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Loss of storm-time ring current

Yusuke Ebihara[1*], Mei-Ching Fok[2], Thomas J. Immel[3], Brandt C. Pontus[4]

[1]RISH, Kyoto University, [2]NASA GSFC, [3]UCB, [4]JHU APL

The development of the ring current is the manifestation of magnetic storms. Decay of the ring current occurs when loss of particles trapped in the inner magnetosphere exceeds injection of particles. It had been thought that the charge exchange with geocoronal neutral hydrogen is the dominant loss process for the storm-time ring current. Recently, we have shown that pitch angle scattering due to violation of the 1st adiabatic invariant in a curved field line plays an important role in the rapid decay of the ring current by means of a numerical simulation. Hereinafter, we refer this to field line curvature (FLC) scattering. Some of the scattered particles are entered into the loss cone, and precipitated into the upper atmosphere, resulting in proton aurora. The power of precipitating protons is consistent with that obtained from the proton auroral observation for the large magnetic storm of August 12, 2000. However, a few issues remain to be solved with regard to the followings: When does the FLC scattering dominates the charge exchange? Why was the observed proton aurora expanded largely in comparison with the simulation? Is an inclination of the magnetic field at geosynchronous altitude good proxy for the equatorward boundary of the proton precipitation as was previously suggested? We will discuss these issues and role of the FLC scattering in the recovery of magnetic storms in detail.

Keywords: ring current, decay, magnetic storms