

Suitability of Conditional Bivariate Polar Plots for Identifying Sources of PM_{2.5} in Low-Cost.

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Abstract

This proof-of-concept study examines the suitability of miniaturised air sensor data for identifying local and long-range sources of PM_{2.5} using a conditional probability function (CPF) and its extension in bivariate polar plot (CBPF). As a proof-of-concept, lower percentiles (0-50) were used to identify potential sources away from the monitoring site and higher percentiles (60-100) leveraging miniaturised air sensor (AirGradient) data to identify local sources of PM_{2.5} at the University of Ghana, Accra. The NE, E and SE of the site is the N4 Highway while the rest of the quadrants comprises of campus road networks integrated with residential halls, office complex and mini market that relies on a mixture of energy sources including solid fuels for cooking and food vending. The bivariate polar plot revealed that PM_{2.5} pollution was local from NE and NW quadrants. Using a 35th percentile, long range sources were identified from SE, SW and NW which were 11.2 $\mu\text{g m}^{-3}$. The 75th percentile revealed E, SE, and NW with higher concentrations (18 $\mu\text{g m}^{-3}$). Using the CBPF with varying percentiles, it was observed that percentiles from 0-50 revealed a common source from the SW quadrant with concentrations from 4.20 to 14.00 $\mu\text{g m}^{-3}$ indicating sources away from the monitoring site. With percentiles between 60-100, three main sources were identified with varying concentrations. Firstly, SW (15-18 $\mu\text{g m}^{-3}$), SW and NW quadrant (18-21 $\mu\text{g m}^{-3}$), and lastly NW quadrant only (21-58 $\mu\text{g m}^{-3}$). The CPF and CBPF adopted here revealed sources of PM_{2.5} other than what was shown in the bivariate polar plot. The novel approach used in this study is useful for identifying sources that might have diluted before reaching the monitoring site and offers us the potential of further investigating the site to develop bespoke clean air solutions especially in environments where these types of information will be desirable.

Early Career Scientist

YES, I am an early career scientist.

IGAC Activities

CCMi: Chemistry Climate Model Initiative, GEIA: Global Emissions Initiative, MAP-AQ: Monitoring, Analysis and Prediction of Air Quality, Allin-Wayra: Small Sensors for Atmospheric Science

IGAC Regional Working Groups

ANGA: African Group on Atmospheric Sciences