Statistical analyses of UHR and Z-mode waves observed in the equatorial region of the plasmasphere

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In order to investigate distributions of upper hybrid resonance (UHR) and Z-mode waves frequently observed in the equatorial region of the plasmasphere, statistical studies have been performed by using plasma waves and sounder (PWS) system [Oya et al., 1990] on board the Akebono satellite. To obtain UHR and Z-mode wave intensity, we have developed the intensity data of 7-years UHR and Z-mode waves for statistical analyses based on automatically determined electron cyclotron frequencies, Z-mode cut-off frequency, plasma frequency, and UHR frequency.

It has been clarified by statistical studies that both UHR and Z-mode waves intensify within 5 degrees of geomagnetic latitudes in an altitude range of 2000-10500 km with no obvious local time dependence. Furthermore, these waves extend in a geomagnetic latitude range of 10 degrees within 1 day after the onsets of geomagnetic disturbances. On the other hand, during the geomagnetic quiet times, these intensified waves localize within a geomagnetic latitude range of 3 degrees.

The statistical analysis results that UHR and Z-mode waves have been observed in the same regions, suggest that these waves are caused by some common sources. However, since Z-mode waves as intense as UHR waves, it does not seem that Z-mode waves are produced by mode conversion processes from UHR waves. It is possible that ring current particles are sources of intense Z-mode and UHR waves. If these particles are injected to the inner plasmasphere during the magnetic disturbances, and continue to drift around the earth during the recovery phases of magnetic storms, they can become the free energy sources of plasma waves.

Based on the magnetic field data observed by the magnetic field detector (MGF) [Fukunishi et al., 1990], we have found that Bz and Br components sometimes decrease about 50 nT from IGRF model magnetic fields in the geomagnetic equatorial region of the plasmasphere during the geomagnetic quiet times. It suggests that there are particles drifting in the plasmasphere in the geomagnetic equatorial region of the plasmasphere even during quiet times, which generate intense Z-mode and UHR waves.