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Seasonal and episodic influence of local meteorology on fine particulate matter at a regional background site in North East India.

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Climatological parameters like wind speed, temperature, boundary layer height facilitate in dispersion and accumulation of aerosols. Stagnant condition of atmosphere promote accumulation while the pollutants are more likely to get dispersed when non stagnation conditions exist. Sparse studies exist to assess the seasonal and episodic impact of stagnant weather conditions on enhancing aerosol formation in the North-East region of India.$PM_{2.5}$ sampling was carried from January to November 2019 at a regional background site in Jorhat,Assam. Meteorological variables like wind speed, surface ambient temperature and relative humidity were obtained at one-minute resolution from a collocated air weather sensor. Ventilation coefficient was calculated from wind speed and Boundary Layer Height (BLH) (from ERA5 reanalysis dataset)

Episodic days were identified as those exceeding permissible values of $PM_{2.5}$ (National Ambient Air Quality Standards) i.e, 60µg/m^3. Average wind speed on polluted and non-polluted days was 0.58±0.08 and 0.77 ± 0.17 m/s respectively. The average BLH was lower for the polluted days (243±73) than the non-polluted days (316±79). Pearson corelation coefficient of $PM_{2.5}$ and wind speeds on polluted days was low (-0.23) compared to the non-polluted days (-0.54).

Wind rose plots reveal a seasonality trend with winter and summer winds being mostly between North East and South South-West while in monsoon and autumn it lies predominantly between SSW and South South-East (from the Bay of Bengal). The Pearson correlation coefficients between $PM_{2.5}$ and wind speeds are -0.66, -0.54 and -0.52 (all $p < 0.01$) in winter, summer and autumn, respectively.Low average BLH persists in Winter and autumn . The seasonal maxima of BLH during winter, summer, monsoon and autumn was 847±167m, 932 ± 271m, 871 ±275m and 814 ± 256m, respectively. Low night-time BLH (≈ 50m) in winter and autumn contributes to higher aerosol loading. The ventilation coefficient reaches its maxima during daytime around noon with summer season having the maximum daytime VC. High VC (≈270m^2/s) in summer and monsoon signify the seasonal effect on the pollutant dispersion and consequent high $PM_{2.5}$ loading. Statistically significant negative correlations were obtained between $PM_{2.5}$ and VC in winter and autumn seasons (-0.75 and -0.43).

Wind speeds have a strong correlation with $PM_{2.5}$ except for the monsoon season and play a major role in aerosol dispersion.During monsoon, weak dependence of $PM_{2.5}$ with wind speed and

ventilation coefficient suggest significance of precipitation which cause sscavenging of aerosols. Low correlations exist in summer for $PM_{2.5}$ and VC due to possible interference due to regional transport of aerosols. 5-day backward trajectory analysis suggest transport of air masses across the Thar desert and Indo Gangetic Plains to the site during the March(summer) suggesting transport of dust across the region.