



Swarm satellite and EISCAT radar observations of a plasma flow channel in the auroral oval near magnetic midnight

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We present a multi-instrument case study of ionospheric electrodynamics at high latitudes, showing formation of a high-speed plasma flow channel in the midnight sector. Plasma flow velocities within the channel reach 3300 m/s in the F-region and the flow channel is 1.5 deg wide in latitude. The flow channel is measured by both the Swarm satellite EFI instrument and the tri-static EISCAT incoherent scatter radar. The flow channel is located equatorward of the polar cap boundary within the dawn plasma convection cell. Hence, while the poleward part of the auroral oval in this event is electric field dominant with low conductivity and the flow channel, the equatorward part is conductivity dominant with at least five auroral arcs, indicated by Swarm magnetometer and ground-based all-sky camera measurements.

The flow channel is observed after a substorm onset during solar wind high-speed wind conditions. We suggest that the observed narrow flow channel, which is associated with a 13-kV horizontal potential difference, accommodates the increased nightside ionospheric plasma flows, produced by increased reconnection rate in the near-Earth magnetotail during the substorm expansion phase.