

Formation of Cowling channel from Polar to Equatorial Ionosphere

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Possible mechanism for formation of global Cowling channel from polar to equatorial ionosphere along the dawn and dusk terminator line is discussed. In our model, the global (primary) Hall current accompanied by the two-cell type convection has divergent component when they cross the conductivity gradient region at the terminator-line and resultant polarization charge are induced along it. The secondary electric field accompanied by this induced charge generates the secondary Hall current, which flows along the terminator line and also diverges when they cross it. The induced secondary charges at the end of equator side produces the electric field along the magnetic dip equator line and becomes the driver of the equatorial electrojet or counter-electrojet components according to the sign of their polarization charge. Resultantly, the global Cowling channel connecting between polar to equatorial ionosphere via the terminator-line and magnetic-dip equator could be formed. This mechanism can be applied to the equatorial electrojet disturbances accompanied by the solar wind variations such as DP2-type magnetic field disturbances and many phenomena associate the equatorial enhancement and depression of the geomagnetic field disturbances.

Keywords: solar wind, polar ionosphere, equatorial ionosphere, Cowling channel, Global coupling