Field-aligned energetic electrons during the storm of July 24, 2004: Cluster RAPID observations

J. Roeder (1), J. Fennell (1), T. Mulligan (1), A. Korth (2)

(1) The Aerospace Corporation, Los Angeles, California, USA, (2) Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany (james.roeder@aero.org)

Observations by the Cluster constellation of spacecraft in the magnetotail are used to characterize the magnetic field-aligned energetic electrons during the main phase of the geomagnetic storm of July 24, 2004. The storm on this date reached a minimum Dst of -148 nT, and was the third in a sequence of storms during July 2004. Cluster made a pass through the night side of the Earth's magnetosphere during a nine-hour interval (1500-2400 UT) in the early part of the storm main phase. The RAPID Imaging Electron Spectrometer on the Cluster satellites made 3-d measurements of the electrons at energies in the range 52-400 keV during this time. Intense field-aligned distributions of electrons in this energy range were detected intermittently throughout the pass. Several of these episodes had continuous field-aligned electron signatures for as long as 30 minutes, despite large variations in the measured magnetic field direction. Such field-aligned electrons are usually observed for extremely short bursts, like the 50-s event reported by Taylor et al. [2006]. The conventional interpretation is the electrons are accelerated in the reconnection region and stream outward along the magnetic field lines to the observation point. The electrons are detected only momentarily when the spacecraft is on the field line connected to the X-line. The long-duration events observed on July 24th imply that acceleration process associated with the reconnection region expanded to a larger volume, or that an entirely different mechanism is responsible for the field-aligned energetic electrons.