A two-dimensional simulation of whistler-mode waves propagating in the dipole magnetic field

Yuto Katoh[1]
[1] Dept. Geophys., Grad. Sch. Sci., Tohoku Univ.

Whistler-mode chorus emissions are observed in the Earth's inner magnetosphere mostly on the dawn side and are enhanced during geomagnetically disturbed periods. Chorus emissions are typically observed in the frequency range of 0.2 to 0.8 f_{e0} with a gap at the half f_{e0}, where f_{e0} represents the electron cyclotron frequency at the magnetic equator. Components of emissions in the frequency range lower and higher than 0.5 f_{e0} are respectively called the lower-band and upper-band chorus emissions. The gap at 0.5 f_{e0} has been understood by the difference of the propagation characteristics of whistler-mode waves of frequency higher or lower than 0.5 f_{e0} propagating along the field aligned ducts of enhanced/depleted plasma density [e.g., Bell et al., 2009]. The difference of the characteristics of upper-band and lower-band chorus emissions has been explained by the different propagation properties of whistler-mode waves of different wave frequency.

For the discussion of interactions of energetic electrons with chorus emissions in the dipole magnetic field, we have developed a two-dimensional simulation code in the dipole coordinate system. In this presentation we show results of the simulation of the whistler-mode wave propagation in the dipole magnetic field. We assume the wave source of whistler-mode waves in the equatorial region of the magnetosphere. We also treat whistler-mode waves of rising/falling tones which are often observed in frequency spectra of chorus emissions. By assuming a cold plasma density distribution with a spatial gradient in both latitudinal and radial direction in the dipole magnetic field, we study the difference of propagation properties of whistler-mode waves of different wave frequency. In addition, we solve the motion of energetic electrons in the dipole field simultaneously computing with the propagation of whistler-mode waves and study the effect of cyclotron resonant interactions on the dynamics of energetic electrons.