A model for the lower atmospheric electric field due to thunder cloud charge distribution

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The distribution of electric charges in the electrified cloud introduce important effects in the ionosphere and into the region between the ionosphere and the earth. The electrical properties of the medium changes greatly between thundercloud altitudes and the magnetosphere. Various models are there to examine the electrical coupling between the earth's upper and lower atmospheric regions. The main sources of electric current in these regions are thunderstorms which are distributed statistically in geographic areas.

A model for the penetration of DC thundercloud electric field at these regions has been presented here. The model deals with the electromagnetic responses of the atmosphere which are simulated through Maxwell's equations together with a time varying source charge distribution.

The modified ellipsoidal-Gaussian profile has been taken for the charge distribution of the electrified cloud. The conductivity profile of the medium is taken to be isotropic below 70 km height and anisotropic above 70 km. The earth's surface has been considered to be perfectly conductor.

A general form of equation representing the thundercloud electric field component is deduced. The solution is appropriate to study the electric field variation in the atmosphere.

Electrified clouds and lightning play important role in the global electric circuit. The vertical component of the electric field would relate the global electric circuit while the radial component would show the electrical coupling between the lower ionosphere and the ionized earth environment. The role of such thundercloud electric field may be made useful to investigate the formation of field-aligned irregularities in the upper atmosphere.

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