# Behavior of Ring Current and Radiation Belt Particles under the Observed Storm-Time Electric Fields

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In the inner magnetosphere, the storm-time electric field has an important role to inject and accelerate ring current particles. Although it has been considered that the enhanced convection largely contributes to the storm-time electric field, the electric fields more than 5 mV/m is observed in a limited $L$-shell range around $L = 3$ during geomagnetic storms [Wygant et al., 1998; Shinbori et al., 2005]. In the present study, we have investigated the spatial distribution of the observed electric field in the equatorial plane and its effect on the behavior of the ring current and the radiation belt.

The MLT and $L$-shell distribution of electric field is obtained from the Akebono/EFD data from 1989 to 1995. The observed electric field is mapped onto the geomagnetic equatorial plane by assuming equipotentials of the magnetic field line. During the main phase of geomagnetic storms, the electric field is intensified with the amplitude from 1.5 to 4.0 mV/m especially in the dawn and dusk regions in a limited $L$-shell range of $2 < L < 8$. This electric field is stronger and has different distribution compared with the convection electric field.

Trajectories of energetic oxygen are calculated under the observed electric field distribution during geomagnetic storms. The relativistic guiding center equation is adopted which includes the $E \times B$, $\nabla B$ and polarization drifts conserving the first adiabatic invariant. Due to the strong $E \times B$ drifts, the ring current electrons and ions with the energy around 10 keV at the geosynchronous orbit are injected more deeply into the inner magnetosphere of $L < 3$ and adiabatically accelerated to some tens of keV by conserving the first and second adiabatic invariants. It is 1 $R_E$ more inward than the prediction by the simulations under the Volland-Stern model performed by Jordanova and Miyoshi [2005], and the present result is well consistent with the ring current observations by the CRRES satellite.

For the radiation belt electrons, electrons putted on the geosynchronous orbit with initial energies of less than 500 keV reach $L = 4.7$ within 6 hours and are energized to relativistic energies of around 1 MeV. The simulated relativistic electron flux is fairly consistent with observations. This result suggests that the strong large-scale electric fields during geomagnetic storms can produce relativistic electrons without the internal acceleration process by plasma waves or the radial diffusion process.