

A Numerical Simulation of Electric-Field Overshielding Due to the R2 Current.

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It is sometimes observed that the electric field associated with the Region-2 (R2) current overcomes the electric field induced from the R1 current. This event is called as the overshielding caused by the R2-current-associated electric field. The overshielding effect appears when the IMF Bz turns northward [Kikuchi et al., 2000]. They discussed that time delay of the R2-current's response to the IMF Bz northward turn against the R1-current's response causes the overshielding effect. We carried out a numerical experiment of the overshielding effect by imposing northward turn of the IMF Bz based of a global MHD simulation of the magnetosphere-ionosphere system [Tanaka, 1995]. The simulation successfully reproduced the overshielding effect due to the R2 current. The time delay of the R2-current's response to the solar wind IMF Bz change against the R1-current's response is about 15 minutes in the simulation results; this is consistent with the observations. When we compare temporal behaviors of the R1 current and the R2 current in two cases where the IMF Bz turns northward and keeps southward in the simulation period, we notice that the R2 current in the northward-turning case is enhanced over the R2 current in the constant southward IMF Bz case. This result is harmonized with the enhancement of the FAC in transition of the magnetosphere-ionosphere compound system [Fujita et al., 2005].