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ABSTRACT

Title of the thesis: *Studies on the effects of lightning generated electric field upon some parameters of lower atmosphere*

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Electric field at a point on the Earth's surface depends on the major thunderstorm activities of the globe and on the local environmental factors. There exists a correlation between the electric field and worldwide thunderstorm distribution. Various models for thundercloud electric field have been developed to investigate their characteristics and connectivity with different Global Electricity Parameters within the region between the surface of the earth and the upper atmosphere. Thunderstorms generate and separate electrical charges, whereas lightning neutralizes electrical charges. Negative and positive charge centers mix up randomly due to convection and produce discharge phenomenon in the form of lightning. Due to the updraft, the upper part of the thundercloud with positively charged regions goes upward up to the lower ionospheric height and joins the global electric circuit, thereby, introducing itself as the generator.

Global weather activity maintains a potential difference of about 250 KV between Earth–ionosphere waveguide, which generates a potential gradient of about 120 volt/meter at the earth's surface. In fair-weather condition (quasi-static state), electric field, current density and conductivity over the surface of the earth are subjected to both global and local variations. During meteorologically active periods, the impulse-like lightning signals (sferics) have important significance in regard to electrical phenomena occurring in different types of clouds. ELF-VLF sferics are mainly produced during lightning discharge from cloud to ground (CG).

Investigations of important characteristics of lightning generated electric field upon some parameters of the lower atmosphere are carried out and the results are examined. The atmospheric electric potential gradient on ground surface is measured at Kolkata during monsoon and winter and the results are plotted and compared with the results obtained from other ground-based stations of northern and southern hemispheres and critically analyzed thereafter. Considerable fluctuation in the magnitudes of PG is observed at day time and night time. The atmospheric electric field values are seen to be higher from the daily average. Also the measured

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field recorded a few hours difference in phase with the observation made by other researchers. The high value of PG is interpreted and inter-relationship between global thunderstorm activities and PG is established. Moreover, the correlations of PG and PDC are calculated and the results are presented in the thesis.

Schumann Resonance (SR) spectra from Kolkata are investigated from the recorded data. Various aspects of SR phenomena are presented and studied. A logical relation of SR parameter with surface air temperature of Earth and upper trophospheric water vapour (UTWV) is established. Variation in SR parameters is best utilized in monitoring the natural ENSO phenomena by the measurement of surface temperature and upper tropospheric water vapour. The details of all are presented in this thesis.

Some typical variations of maximum temperature, relative humidity, air pressure, wind speed and rainfall during a large earthquake are presented. A model calculation is set up to estimate the changes in the electron concentration and the electron temperature in the ionosphric regions through energy balance equation, continuity equation and ionization balance equation. Also, the statistical analyses on the three sub-ionospheric VLF transmitted signals from the recorded data at Kolkata are investigated during the occurrence of several earthquakes having M $\geq$ 5.0. These all are considered as the precursor of earthquake.

There are other areas to be explored and further studies are contemplated to gather more information in the field.

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