

Holistic Simulation Studies of Quiet Auroral Arcs Formation 2

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The process of quiet auroral arcs formation has been investigated with Macro-Micro Interlocked (MMI) simulations. In the macro part of our simulation code, the macroscopic interaction between the magnetosphere and ionosphere is described by the magneto-hydro-dynamics (MHD) model in a dipole geomagnetic field. On the other hand, in the micro part, the microscopic process (i.e., production of auroral energetic electrons) is calculated by the particle-in-cell (PIC) model in the open boundary condition.

In the MHD simulation, it is shown that longitudinally striated structures of the field-aligned current are formed by an ionospheric feedback instability[1]. Then, when the field-aligned current exceeds some threshold, its value is sent to the micro part. The PIC simulation exhibits electron acceleration by a super ion-acoustic double layer[2] and provides the energy spectrum of auroral energetic electrons. Further, the growth rate of ionospheric plasma density and the emission intensity are obtained from the energy spectrum with ionization and excitation models.

In this paper, we will show the results of holistic simulation and discuss the role of energetic electrons in arc formation. We are going to display the animation which is obtained from the emission intensity data.

[1] T. Sato, J. Geophys. Res., 83, 1042, 1978.

[2] T. Sato and H. Takamaru, Phys. Plasmas, 2, 3609, 1995.