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Empirical wave power models of whistler-mode chorus waves deduced from the Arase observation

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Whistler mode chorus waves play crucial roles in the Earth's inner magnetosphere dynamics through wave-particle interactions. In particular, stochastic acceleration by chorus waves is responsible for the creation of relativistic electrons in the Earth's outer radiation belt during geomagnetic disturbances. The quasi-linear diffusion regime can describe the stochastic acceleration, and modeling works based on that regime successfully reproduce observed flux increase in radiation belt electrons during geomagnetic disturbances. The quasi-linear diffusion model of chorus waves requires information on wave power and the normal angle of chorus waves, which significantly changes the timescale for the acceleration of relativistic electrons. The model describes the wave power distribution as a function of frequency using a Gaussian function. The magnetic latitude dependence of this distribution needs to be incorporated into the model to correctly evaluate stochastic acceleration of electrons during the propagation of chorus waves from the magnetic equator to higher latitudes.

We aim to develop the empirical chorus wave model based on the Arase satellite observation, which describes the wave power distribution as a function of L^* , magnetic latitude, and magnetic local time. We have statistically investigated the frequency spectra of wave magnetic fields obtained by the Onboard Frequency Analyzer (OFA), a part of the Plasma Wave Experiment onboard the Arase satellite. The wave power of chorus waves is derived from the OFA-SPEC dataset, and the wave power is modeled so that the parameter can be used as input for the quasi-linear diffusion model. We report on the integrated wave power distributions of lower-band and upper-band chorus waves as a function of L^* , MLAT, and MLT. We derived the wave power distributions of the waves with and without wave power close to the instrument noise level. The input parameters of the quasi-linear diffusion model are derived from the obtained distributions. We will discuss the use case of the chorus wave models with and without the wave power close to the instrument noise level, together with quasi-linear diffusion rates evaluated from the wave power obtained from the constructed models.