Physics of Magnetosphere-Ionosphere Coupling System from the Collisional Three-Fluid Model.

*Hayato Higuchi[1], Akimasa Yoshikawa[1]

1. Kyushu University

Previous simulation studies of magnetosphere-ionosphere coupling have been based on the electrostatic assumption of the magnetosphere taking the ionosphere as the boundary value. However, we have found through our study on the aurora electron acceleration mechanism that parallel electric fields are generated naturally by removing the electrostatic assumption and simulating both the magnetosphere and ionosphere in a multi-scale system. Then, the altitude of the maximum electron acceleration region is located more exactly by considering the response from the ionosphere. For this reason, we took the approach of self-consciously reproducing the ionospheric response by expanding from two fluids (ions and electrons) to three fluids (ions, electrons, and neutral). As a result, we were able to reproduce the height of the electron acceleration region, which is consistent with the observed facts [A. Morioka, 2009].
We removed the electrostatic assumption and added an inducing effect to the Lorentz gauge condition. No theoretical system for the 3-fluid-electromagnetic interaction based on this assumption has been established yet. Therefore, as our next step, we built a three-fluid model and a theory of collisional Hall-MHD. In this way, we verified the complicated simulation results by using the theoretical aspect.
In this presentation, we will explained the theoretical system of the three-fluid model and collisional Hall-MHD and the theoretical verification using the auroral electron acceleration simulation results calculated in advance.

Keywords: M-I coupling system, non-static assumption, Three-fluid (ion-electron-neutral)

