, especially in large urban centers, and is associated with cardiovascular and respiratory diseases, as well as other adverse outcomes. Despite its relevance, systematic air quality monitoring is still incipient in most Brazilian cities, particularly in the Northeast of the country. In this context, the present study aims to analyze approximately one year of monitoring of fine particulate matter (PM_{2.5}) and inhalable particulate matter (PM₁₀) in the city of Recife, Brazil, using low-cost sensors, seeking to identify temporal and spatial patterns and potential risks to public health. Nine monitoring stations were installed in areas with distinct socio-environmental characteristics, considering factors such as urban density, vegetation cover, vehicle flow, and population income. The measurements, carried out between November 2023 and September 2025, were obtained using IQAir AirVisual Outdoor model sensors, with data available in near real-time. The analyses included descriptive statistics, assessment of exceedances of the limits recommended by the World Health Organization (WHO), analysis of variance, correlation with meteorological variables, and spatial clustering. The results indicate a daily average PM₁₀ value of 6 µg/m³, with significant variations between stations. On 92 days of the analyzed period (13.16%), at least one station recorded concentrations exceeding the WHO daily limit (15 µg/m³), evidencing recurring episodes of air pollution. Well-defined seasonal patterns were highlighted, with higher concentrations in the months of August and September, in addition to extreme peaks observed recurrently at the end of June, associated with local cultural events, such as the June festivities. Spatial analysis revealed intra-urban inequalities in exposure to particulate matter, with one station showing systematically higher concentrations, possibly related to local emission sources and unfavorable socio-environmental conditions. The findings demonstrate the feasibility and relevance of using low-cost sensors to expand air quality monitoring in urban contexts with data scarcity. Furthermore, the results provide important input for the formulation of intersectoral public policies in the areas of health, urban planning, and the environment, contributing to the reduction of socio-environmental inequalities and risks to public health.