Multipoint observations of energetic particle injections with NASA’s MMS and Van Allen Probes missions: Impacts on wave activity and radiation belt electrons

Between March and September of 2016, the orbits of NASA’s Magnetospheric Multiscale (MMS) and Van Allen Probes missions overlapped on the dawn side of the near-equatorial magnetosphere, a region ideal for studying injections of 10s to 100s of keV electrons from the plasma sheet into the inner magnetosphere. During this period, the four MMS spacecraft also underwent a series of conjunctions with both Van Allen Probes, including several in which all six spacecraft were within 1 Earth radii of each other. From such multipoint observations, we investigate the connection between Earth’s magnetotail and inner magnetosphere via dipolarization events and the energetic particle injections associated with them. Using the multipoint MMS data, we show how dipolarization fronts surge earthwards through the tail at 100s of kilometers per second, corresponding to strong electric fields that accelerate energetic particles and transport them earthward. Combining MMS with Van Allen Probes, we are able to estimate the transport of particles over larger spatial scales (macroscopic view) and multipoint observations of wave activity during close conjunctions (microscopic view). With such observations, we examine and report on new perspectives concerning the role of energetic electron injections as the seed populations of Earth’s outer radiation belt electrons as well as the relationship between freshly injected electrons and chorus and ultra-low frequency (ULF) wave activity.