

Electron inertia effect on the feedback instability in the magnetosphere-ionosphere coupling system

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A possible mechanism of quiet auroral arcs is described in terms of the feedback instability which develops through resonant interactions between the Alfvén waves in the magnetosphere and the plasma density waves in the ionosphere. In previous studies, linear and nonlinear numerical simulations of auroral arc growth were carried out by means of the reduced-MHD model for the magnetosphere.

In this research, we have added the electron inertia term to the reduced-MHD model to introduce the parallel electric field (E_{para}) along field lines. As E_{para} can accelerate electrons, the new model enables us to describe the growth of auroral arcs and the electron acceleration simultaneously in a numerical simulation.

As the first step, we have analyzed the linear dispersion relation including the electron inertia effect, and compared the linear frequency and growth rate with those obtained from the conventional model. It turns out that the lower frequency is found for the higher wave number while the growth rate is smaller in the former for all wavenumbers. We have also examined E_{para} and energy transfer rate dependence on the magnetospheric height and on the perpendicular wave number (k_{perp}). The results show that E_{para} works as acceleration in case with a positive growth rate, and vice versa. Furthermore, we will show the results of nonlinear simulation in the presentation.

Keywords: Aurora, magnetosphere-ionosphere coupling, Alfvén wave