

Geotail 衛星によって磁気圏尾部で観測された大振幅 Alfvén wave の統計解析 (4) 磁気圏の諸現象との関連

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Large-Amplitude Alfvén Waves Observed in the Magnetotail and Associated Magnetospheric Signature

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Alfvén waves in the magnetotail are considered to be associated with the auroral activity at the ionospheric altitudes. We have investigated the electric and magnetic field variations measured by Geotail in the mid-tail region, 10-30 Re, for 4 years, from 1997 to 2000. We found large-amplitude electric field fluctuations, which have peaks over 10 mV/m, and the corresponding magnetic field fluctuations having the components perpendicular to the ambient magnetic field. We made linear fitting analysis between the electric and magnetic fields, and identified these fluctuations as Alfvén waves from the comparison of the local Alfvén speed with the ratio between the electric and magnetic field amplitudes. The large-amplitude Alfvén waves propagate in the direction coinciding with the plasma flow, which is often earthward in the distances of 10-25 Re, and tailward at > 25 Re.

Large fraction of the Alfvén-wave events coincides with (1) ion beams or (2) dipolarization. It suggests that Alfvén waves are excited by cyclotron instability or the change of the magnetospheric shape. Large Poynting flux events (> 0.04 W/m²) are always found with ion beams. Since the probability of Alfvén waves with large Poynting flux decreases with approaching to the earth, the wave energy is suggested to dissipate in the short time after the decay of the sunward ion beam. The plasma sheet may be heated by the Alfvén waves, though the energy flux is not so much as it supplies constantly the thermal energy of the plasma sheet. Alfvén waves are often associated with the magnetic dipolarization in the near-tail -5Re<X<-15Re. The Poynting flux is relatively small, < 0.04 W/m².