Dependence of ExB Drifts in the Night-Time Ionosphere on Winds and Conductivities

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Plasma ExB convection in the night-time ionosphere is driven largely by the F-region dynamo, with additional effects due to boundary electric potentials at dawn and dusk and at high latitude. In the evening a vortex of convection over the magnetic equator is established, of which the upward branch represents the pre-reversal enhancement (PRE) of the vertical drift around 18-19 magnetic local time. The PRE affects the height of the ionosphere, the latitude distribution of electron density, and the likelihood of plasma instabilities. An approximate minimization principle for the night-time convection helps explain its dependence on the winds and conductivities. F-region winds in the Equatorial Ionization Anomaly region determine most of the electrodynamics of the entire low-latitude region at night. After sunset eastward winds drive plasma convection that increases toward the east, and normally causes plasma to be drawn up across lower-altitude geomagnetic-field lines to produce the PRE. Cowling conductivity in the night-time E-region equatorial electrojet retards the upflow, making the PRE sensitive to variable and poorly known night-time ionization.

