Utilizing Low-Cost Air Sensors in West Africa to Address Lack of Air Pollution Data

Oreoluwa Solanke[1,2], Daniel M. Westervelt[1]
[1]Lamont-Doherty Earth Observatory of Columbia University
[2]Columbia University

Many African cities are experiencing high rates of urbanization— high population growth in urban centers— which is worsening air pollution. However, there is sparse air pollution data and/or a lack of public accessibility of such data in many of these cities, and the expensive price of leading reference grade air sensors remains a key obstacle to determining the extent of the air pollution problem. As such, air pollution continues to pose major health hazards, estimated to cause ~700,000 deaths annually across the continent. Our research goal is to close this gap of air pollution data in African megacities by analyzing and characterizing their time series data. We focus on atmospheric concentrations of particulate matter with a diameter of less than 2.5 micrometers ($PM_{2.5}$)—which are considered "fine" particles, commonly used as an indicator of air quality. The data from the PurpleAir PA-II sensors and Clarity Nodes that were placed to collect air pollution data in Accra, Ghana and Lomé, Togo from 2019 to present were used for the data analysis. Our methods then involved processing (cleaning and arranging) the PM2.5 data as collected from the sensor(s) at each site in each city—18 in Accra, Ghana and 4 in Lomé, Togo—to depict how air quality at each location varied with time, particularly seasonality. The results show seasonal alternation, between rainy and dry season, in both Lomé, Togo and Accra, Ghana, with the average PM2.5 concentration as observed in Accra being 34.3 ug/m3 and 36.63 ug/m3 in Lomé. Additionally, due to major restrictions put on human activity in attempts to control the spread of virus, covid-19, in Accra, the overall effect of this regulation on air quality led to lower raw PM2.5 atmospheric concentrations in 2020 when compared to 2019.