Geophysical Research Abstracts, Vol. 8, 00480, 2006
SRef-ID: 1607-7962/gra/EGU06-A-00480

CLUSTER Observations of Polar Cap Field-Aligned Currents by Northward IMF

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During periods of northward or weak IMF, CLUSTER spacecraft detect many ionospheric upgoing electron beams at high altitudes $\sim$5 - 8 Re above the polar cap. Observations suggest that these electrons are accelerated by potential drops aligned along open magnetic field lines, stretched in the distant tail. These accelerative structures are generally narrow and spatially and temporally variable. The beam energy fluxes are intense and the upgoing electrons carry substantial downward currents. We determine the main characteristics of these upgoing electron beams (acceleration, potential drop, heating, ...) and we estimate the downward current density that they carry. The typical orders of magnitude of these estimates from CLUSTER observations are compared to results obtained in the auroral zone. Finally, we discuss the processes that are capable of producing these accelerated electron beams over the polar cap.