

Direct observations of the full Dungey convection cycle in the polar ionosphere for southward IMF

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Tracking the formation and full evolution of polar cap ionization patches in the whole polar ionosphere, we directly observe the full Dungey convection cycle for southward interplanetary magnetic field (IMF) conditions. The patches were segmented from the tongue of ionization (TOI) at the equatorward edge of the cusp by the expansion and contraction of the polar cap boundary (PCB) due to the pulsed dayside magnetopause reconnection indicated by in-situ THEMIS observations. Convection leads to the patches entering the polar cap and being transported antisunward across the polar cap along the streamlines continuously monitored by the globally distributed arrays of GPS receivers and SuperDARN radars. The pulsed nightside reconnections, occurring as part of the magnetospheric substorm cycle, modulated the exit of the patches from the polar cap, as confirmed by the coordinated observations of the magnetometer at Tromsø and EISCAT Tromsø UHF Radar. After exiting the polar cap, the patches broke up into a number of plasma blobs, and returned sunward in the auroral flow of the dawn and/or dusk convection cell. The full evolution time, corresponding to the full circulation of energy and momentum from the solar wind to the magnetosphere, is about three hours.

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