

Relationships between near-earth tail substorm signatures and ground substorm/Pi 2 onsets

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Relationships between onsets of substorm signatures, such as dipole-like magnetic field changes, fast plasma flows and plasma injections observed in the near-Earth magnetotail in the midnight region and those of ground substorm or Pi 2's are studied. Present study is only a case study, in which a substorm event, consisting of successive two occurrences of plasma flows in the magnetotail is studied. The results are as follows, i.e., the first earthward plasma flow was observed with a high speed in excess of 570 km/s at $L = 10$ in the midnight magnetotail, which brought only an onset of Pi 2 oscillations on the ground only near the sub-auroral latitudes. While, the second plasma flow, which was observed 12 minutes later than the observation of the first plasma flow, brought at first an onset of negative bay at high latitude ground stations and successive development of substorm activity. However, the onset of the negative bay began two minutes before the observation of the second plasma flow in the magnetotail at $L = 10$, and the onset of low latitude Pi 2 and/or a simultaneous occurrence of positive bay began three minutes later than the onset of the negative bay. From these results where the substorm should be triggered in the magnetotail, earthward or tailward compared with the observation point, i.e., the satellite location at $L = 10$, and onsets of substorm and/or Pi 2 on the ground from high to low latitudes are discussed in relation to the plasma flow in the magnetotail.