Rapid acceleration of outer radiation belt electrons associated with solar wind pressure pulse : A coupling simulation of GEMSIS-RB and GEMSIS-GM

*林 昌広[1]、三好 由純[1]、齊藤 慎司[1]、松本 洋介[2]、桂華 邦裕[3]、堀 智昭[3]、天野 孝伸[3]、関 華奈子[3]、町田 忍[1]
*Masahiro Hayashi[1], Yoshizumi Miyoshi[1], Shinji Saito[1], Yosuke Matsumoto[2], Kunihiro Keika[3], Tomoaki Hori[3], Takanobu Amano[3], Kanako Seki[3], Shinobu Machida[1]

1. 名古屋大学宇宙地球環境研究所、2. 千葉大学、3. 東京大学
1. Institute for Space-Earth Environmental Research,Nagoya University, 2. Chiba University, 3. University of Tokyo

Relativistic electron fluxes of the outer radiation belt dynamically change in response to solar wind variations. There are several time scales for the particle acceleration in MeV energy range. One of the shortest acceleration processes is wave-particle interactions between drifting electrons and fast-mode waves induced by compression of the dayside magnetopause through interplanetary shocks (e.g., Li et al., 1993). In order to investigate how relativistic electrons are accelerated by fast-mode waves driven by solar wind pressure pulse, we perform a code-coupling simulation using the GEMSIS-RB test particle simulation (Saito et al., 2010) and the GEMSIS-GM global MHD magnetosphere simulation (Matsumoto et al., 2010). As a case study, the interplanetary pressure pulse with the dynamic pressure of ~ 5 nPa is used as an up-stream condition. In the magnetosphere, the fast mode waves with the azimuthal electric field (negative E_{phi} : $|E_{phi}|$ ~ 10 mV/m) propagates from the dayside and then extends to the entire dayside magnetosphere from 0600 to 1800 MLT. Using the electric/magnetic fields simulated by the GEMSIS-GM, we calculate the electron motion with different initial conditions (energy, and pitch angle). As a result, the increase of electron fluxes occurs for a wide energy range and energy spectrum become hard. The acceleration depends on the initial energy of electrons. We also investigate initial pitch angle dependence of acceleration and find that the fluxes of electron whose initial pitch angle closer to 90°are largely enhanced. The pitch angle dependence may be a result of the latitudinal structure of the induced electric fields and the pich angle dependence of the drift velocity.
The results of investigation for initial energy and pitch angle imply that the acceleration condition of electrons is related to propagation speed of fast-mode waves, drift velocity of electrons and the spatial structure of electric field.

キーワード：放射線帯
Keywords: radiation belt

