A simulation study of competing processes in generation of equatorial plasma waves

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There are various modes of plasma waves in the equatorial region of the magnetosphere, such as whistler mode, electrostatic and electromagnetic waves. From simultaneous observations of plasma waves and energetic particles, it has been shown that these emissions are related to the existence of unstable velocity distributions of particles localized in the equatorial regions [e.g., Kurth et al., 1980]. Especially during geomagnetically disturbed periods, these plasma waves are intensified in a narrow latitude range around the geomagnetic equator [e.g., Kasahara et al., 1992; Green et al., 2004], and free energy sources are expected to be fed by the strong wave-particle interactions in the equatorial region. Nishimura et al. (2007) conducted linear analyses for the generation process of Z-mode waves in the equatorial plasmasphere by considering cyclotron resonant interactions with energetic electrons having a ring-type velocity distribution. While they showed that positive linear growth rates are obtained in Z-mode and whistler-mode branches, the linear and nonlinear evolution of waves and resultant wave power should be examined. In the present study, by performing numerical experiments, we investigate the wave-particle interaction between energetic electrons with ring-type velocity distributions. Based on the simulation results and the comparison with the observation results, we discuss competing processes in the generation of equatorial plasma waves. We perform simulations by using Electron Hybrid Code [Katoh, 2003]. First we have carried out a two-dimensional simulation by assuming the same physical parameters used in Nishimura et al., and discuss the resultant wave characteristics through the competing of wave excitation processes of Z-mode and whistler-mode waves. Next we have conducted simulations using initial parameters derived from typical cases of observation results by the Akebono satellite. We compare the simulation results with the observed wave power of equatorial plasma waves so as to discuss the efficiency of the wave generation process in the equatorial magnetosphere.