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Long term variability trends study of black carbon mass concentration levels associated with PM_{2.5} in the megacity of Lahore, Pakistan

Noor Ahmad¹, Imran Shahid², Maria Razi³, and Rab Nawaz¹

¹Department of Environmental Sciences, University of Lahore, Lahore, Pakistan

²Department of Space Science, Institute of Space Technology, Islamabad, Pakistan

³Satellite Remote Sensing Group, Max Planck Institute for Chemistry, Mainz, Germany

Black Carbon (BC) particles result from the incomplete combustion of fossil fuels and biomass burning. It is an important atmospheric pollutant having a strong affinity to absorb thermal radiations and thus is also responsible for disturbing the atmospheric radiation balance. We measured long-term BC mass concentrations in Lahore. Continuous measurements were performed between January 2019 and December 2020 using an aethalometer at a site close to the city center. Lahore is a megacity and capital of the Punjab province with 11.1 million occupants. The city is bearing emissions of around 5 million vehicles (Punjab Bureau of Statistics, 2017) and thousands of industrial activities. The megacities like Lahore are thus strong emission sources of BC.

BC mass concentrations contained in PM_{2.5} aerosols were measured with a resolution of one-minute intervals. Data was analyzed for hourly, daily, monthly, and seasonal variations. High levels of BC were generally observed during the winter months (January, February, and December). The highest values were observed during the smog episode in winters. A typical weekly trend was also observed with the lowest values on weekends and the highest values on weekdays. A prominent diurnal variation with a bimodal trend was also observed. A drop in BC mass concentration levels was also observed during the COVID-19 lockdown period. We also investigated the effect of different meteorological parameters like precipitation, temperature, and relative humidity on BC mass concentration levels.