Understanding the 3-dimensional current between the magnetosphere and the ionosphere<gdiv></gdiv>

*Yuto Yano[1], Yusuke Ebihara[1]

1. Research Institute for Sustainable Humanosphere, Kyoto University

We developed a simplified 3-dimensional Hall-MHD simulation in order to understand the magnetosphere-ionosphere coupling in the polar region during the auroral substorm. The governing equations were derived from the law of conservation of momentum of ions and electrons, the equation of continuity of plasma, the law of Ohm, the law of Ampere, and the law of Faraday. The Hall effect is included because it retains the Hall term in the governing equations. The advection in the governing equations is solved by using the implicit scheme and the Lax-Wendroff scheme and the Superbee limiter function. We employed two different initial conditions, case 1 and case 2. In case 1, the density is uniform. In case 2, the density was enhanced in a longitudinally elongated region. An electric field perturbation is applied to the upper boundary of the simulation box, which represents a part of the magnetospheric convection with shear. The Alfven wave was launched by the shear, and propagated downward accompanied with field-aligned currents (FACs). In case 1, most of the FACs are closed primarily by the Pedersen current. A part of them are closed by the Hall current, which is presumably associated with the induction effect. In case 2, the FACs are closed by the Pedersen current and the Hall current as well. Additional FACs are generated at low altitudes, which are presumably associated with the polarization effect. We discuss the roles of the induction and the polarization effects in the 3-dimensional closure of the current<gdiv></gdiv>

Keywords: Polarization, Magnetosphere-Ionosphere Coupling

