

MULTIPLE-HARMONIC ULF WAVES IN THE PLASMA SHEET BOUNDARY LAYER OBSERVED BY CLUSTER

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The passage of the Cluster satellites in a polar orbit through Earth's magnetotail has provided numerous observations of harmonically related Pc 1-2 ULF wave events, with the fundamental near the local proton cyclotron frequency. Broughton et al. [JGR 2008] reported observations by Cluster of three such events in the plasma sheet boundary layer, and used the wave telescope technique to determine wave propagation nearly perpendicular to B_0 . We report here on a survey of the entire set of Cluster observations in Earth's magnetotail during 2003: 34 harmonically related wave events were observed during 13 of the 42 tail passes of Cluster from July 22 to October 28. Event durations were commonly < 5 min, but ranged up to 40 min. Wave events were distributed rather evenly from $-7 R_E$ out to the Cluster apogee distance of $-18 R_E$, with one event also observed at $X = -4 R_E$. The distribution in the YGSE coordinate was also rather even but asymmetric, between -9 and $+17 R_E$. Events occurred for ZGSE values from -10 to $-3 R_E$ and $+3$ to $+7 R_E$; i.e., none was observed for $|Z| < 3 R_E$. Each wave event was associated with signatures of the PSBL in the CIS instrument: elevated fluxes of ions with energies from 1 keV to over 30 keV, and highly variable, often counterstreaming ion velocities.

Magnetotail, ULF Waves, Plasma Sheet Boundary Layer

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