Studies on electric fields in the lower atmosphere due to thunder cloud charge distribution

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A model for the penetration of DC thundercloud electric field in the ionosphere and into the region between the ionosphere and the Earth has been presented in this paper. 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 is taken for the charge distribution of the electrified cloud. Coupling between the troposphere and the ionosphere is critically dependent on the height variations of electrical conductivity. These electric fields can initiate field-aligned electron density irregularities in the ionosphere which is dependent on the electric field distribution. 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 conducting.

The equation for the thundercloud electric field is deduced. In spite of assumptions for axial symmetry of thundercloud charge distribution considered in the model, the results are obtained giving the electric field variation in the upper atmosphere. 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 atmosphere and the ionized Earth's environment.

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