Abstract

Investigations on the characteristics of air pollution in African regions are fewer compared to other parts of the world. This study presents the temporal characteristics of PM2.5 and PM10 (mass concentration of particulate matter with aerodynamic size less than or equal to 2.5 and 10 microns, respectively) and their ratio (PM2.5/PM10) over Durban, South Africa for the period 2019–2020. The study further explores the satellite aerosol optical depth (AOD) and particulate matter (PM) relationship using an advanced statistical model. The PM data used in this study is obtained from ground-based monitoring stations being maintained by the South African Air Quality Informative System (SAAQIS) network. Within Durban, PM2.5 and PM10 showed an increasing trend toward the south. The annual mean PM2.5 (PM10) ranged between 15 and 24 μg m-3 (37 and 54 μg m-3) across the four study sites in Durban. Winter is observed to be the most polluted season among all, with daily mean PM levels exceeding the World Health Organization (WHO) standards. PM2.5, PM10, and the PM2.5/PM10 ratios exhibited pronounced diurnal variations. Concentration Weighted Trajectory (CWT) analysis identified the potential non-local source regions and long-range transportation pathways of PM. Investigation into the impact of COVID-19 lockdown on PM revealed a maximum of 15% reduction compared to a business-as-usual (BAU) year. The observed reduction in PM during lockdown is compared and contrasted with that observed in other cities worldwide. The statistical model's tenfold cross-validation (CV) coefficient of determination (R2) ranged between 0.6 and 0.8. The model predictions can be highly useful in the spatial mapping of PM over the measurements-deficit African regions.

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