Geophysical Research Abstracts
Vol. 14, EGU2012-1384, 2012
EGU General Assembly 2012

First results of phase space density radial distributions through the outer radiation belt using THEMIS-SST

D. L. Turner (1), V. Angelopoulos (1), Y. Shprits (2), P. Cruce (1), and D. Larson (3)

(1) Dept. of Earth and Space Sciences, Univ. of California, Los Angeles, United States (dturner@igpp.ucla.edu), (2) Dept. of Atmospheric and Oceanic Sciences, Univ. of California, Los Angeles, United States, (3) Space Sciences Laboratory, Univ. of California, Berkeley, United States

Here, we present new results demonstrating the important relationship between electrons in Earth's plasmasheet and the outer electron radiation belt using data from the newly characterized and calibrated THEMIS-SST instruments. We first demonstrate that the SST instruments are fully capable of measuring outer radiation belt electrons throughout the outer belt zone with energies ranging from ∼300 keV to greater than 1 MeV. Beyond geosynchronous orbit and into the plasma sheet, the current SST dataset provides electron measurements from as low as 30 keV.

We show how instrument characterization was performed using Geant4 simulations of energetic particle interactions in a detailed model of the SST instrument. These simulations provide instrument response functions, which normally are produced by testing the actual instruments in particle beams but were never fully completed for SST. We also briefly discuss how the data have also been recently calibrated to provide accurate pitch angle distributions.

With these new data, and taking advantage of THEMIS' near equatorial, high apogee orbits, we present reconstructed radial distributions (i.e. in terms of the third adiabatic invariant, L*) of electron phase space densities (PSD) for fixed first and second adiabatic invariants. Interestingly, these distributions reveal: 1) that the PSD gradients in L* are energy-dependent beyond GEO, they are often positive for electrons below a few hundred keV but negative for electrons with energy above this; and 2) the PSD distribution for relativistic electrons has a peak near the heart of the belt (L* $\sim$ 5). These results are consistent with several previous studies that used data from different missions, which further confirms the effectiveness of the SST characterization and calibrations. Most importantly, these results demonstrate how a seed population of 10's to low-100's of keV electrons are injected into the outer belt zone from a source in the plasma sheet and subsequently accelerated to relativistic energy via a localized acceleration mechanism. We conclude with a discussion of the picture this leaves us with as we prepare to enter the Radiation Belt Storm Probes (RBSP) era and how, by observing the electron populations beyond GEO and into the plasmasheet, THEMIS will play a critical role in exploring RBSP's scientific goals.