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Characterization of Aerosol Particles in Ilorin, Nigeria: Ground-Based Measurement Approach

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Abstract : Understanding aerosol properties is the main goal of global research in order to lower the uncertainty associated with climate change in the trends and magnitude of aerosol particles. In order to identify aerosol particle types, optical properties, and the relationship between aerosol properties and particle concentration between 2019 and 2021, a study conducted in Ilorin, Nigeria, examined the aerosol robotic network's ground-based sun/sky scanning radiometer. The AERONET algorithm version 2 was utilized to retrieve monthly data on aerosol optical depth and angstrom exponent. The version 3 algorithm, which is an almucantar level 2 inversion, was employed to retrieve daily data on single scattering albedo and aerosol size distribution. Excel 2016 was used to analyze the data's monthly, seasonal, and annual mean averages. The distribution of different types of aerosols was analyzed using scatterplots, and the optical properties of the aerosol were investigated using pertinent mathematical theorems. To comprehend the relationships between particle concentration and properties, correlation statistics were employed. Based on the premise that aerosol characteristics must remain constant in both magnitude and trend across time and space, the study's findings indicate that the types of aerosols identified between 2019 and 2021 are as follows: 29.22% urban industrial (UI) aerosol type, 37.08% desert (D) aerosol type, 10.67% biomass burning (BB), and 23.03% urban mix (Um) aerosol type. Convective wind systems, which frequently carry particles as they blow over long distances in the atmosphere, have been responsible for the peak-of-the-columnar aerosol loadings, which were observed during August of the study period. The study has shown that while coarse mode particles dominate, fine particles are increasing in seasonal and annual trends. Burning biomass and human activities in the city are linked to these trends. The study found that the majority of particles are highly absorbing black carbon, with the fine mode having a volume median radius of 0.08 to 0.12 meters. The investigation also revealed that there is a positive coefficient of correlation (r = 0.57) between changes in aerosol particle concentration and changes in aerosol properties. Human activity is rapidly increasing in Ilorin, causing changes in aerosol properties, indicating potential health risks from climate change and human influence on geological and environmental systems.

Keywords : aerosol loading, aerosol types, health risks, optical properties
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