# 弱電離気体系に於ける一般化された3次元オームの法則と分極電場生成について

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# On generation of polarization electric field in the ionosphere and the generalized Ohm's law

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Time-dependent generalized 3-fluids Ohm's law in the ionosphere is reconsidered. We explicitly show that difference between electric field and E.M.F.(such as Lorentz force, friction force and pressure gradient force acting to electron fluid) become source for radiation of electromagnetic wave. In a spatio-temporal scale much slower than the electron plasma frequency and much larger than the electron inertial length, the electric field and E.M.F should converge to the same value. Thus the evolution of magnetic field in a time scale that we are interested in, is described by the Faraday's law driven by the E.M.F. After time scale that an inductive response is completing, the resultant electric field distribution is determined by the current conservation law.

Using this framework, possible mechanism for current closure from polar to equatorial ionosphere via global Cowling channel is discussed. In our model, a global (primary) Hall current accompanied by two-cell type ionospheric convection induces polarization charge at the conductivity gradient region of dawn-dusk conductivity terminator and magnetic dip-equator. The secondary electric field accompanied by this induced charge generates the secondary Hall current flows along the dawn-side terminator line to the magnetic dip-equator. Resultantly, the global Cowling channel from polar to equatorial ionosphere via the terminator-line and magnetic-dip equator could be formed. Our model shows that growing of equatorial electrojet (EEJ) is due to the converging Hall current from polar region to the dawn side dip-equator. Meanwhile, decaying of EEJ is due to the diverging Pedersen current from dusk-side dip-equator to the polar region. This mechanism can be applied to the EEJ disturbances accompanied by the solar wind variations such as DP2-type magnetic field disturbances and many phenomena associate the equatorial enhancement and/or depression of the geomagnetic field disturbances.