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Field evaluation of a Low-Cost PM_{10} Monitoring Instrument under Humid Savanna conditions at the Lamto geophysical station, Côte d'Ivoire

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This study evaluates the performance of the low-cost AirQino sensor for measuring PM_{10} concentrations in a humid savanna environment at the Lamto Geophysical Station, Côte d'Ivoire. A 40-day co-location campaign was conducted with a reference TEOM analyzer. Raw results indicate a moderate but significant correlation between AirQino and TEOM measurements ($r = 0.51$; $R^2 = 0.26$), with a systematic underestimation of PM_{10} concentrations (NMB = −34.3%). The root mean square error (RMSE = 12.15 µg m^{-3}) and mean absolute error (MAE = 8.51 µg m^{-3}) reflect substantial variability, likely linked to high relative humidity. To correct these biases, several multivariate calibration models were tested. The most effective configurations, integrating meteorological variables (temperature, relative humidity) and gaseous co-pollutants (CO, NO_2, O_3), significantly improved performance ($r = 0.77$; $R^2 = 0.60$; RMSE = 7.57 µg m^{-3}; CVMAE ≈ 28%; bias ≈ 0%). These results emphasize the critical influence of environmental conditions on sensor accuracy. Although AirQino cannot fully replace reference-grade instruments without prior calibration, it offers a reliable and cost-effective alternative for spatiotemporal PM_{10} monitoring in data-scarce regions when locally adjusted with appropriate correction models.

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