Geophysical Research Abstracts
Vol. 13, EGU2011-7361, 2011
EGU General Assembly 2011

Three-dimensional non-steady magnetic reconnection signatures: Model and observations

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In the current work we consider the process of magnetic reconnection in the Earth magnetotail. As reconnection is a locally initiated process, its onset characteristics are difficult to be measured in-situ. However, signatures of reconnection are frequently observed in the Earth magnetotail. One compulsory consequence of the reconnection is the appearance of fast plasma flows. These flows result in specific disturbances of the plasma parameters in the ambient medium. We develop a method to estimate the reconnected magnetic flux, the location of the ion diffusion region and the length of the X-line from the properties of magnetic field and plasma velocity fluctuations in the surrounding regions of this plasma flow. We present a 3D time dependent reconnection model where the X-line has a finite length. In this framework, reconnection in a thin current layer is investigated theoretically. We obtain a system of equations connecting the fluctuations of the magnetic field and plasma flow with the reconnection characteristics. These equations allow an estimation of the global reconnection parameters from one-point temporal measurements of the magnetic field and plasma flows. We show here the theoretical result and its application on the THEMIS data for the specific reconnection signatures in the distant magnetotail.