ABSTRACT

Black carbon (BC), light absorbing carbon (LAC), or soot is a known component of air particulate matter and has been identified as the second top contributor to global warming due to its strong positive radiative forcing. In the Philippines, specifically in Metro Manila, increased black carbon concentrations have been observed coming from public utility vehicles (PUVs), particularly from jeepneys. As such, increased absorption of solar radiation is expected, potentially causing a warming effect in the affected region.

The study aimed to investigate the relationship between BC concentrations and upwelling irradiance. BC data from PM_{10} was gathered from the long-term monitoring stations of DENR-EMB from 2016 - 2020 at different sampling stations in Metro Manila, namely, DOH, Muntinlupa, MMDA, Marikina, and NPO. A multi-wavelength absorption black carbon instrument (MABI) was used to measure BC concentrations at 405 nm, 465 nm, 525 nm, 639 nm, 870 nm, 940 nm, and 1050 nm. These wavelengths were further utilized to determine the absorption Ångström exponent of BC. Furthermore, the simulation of solar spectrum and calculated upwelling irradiance at the sampling sites was evaluated using the Tropospheric Ultraviolet and Visible (TUV) Radiation model, incorporating local parameterization. Lastly, cloud optical depths were determined using the Wyoming upper air sounding at the Tanay station.

The findings of this study showed that the trend pattern of BC concentration exhibited a constant decline as it moved towards 2020. The opposite trend was observed for the upwelling irradiance. In addition, correlation coefficients revealed strong negative correlations between BC concentrations and upwelling irradiance and were significant at the 0.001 level. The findings suggest that heightened BC concentrations would lead to more energy surplus on the surface of the Earth, intensifying localized warming.