URSI - RCRS 2022, IIT (Indore), India, 1 - 4 December, 2022

Multi-scale analysis of the Magnetic reconnection events using multi-spacecraft observations during 31 December 2015 geomagnetic storm

Sritam Hajra[(1)] and N. Dashora[(1)]
(1) National Atmospheric Research Laboratory, Gadanki, India – 517112
e-mail: sritam@narl.gov.in; ndashora@narl.gov.in

This study presents a unique analysis of the coordinated observations from the MMS, Cluster and THEMIS spacecraft during an intense geomagnetic storm on 31 December 2015. The meeting of the spacecrafts with magnetic reconnection regions is the focus of the analysis. An investigation is carried out to understand the intricacies of both the small (less than 20 minutes) and large-scale (8 hours) processes associated with the magnetic reconnection.

The major outcomes of this study reveal that at the reconnection sites in the magnetotail, a major contribution to the FAC (field aligned current) comes from the anti-parallel electrons. However, the ion contribution to the FAC is enhanced at sites at the magnetopause. The majority of the electron population is found to shift towards the mid (0.2-2 keV) and high-energy (2-30 keV) range during the reconnection. In context to the total electric field, the Hall term is found to be the major contributor during magnetic reconnection whereas, the pressure divergence term becomes significant during later phases of the storm. Large scale continuous observations show a dominance of magnetic (plasma) properties over plasma (magnetic) properties in the magnetotail (magnetopause). However, the large conversion of magnetic to plasma energy is found only during the reconnection events in the magnetopause. The magnetotail (magnetopause) is found to be highly dynamic with higher (lower) levels of the electric and magnetic field, ion and electron temperature, and simultaneous lower (higher) levels of plasma density, energy flux, and FACs. A possible implication on the ionosphere will also be presented.