Global Characteristics of Electromagnetic Ion Cyclotron Waves: AMPTE/CCE observations

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We statistically examine the occurrence rate of electromagnetic ion cyclotron (EMIC) waves in the magnetosphere observed by AMPTE/CCE. We use the 8-Hz magnetic field dataset that covers the whole CCE mission period of nearly 4.5 years (August 1984 to January 1989), which is more than three times the period studied by Anderson et al. [1992] (˜452 days). The large data volume allows us to evaluate the storm dependence of the spatial occurrence pattern of EMIC waves. The results show that H-band events occur frequently in the outer magnetosphere (L smaller than 7) in the afternoon sector, regardless of geomagnetic activity. Under quiet conditions, H-band events also occur in the outer magnetosphere on the morning side (MLT = 4 - 8h). He-band events frequently occur in the inner magnetosphere (L smaller than 7) on the pre-noon to dusk side (MLT = 10 - 19h) under disturbed conditions (Dst smaller than -50 nT). The storm-time He-band waves are generated more frequently during the storm main phase than the recovery phase, with the main-phase wave excitation seen toward the afternoon-side outer magnetosphere (L greater than 7). The results indicate two independent major processes that cause EMIC wave excitation: one externally triggers H-band waves on the dayside, and the other internally excites He-band waves on the dusk to afternoon side. We suggest that the former is due to solar wind compression which leads to perpendicular adiabatic ion heating and in turn an increase in the temperature anisotropy, and that the latter is caused by injections of new, highly energetic ion population from the plasma sheet, with its velocity distributions becoming pancake-like on the dusk-to-afternoon side. The occurrence pattern of He-band waves during the main phase strongly suggests that the sunward surge of the plasmasphere and plasma plumes are one of the EMIC wave generation regions associated with injected energetic ions. In this paper, we will also discuss wave properties such as wave power, spectral width, and polarization for each type of EMIC waves.