CLUSTER OBSERVATIONS OF GEOMAGNETIC STORMS AND OF MAGNETOSPHERIC SUBSTORM BEHAVIOR IN THE NEAR- AND MID-TAIL REGIONS

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The Cluster constellation of spacecraft have returned a wealth of new data on particle and field variations in the near- and mid-magnetotail regions of Earth's magnetosphere. Using the Research with Adaptive Particle Imaging Detectors (RAPID) systems onboard the four Cluster vehicles, we have identified substorm-related energetic (E > 20 keV) electron enhancement events during the period March 2001 through October 2001 in the geocentric radial range of 4 to 19 Earth radii. We have used concurrent data from other Cluster instruments as well as from the IMAGE, FAST, GPS, and geostationary orbit spacecraft in order to understand particle injection and transport phenomena throughout this key region of the magnetotail. One particularly striking event during a major geomagnetic storm on 31 March 2001 showed a dispersionless electron injection event in as close to the Earth as 4 Re. More normal electron enhancements in the plasma sheet at intermediate radial distances are also studied in a global substorm context. A particularly well-observed substorm case occurred on August 27, 2001 when CLUSTER was almost exactly in the midnight meridian and complementary data were available from IMAGE, POLAR, GOES-8, and the LANL satellites. We find evidence that CLUSTER was very near the near-Earth substorm neutral line and that magnetic reconnection began some seven minutes prior to the substorm auroral brightening of the expansive phase onset.