Transport and acceleration of electrons trapped in the inner magnetosphere in response to interplanetary shock

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Interplanetary (IP) shock is known to have a large effect on the electrons trapped in the inner magnetosphere. Observations have shown that the enhancement of the electron flux depends on the pitch angle and energy. It is also proposed that when the IP shock impinges on the magnetosphere, the electrons in the radiation belts are energized not only by induced electric field but also waves excited by low-energy electrons. Therefore, we conduct simulations for acceleration processes of both energized and low-energy electrons by using the global magnetohydrodynamics(MHD) simulation and Comprehensive Inner Magnetosphere-Ionosphere Model (CIMI).In MHD simulation, 12 solar wind conditions are imposed on the upstream boundary condition by changing solar wind velocity, solar wind density and Bz of the Interplanetary magnetic field (IMF). We examine the results of response of the electron flux, temperature anisotropy, the ratio of cyclotron frequency and plasma frequency, the ratio of hot and cold electron density and cold electron density.
We obtained the simulation results as follow. 1) Generally, when the IP shock arrives, energetic electrons (>50 keV) in the dayside magnetosphere are accelerated by the sudden enhancement of the electric field associated with a compressional wave. On the nightside when southward IMF is imposed electrons are transported inward due to E×B drift because the convection electric field is developed. 2) Temperature anisotropy is increased on the nightside by the E×B drift. The value is more than 1 when southward IMF is imposed. 3) Plasmapause is slightly compressed by the compressional wave. Plasmapause is contracted by the convection electricfield when sauthward IMF is imposed. 4) The ratio of plasma frequency and cyclotron frequency is decreased because the magnetic field is increased.

