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Motion of the Polar Cap Arcs and Associated Plasma Flows

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Arc-like auroral structures in the polar cap often move in the dawn-dusk direction. Speeds of such motions vary between ~ 100 m/s and 2 km/s depending on the magnetic local time of observations. In the midnight sector, typical speeds of 300-500 m/s have been reported. We show that these values are somewhat larger than plasma flow speeds in the zonal direction typically observed by the Clyde River SuperDARN HF radar. This raises a question whether the zonal motion of the polar cap arcs is consistent with the projection of the ExB plasma velocity on the direction of the shift. In this study, we consider several events of the polar cap arc monitoring with the Resolute Bay 630 nm all-sky imager and concurrent measurements of the plasma flow with the PolarDARN/SuperDARN HF radars and Resolute Bay-North AMISR incoherent scatter radar to assess typical plasma flows established in the ionosphere while the arcs move through the common field-of-view. We show that the optical arcs zonal speed is close to the ExB velocity component. We also investigate the microstructure of plasma flows in the arcs' vicinity by adding to the large-scale SuperDARN convection patterns data from localized AMISR measurements. For one event, plasma density and magnetometer measurements on the SWARM satellite are added to estimate the location and intensity of the field-aligned currents.

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