

Substorm Induced Nighttime Plasma Flow Pulsations Observed by ROCSAT-1 at Topside Ionosphere

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The Republic of China Satellite-1 (ROCSAT-1) orbiting at 600 km topside ionosphere has observed the topside ionospheric plasma flow pulsations induced by the substorm onsets. These pulsation events indicated that the plasma flow pulsations mainly oscillate in the two mutually perpendicular directions with respect to the geomagnetic field lines. The field-aligned flow as well as the ion density indicates almost no variation. This implies that the pulsation events are of Alfvén wave in nature. The Hilbert-Huang transform (HHT) analysis is applied to study the dominant wave frequencies and polarizations in the two perpendicular components of plasma flow oscillations (equivalent to the perturbed electric/magnetic fields). The hodograms of the polarization in the Pi1 frequency range is shown to be linearly polarized, while the left-handed polarization is seen in the Pi2 frequencies that are in harmonic relationship with the Pi1 frequency. These plasma flow pulsations in the nighttime topside ionosphere are caused by the field-line-resonances of the magnetic field pulsations that are converted from the inward propagated compressional disturbance across the nighttime magnetosphere/plasmasphere. The origin of the compressional disturbances is at the near-Earth magnetotail region during the substorm onset. Examples of the observed plasma flow oscillations further show direct correlations in the oscillation wave forms with the midlatitude geomagnetic variations in the ground ASY-H and ASY-D indices.

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