MOMENTUM TRANSFER ON OLD OPEN FIELD LINES AND THE ROLES OF THE IMF EAST-WEST COMPONENT (BY) AND CONDUCTIVITY GRADIENTS

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Using DMSP F13 data we investigate the newly discovered channels of enhanced antisunward convection occurring at the dawn (0600-0900 MLT) or dusk (1500-1800 MLT) flanks of the polar cap for the different combinations of IMF By polarity, hemisphere and the dawn/dusk sides. Dawn-side cases occur for the following combinations of hemisphere (NH/SH) and By polarity: NH-dawn/By > 0 and SH-dawn/By < 0. The dusk-side cases are: NH-dusk/By < 0 and SH-dusk/By > 0 .
The flow channels are placed in the context of particle precipitation regimes/boundaries and ionospheric conductivity gradients. They are found to be threaded by "old open field lines" characterized by polar rain precipitation.
In the dawn-side cases (NH-dawn/By > 0 and SH-dawn/By < 0) the polar rain contains the "solar wind strahl" component. The convection enhancement is attributed to the Pedersen current closure of Birkeland currents poleward of the R1/R2 currents.
This is momentum transfer from the solar wind via dynamo action at the high-latitude boundary layer (HBL). The conductivity gradient at the polar cap boundary contributes to establishing the convection channel and the enhancement of the dawn-dusk convection asymmetry extending beyond the dawn-dusk terminator during intervals of nonzero IMF By component. The HBL - ionosphere coupling via Birkeland currents is a source of dawn-dusk convection asymmetry and Svalgaard - Mansurov effect which comes in addition to the effect of magnetic tension acting on "newly open field lines".

Momentum, conductivity

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