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

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Relativistic electron fluxes of the outer radiation belt dynamically change in response to solar wind variations. There exist several time scales for the outer belt flux enhancement. One of the shortest processes is caused by wave-particle interactions between drifting electrons and fast-mode waves induced by compression of magnetosphere caused by interplanetary shock (e.g., Li et al., 1993). In recent years, Van Allen Probes spacecraft observations indicated that electrons whose drift velocity is close to the fast-mode velocity are selectively accelerated (Foster et al., 2015). In this study, we performed a code coupling simulation using GEMSIS-RB test particle simulation (Saito et al., 2010) and GEMSIS-GM global MHD magnetosphere simulation (Matsumoto et al., 2010) to investigate how relativistic electrons are accelerated by fast-mode waves induced by solar wind pressure pulses. We simulated electron motions with different initial L-shells and initial energies and investigated how electrons are accelerated effectively by fast-mode waves launched at dayside magnetopause . As a result of the analysis, we found that electron acceleration strongly depends on both initial positions and initial energies of electrons. Effective accelerations are observed at high energy electrons at larger L-shells. We suggest that the effective acceleration occurs when electron’s drift velocity is faster than fast-mode velocity.

Keywords: outer radiation belt, acceleration of electron, GEMSIS

