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Initial results from the total lightning detector installed at the Calcutta University

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Lightning is an electrostatic discharge in the troposphere that radiates electro-magnetic energy in a very wide radio frequency range below 1 Hz to near 300 MHz. The maximum radiation energy is concentrated in the frequency spectrum near 5 to 10 kHz [1]. Lightning discharge also radiates energy in the X-ray, gamma-ray and optical range and generally occurs during thunderstorm time. In a cloud-to-ground (CG) lightning, electrical charge is transferred from cloud to ground. CG lightning can be downward negative, upward negative, downward positive or upward positive discharge. Generally, about 90% or more global CG lightning are downward negative discharge and that of 10% or less of CG lightning are downward positive (Rakov and Uman, 2003). But, majority of lightning discharge, almost 70% or more, occur within the cloud that do not involve ground, known as in-cloud (IC) lightning which can be intra-cloud, inter-cloud and cloud-to-air discharge. Recently, there has been increasing interest in ground based lightning detection networks because of its potential use in meteorological applications. Continuous thunderstorm identification and tracking by lightning detection network also improves the now-casts of thunderstorm, precipitation, severe weather, turbulence and tropical cyclone intensity which can act as a radar proxy in areas of poor radar coverage [2, 3, 4].

In recent years, the frequency of severe thunderstorms, intense lightning, dust storms, flash floods, heavy rainfall is substantially increasing in different parts of the world and also in Indian sub-continent. In this paper, we report preliminary results from the total lightning detector installed at the Calcutta University during 2016. This detector is a part of Earth Networks Total Lightning Network (ENTLN) operated globally for ground-based monitoring of total lightning activity and forecasting of localized storm alert and severe weather conditions. This set up provides improved measurement of IC and CG lightning in addition to daily weather data. We have analysed the thunderstorm events during March to early June 2018 around Kolkata. Total lightning flash rate, which includes both IC and CG lightning, has been found to increase rapidly during the initial stage of each thunderstorm much before the occurrence of damaging wind and intense lightning. Four categories of lightning rate curves are found and out of which two categories tend to produce damaging wind, intense lightning and heavy rainfall.

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