

The global electric circuit: new progress in monitoring and modeling

The global electric circuit: new progress in monitoring and modeling

Mareev E.A.^{2*}, S.S. Davydenko², 芳原 容英¹

E.A. Mareev^{2*}, S.S. Davydenko², Yasuhide Hobara¹

¹電気通信大学, ²Institute of Applied Physics

¹The University of Electro-Communications, ²Institute of Applied Physics

New results in the experimental study and theory of the global atmospheric electric circuit are discussed. The dynamics of slow transient currents following lightning flashes, and their role in the global electric circuit have been investigated.

The calculations of electric energy of intensive thunderstorm clouds have been performed characterizing the global circuit as the most dynamical among the existing geophysical systems. A model of macroscopic electrodynamics of the global circuit has been developed with account for both quasi-stationary processes of the cloud charging evolution and lightning discharges.

Simultaneous observations of the atmospheric electric field have been performed in the summers of 2005 - 2009 at the stations Gorodets, Nizhny Novgorod, Borok, and Prozorovo, where the station separations lie between 100 and 370 km. Recent observations clearly demonstrate the important role played by local and regional (convective) generators; these arise due to the mixing of charged particles in the boundary layer over the land surface and lead to short-period (with periods from 1 to 1000 s) electric field, current and conductivity perturbations. Studies of the spectra of these perturbations can be used to distinguish between local and global perturbations of the global circuit.