Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM08-P02 Room:Convention Hall Time:May 26 18:15-19:30

The energy dependent enhancements of radiation belt electrons during weak magnetic storms: Van Allen Probes observations

MATSUO, Taketo[1*] ; KATOH, Yuto[1] ; KUMAMOTO, Atsushi[1] ; BAKER, Daniel[2] ; REEVES, Geoff[3] ; CRAIG, Kletzing[4] ; KANEKAL, Shri[2] ; JAYNES, Allison[5] ; SPENCE, Harlan[6]

[1]Department of Geophysics, Graduate School of Science, Tohoku University, [2]Laboratory for Atmospheric and Space Physics, University of Colorado, [3]Los Alamos National Laboratory, [4]Department of Physics and Astronomy, University of Iowa, [5]Goddard Space Flight Center, NASA, [6]Center for Earth, Oceans, and Space, University of New Hampshire

By analyzing in situ observation results by Van Allen Probes, we study the spatial and temporal evolution of the phase space density (PSD) of radiation belt electrons, the plasma environment, and plasma wave activities in the Earth ′ s inner magnetosphere during weak geomagnetic storms.

Radiation belts are the region where relativistic particles are trapped by Earth ′ s magnetic field. In general, the flux of outer radiation belt electrons decreases during the main phase of geomagnetic storms, while the flux variations during the recovery phase are observed differently in each storm [Reeves et al., 2003]. The variation of the flux of radiation belt electrons also occurs during weak storms (Dst˜-50nT), and we expect that the variation of radiation belt electrons can be clearly identified by analyzing the formation process during weak storms.

In the present study, we analyze Van Allen Probes observation data measured during 24 April 2013 storm. The minimum Dst index is -50 nT in this event. We use the flux of relativistic electrons measured by the Relativistic Electron-Proton Telescope (REPT) [Baker et al., 2012] and Magnetic Electron Ion Spectrometer (MagEIS)[Blake et al., 2012]. We also analyze plasma wave and background magnetic field data measured by Electric and Magnetic Field Instrument Suite and Integrated Science (EMFISIS) [Kletzing et al., 2012]. The second invariant K and the third invariant L$*$used in the present study are provided by the ECT Science Operations Center.

First, we analyze the radial distribution of PSD for particles of different first adiabatic invariants during the storm event. We also analyze wave magnetic field intensity of plasma waves in the frequency range from 0.1 fce to 0.5 fce, where fce is the cyclotron frequency of electrons, corresponding to the typical frequency range of lower-band whistler-mode chorus emissions. By comparing the analyzed data, we find that the activities of chorus emissions enhance concurrent with the timing of the PSD increase of relativistic electrons, suggesting a close relationship between them. We also identify two-step enhancements of relativistic electrons during this event. We find at the first step that the PSD of electrons in 1 MeV or less ($\mu \leqq 600$) enhances during the early recovery phase and at the second step that the PSD of electrons of several MeV increases simultaneously during the late recovery phase. To examine the PSD variation quantitatively, we analyze the ratio of the PSD from L$*$= 4.2 to L$*$= 5.0. We then find at the first step during the early recovery phase that the PSD of electrons of 1 MeV or less ($\mu \leqq 600$) increases more than that of the prestorm level. On the other hand, the PSD of electrons in several MeV did not increase to the pre-storm level during the early recovery phase but increases more than 10 times of magnitude larger than the pre-storm level during the late recovery phase. To understand the identified energy dependence in detail, we analyze details of the plasma environment in the inner magnetosphere, the correspondence between the PSD enhancements and the plasma wave activities, and the spectral characteristics of whistler-mode chorus during the event.

Keywords: radiation belt, magnetic storm, Van Allen Probes, whistler mode chorus