Geophysical Research Abstracts
Vol. 18, EGU2016-13754, 2016
EGU General Assembly 2016

Multi-Spacecraft Analysis of Plasma Jet Events and Associated Whistler-Wave Emissions using MMS Data

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Plasma jets aka bursty bulk flows play a crucial role in Earth's plasmasheet dynamics, in particular during substorms where they can sometimes even penetrate down to the geosynchronous orbit. The energy input from the solar wind is partly dissipated in jet fronts(also called dipolarization fronts) in the form of strong whistler waves that can heat and accelerate energetic electrons. The ratio of the energy transported during jets to the substorm energy consumption is still under debate due to instrumental limitations. In May 2015 the Magnetospheric Multiscale (MMS) mission evolves in a string-of-pearls configuration with an average inter-satellite distance of 300 km which allows us to study in detail the microphysics of these phenomena. Thus in this study we employ MMS data to investigate the properties of jet fronts propagating earthward and their associated whistler-mode wave emissions. We show that the spatial dynamics of jet fronts are of the order of the ion gyroradius and whistler-wave dynamics have a temporal scale of a few seconds. We also investigate the energy dissipation associated with such waves and their interaction with energetic electrons in the vicinity of the flow/jet braking region. In addition, we make use of ray tracing simulations to evaluate their propagation properties, as well as their impact on particles in the off-equatorial magnetosphere.