

Cowling Channel Formation in the 3D-Ionosphere

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In the Earth's ionosphere, nonuniform and anisotropic electroconductivity distribution causes strongly complex but organized current system by the incidence of electric fields from magnetospheric and atmospheric dynamo origins. Total current distribution is determined by generation of polarization and inductive electric fields to satisfy the current conservation law in total with generation of secondary currents.

Several peculiarities of the Earth's ionospheric current system come from the existence of Hall effect. As in the same context as semi-conductors, Hall voltages are generated by breaking Hall current continuity and charge accumulation at the boundary regions. Secondary Hall current generated by this Hall voltage flows in the same direction of the primary Pedersen current, which is directly driven by the primary electric field. Such system has called as Cowling channel. Until now formation of Cowling channel had been discussed in the context of 2-D current system.

In this paper, by taking into account two current layers model of Pedersen and Hall current system connecting via the vertical current, we discuss about 3D-structure of Cowling channel and their energy transfer mechanism for keeping system in stationary.