SURVEY OF MAGNETOSONIC WAVES AND PROTON RING DISTRIBUTIONS IN THE EARTH'S INNER MAGNETOSPHERE

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Fast magnetosonic waves can lead to the local acceleration of electrons from ~10 keV up to a few MeV on a timescale of 1-2 days and may play an important role in radiation belt dynamics. Here we present a survey of wave and particle data from the Combined Release and Radiation Effects Satellite (CRRES) to determine the global morphology of the waves as a function of magnetic activity, and to investigate the role of proton rings as a potential source mechanism. The intensity of fast magnetosonic waves in the frequency range $0.5f_{LHR} < f < f_{LHR}$ increases with increasing magnetic activity suggesting they are related to periods of enhanced convection and/or substorm activity. They are observed at most magnetic local times (MLT) outside the plasmapause but are restricted to the dusk sector inside the plasmapause. The MLT distribution of low energy proton rings (E_R < 30 keV) with energies exceeding the Alfvén energy ($E_R > E_A$) required for instability closely matches the distribution of magnetosonic waves on the dusk side, both inside and outside the plasmapause, suggesting that low energy proton rings are a likely source of energy driving the waves. However, intense magnetosonic waves are also observed outside the plasmapause on the dawn-side that do not satisfy ($E_R > E_A$). Although proton rings with E_R>30 keV could drive the instabilities, the source of these waves is yet to be properly identified. Since fast magnetosonic waves can accelerate electrons we suggest that they may provide a significant energy transfer process between the ring current and the outer electron radiation belt.