



Reformulation and energy flow of the Cowling channel

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The present study reformulates the Cowling channel by introducing a two-layer model of the ionosphere consisting of Hall and Pedersen conductivity layers with channel boundaries both in the direction perpendicular to and along the channel. This new model enables us to more physically understand the interconnection between the Hall current, Pedersen current and field-aligned current (FAC). Particularly the finiteness of the channel along its direction enables us to understand that the primary non-zero electric field along the channel and the associated FACs carries the necessary energy from the magnetosphere for the Hall current to set up the secondary electric field. An application of this four-side bounded and two layer model to auroral phenomena will also be presented.