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A multi sensor study of electrical, lightning and microphysical properties of thunderstorms over the north-eastern and eastern part of India

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A comprehensive study is carried out to investigate the electrical, lightning and microphysical properties of thunderstorms during the pre-monsoon season (March-May) over Kohima (25.67 ^{o}N; 94.07 ^{o}E) in Nagaland and Rampurhat (24.17 ^{o}N; 87.78 ^{o}E) in West Bengal federal states of India. One unit each of electric field mill (EFM-100) and lightning detector (LD-350) is installed at these two stations. Data from these instrument are sampled within the 38 km radius from each station. The climatology of cloud microphysical properties is studied from the cloudsat observations, whereas the rain microphysics, associated with thunderstorm, in terms of rain drop size distribution (DSDs) is studied from PARSIVEL disdrometer. For the present investigation, two years of observations during the pre-monsoon seasons of 2017 and 2018 are utilized.

The preliminary analysis suggests that the lightning, electrical and microphysical properties of thunderstorms are distinct over Kohima and Rampurhat. The results show that, occurrence of thunderstorms is more over Kohima compared to Rampurhat, whereas thunderstorms are more intense over Rampurhat. Thunderstorms, predominantly occur during the afternoon hours with significant phase difference between these two stations. Although, occurrence is predominant during the afternoon hours but over Kohima the severe thunderstorms are found during the morning hours. The 90 percentile value of the cloud to ground strike rate over Kohima and Rampurhat is 1x10^5/30 minutes and 2x10^5/30 minutes respectively. Whereas the 90 percentile value of the electric field over Kohima and Rampurhat is 14 and 18 kv m^{-1} respectively. Overall, the intense thunderstorms, synonymous with higher electric field and strike rate, over the Rampurhat are associated with strong mixed phase processes (higher ice water content) compared to Kohima. In terms of diurnal variation the stronger thunderstorms, at Rampurhat during afternoon and at Kohima during early morning hours are consistent with the higher value of the ice water content at the respective hours. During the thunderstorms, the mass weighted mean diameter of rain DSDs is predominantly larger over Rampurhat compared to Kohima consistent with the stronger convection over Rampurhat.