

Space Technology 5 (ST-5) Multipoint Observations of Temporal and Spatial

Variability of Field-aligned Currents

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Space Technology 5 (ST-5) is a three micro-satellite constellation deployed into a 300 x 4500 km, dawn-dusk, sun-synchronous polar orbit from March 22 to June 21, 2006, for technology validations. In this paper, we present a study of the temporal variability of field-aligned currents using multi-point magnetic field measurements from ST5. The data demonstrate that masoscale current structures are commonly embedded within large-scale field-aligned current sheets. The meso-scale current structures are very dynamic with highly variable current density and/or polarity in time scales of about 10 min. They exhibit large temporal variations during both quiet and disturbed times in such time scales. On the other hand, the data also shown that the time scales for the currents to be relatively stable are about 1 min for meso-scale currents and about 10 min for large scale current sheets. These temporal features are obviously associated with dynamic variations of their particle carriers (mainly electrons) as they respond to the variations of the parallel electric field in auroral acceleration region. The characteristic time scales for the temporal variability of meso-scale field-aligned currents are found to be consistent with those of auroral parallel electric field.