Geophysical Research Abstracts
Vol. 21, EGU2019-11313, 2019
EGU General Assembly 2019
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A Survey of Plasma Waves in the Dayside Reconnection Layer

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One of the major un-resolved questions regarding the magnetic reconnection phenomenon is how plasma waves impact the process. In 2015, NASA launched the four-satellite Magnetospheric Multi-scale (MMS) mission to study magnetic reconnection, especially on the electron scale. Since launch, it has identified several wave modes that occur near the dayside reconnection x-line. These include large amplitude parallel electrostatic waves [e.g. Ergun et al., 2016], whistler-mode waves [Wilder et al., 2016; Le Contel et al., 2016], Lower-Hybrid waves [Graham et al., 2017] and turbulence associated with a corrugated current structure [Ergun et al., 2017]. We survey 30 of the electron diffusion region (EDR) events observed by MMS at the dayside magnetopause [Webster et al., 2018] to help understand how these wave modes impact the reconnection process. Common wave modes are identified, as well as their typical location within the ¬reconnection layer (e.g. EDR, ion diffusion region, separatrix, inflow and outflow jet). We find that, with a few exceptions, whistlers are most commonly confined to the separatrices in the exhaust region. Lower-hybrid waves are found on the magnetosphere side of the current layer and don't make it to the dissipation region. The wave modes typically closest to the dissipation region are the corrugated current structures and large amplitude parallel electrostatic waves.