



In-situ observation of electron kappa distributions associated with discrete auroral arcs

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The Medium-energy Electron SPectrometer (MESP) sensor aboard a NASA sounding rocket was launched from Poker Flat Research Range on 3 March 2014 as a part of Ground-to-Rocket Electrodynamics-Electrons Correlative Experiment (GREECE) mission. GREECE targeted to discover convergent E-field structures at low altitude ionosphere to find their contribution to the rapid fluid-like structures of aurora, and MESP successfully measured the precipitating electrons from 2 to 200 keV within multiple discrete auroral arcs with the apogee of 350 km. MESP's unprecedented electron energy acceptance and high geometric factor made it possible to investigate precise populations of the suprathermal components measured in the inverted-V type electron energy distributions. The feature of these suprathermal electrons are explained by the kappa distribution functions with the parameters (density, temperature, and kappa) consistent with the near-Earth tail plasma sheet, suggesting the source population of the auroral electrons. The kappa-values are different between each arc observed as a function of latitude, but are almost stable within one discrete arc. We suggest that this transition of kappa reflects the propagation history of source electrons through the plasma sheet by changing its state from non-equilibrium electron distributions to thermal ones.