Pitch angle evolutions of relativistic electrons in the radiation belt during magnetic storm periods

Yukitoshi Nishimura[1]; Atsuki Shinbori[2]; Takayuki Ono[3]; Masahide Iizima[4]; Atsushi Kumamoto[5]; Akira Morioka[6]

[1] Geophysics Sci.,Tohoku Univ; [2] Geophys. Inst., Tohoku Univ.; [3] Department of Astronomy and Geophysics, Tohoku Univ.; [4] Geophysical Inst., Tohoku Univ.; [5] Tohoku Univ.; [6] Planet. Plasma and Atmos. Res. Cent.,Tohoku Univ.

The storm-time evolution of pitch angle distributions of relativistic electrons in the radiation belt were investigated based on electron flux data in a energy range of more than 2.5 MeV and 300-950 keV obtained in a period of 1989-1998 by the radiation monitor (RDM) instrument [Takagi et al., 1993] on board the Akebono satellite. Pitch angle distributions of these relativistic electrons showed a change from the pancake-type distribution to the dumbbell-type distribution during a magnetic disturbance in a period from March 10 to March 18, 1989. The minimum values of the flux anisotropy parameter, A, which is defined by A=j(90deg)/[(j(45deg)+j(135deg))/2], and their location of L-value have strong dependence on the intensity of the magnetic storms. Strong dumbbell distributions with A less than 0.9 showed a tendency to appear in the inner L-shell during the periods of intense magnetic storms. Under the conservation of the first and third adiabatic invariants, the variation of the more than 2.5 MeV electron flux anisotropy parameter can be produced by the decrease of ambient magnetic field at the beginning of the recovery phase. However, it cannot be explained only by adiabatic processes that dumbbell distribution are kept during the recovery phase. In addition, the anisotropy parameter A of the 300-950 keV electron is quite different from expected value. These results suggest that the dumbbell distributions are generated by the process of the adiabatic cooling due to the decrease of the ambient magnetic field intensity associated with the development of the ring current.