

Highly structured FACs near the poleward boundary of the duskside auroral oval during geomagnetically quiet conditions

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The concentric rings of the Region 1 and Region 2 field-aligned current systems are well-defined large-scale features in the high-latitude ionosphere. The duskside part of the Region 1 sometimes has very strong current intensities, while the Region 1 can be extremely diminished mostly for northward IMF. In this study, using multispacecraft SWARM data and ground-based aurora imager data, we clarify the features of the highly structured field-aligned currents embedded in the diminished duskside Region 1. The magnetic field measurements from SWARM A and SWARM C after May 2014 are ideal for understanding the highly structured field-aligned currents because they are ~5 to ~10 s apart along track. By examining magnetic field data obtained by these satellites in the duskside sector during geomagnetically quiet conditions, we took many events in which relatively large amplitude small-scale (less than 100 km along track) variations are embedded in the diminished Region 1. We found that in almost all cases the relatively large amplitude small-scale variations are fairly well correlated between the SWARM A and lagged (~5 to ~10 s) SWARM C data. This indicates that the observed magnetic field variations represent the spatial structure of the multiple field-aligned currents, not the Alfvén wave. There is no doubt that several pairs of upward/downward field-aligned currents occur in the diminished Region 1. Examination of the all-sky imager data obtained at Longyearbyen, Svalbard during the passage of SWARM A and SWARM C through the field-of-view of the all-sky imager reveals that those multiple pairs of the field-aligned currents were in the region of the modest auroral intensification near the poleward boundary of the auroral oval. DMSP particle observations are also consistent with the existence of the multiple field-aligned current pairs. We will show the occurrence characteristics of the highly structured field-aligned currents in the duskside Region 1, and discuss the possibility of the generation of the multiple pairs of the field-aligned currents in the low-latitude boundary layer.