Mass dependence of penetration depth of multi-energy ions in the inner magnetosphere during magnetic storms: Arase observations

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During magnetic storms, the ring current ions move toward the Earth, and the inner edge position of the ring current depends on the convection electric field. We investigate variations of the inner edge of the ring current ions, so-called, penetration depth, during magnetic storms using the ion measurements made by the Low-energy particle experiments-ion mass analyzer (LEP-i)/Medium-energy particle experiments-ion mass analyzer (MEP-i) instruments onboard the Arase satellite. The Arase satellite typically observes the earthward penetration of the ring current protons associated with the enhancement of the dawn-to-dusk electric field in the inner magnetosphere during the storm main phase. The plasmapause moves earthward during the main phase. On the other hand, the convection electric field decreases during the storm recovery phase in which the flux of ring current protons decreases. We identify that the penetration depth of protons depends on the minimum Dst index during the storms as well as the proton energy.

We also investigate the penetration depth of other ions, i.e., helium and oxygen ions. Because the life times of helium and oxygen ions due to charge exchange reaction for are longer than that of protons, it is expected that these ions can penetrate deeper than protons and temporal and spatial evolution can be observed clearly. We will also discuss the relation between the position of ring current inner edge and cross polar cap potential.

Keywords: The Arase satellite, Ring current, Ions

