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Possible Cause of the Intense Ring Current

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We will show an example where the enhanced convection electric field plays a major role in the development of the intense ring current. We focus on a super storm of 20 November 2003 on which Dst reached -472 nT. Data from NOAA 17 shows that the inner edge of the plasma sheet ion population penetrated deeper into a region for which L<1.5 than usual. Data from DMSP F13 shows that the strong Region 2 type field-aligned current flew near 40 MLAT in the pre-midnight region. Those results indicate that the heart of the storm-time ring current was most likely located near L=1.5-2.0 where the magnetic field is rigid with respect to external current systems and dipolarization events are unlikely to occur. We performed a kinetic simulation of the ring current ions by introducing an empirical magnetic field model, plasma sheet densities based on LANL satellites, the polar cap potential that is consistent with DMSP observations. The result shows that the ring current, in terms of the Dst index and the location of the inner edge of the plasma sheet, can result from the enhancement of the convection electric field. It should be emphasized that the result does not rule out the contribution from substorms because a substorm should alter the distribution function of the seed particles of the intense ring current, and should inject the seed particles into the outer ring current region.