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09:00-09:15

Simulation study of the energetic electron precipitation in the polar region considering the magnetic mirror force

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It has been widely accepted that whistler-mode chorus emissions play important roles in scattering energetic electrons into the loss cone in the magnetosphere. Recent studies suggest that the periodicities of pulsating aurora can be explained by the characteristic time scale of chorus. For the quantitative study of the relation between chorus and auroral activities, numerical experiments enable us to simulate realistic properties of precipitation and resultant auroral emissions in the polar ionosphere.
In the present study, we developed a simulation code for the motion of energetic electrons with the mirror force acting on the precipitating electrons taken into account, which enables us to solve the variation of the pitch angle of the electrons during their precipitation. We also employ a module computing the altitude distribution of the ionization rate by precipitating energetic electrons in the polar ionosphere. We use the Monte Carlo method to derive the ionization rate by the precipitating electrons, as has been used in previous studies [e.g., Hiraki and Tao, 2008]. By combining the developed modules, we study the time scale and intensity of the ionization rate due to the energetic electron precipitation by chorus emissions. Simulation results show that the influence of the mirror force on the altitude profile of ionization is significant for electrons with high initial pitch angle, corresponding to the pitch angle close to the loss cone. The effect of the mirror force results in the broadening of the altitude profile of the ionization upward due to the reflection of mirroring electrons. Simulation results with energetic electrons whose kinetic energy is larger than 100 keV show that the formation of the secondary peak around the mirror point in the altitude profile of the ionization rate. We discuss the energy dependence and the effect of the mirror foce on the altitude profile of the ionization rate quantitatively.