Propagation of Dipolarization Signatures Observed by the Van Allen Probes in the Inner Magnetosphere

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Dipolarization, the change of the local magnetic field from a stretched to a more dipolar configuration, is one of the most fundamental processes of magnetospheric physics. It is especially critical for the dynamics of the inner magnetosphere. The associated electric field accelerates ions and electrons and transports them closer to Earth. Such injected ions intensify the ring current, and electrons constitute the seed population of the radiation belt. Those ions and electrons may also excite various waves that play important roles in the enhancement and loss of the radiation belt electrons. Despite such critical consequences, the general characteristics of dipolarization in the inner magnetosphere still remain to be understood. The Van Allen Probes mission, which consists of two probes that orbit through the equatorial region of the inner magnetosphere, provides an ideal opportunity to examine dipolarization signatures in the core of the ring current. In the present study we investigate the spatial expansion of the dipolarization region by examining the correlation and time delay of dipolarization signatures observed by the two probes. Whereas in general it requires three-point measurements to deduce the propagation of a signal on a certain plane, we statically examined the observed time delays and found that dipolarization signatures tend to propagate radially inward as well as away from midnight. In this paper we address the propagation of dipolarization signatures quantitatively and compare with the propagation velocities reported previously based on observations made farther away from Earth. We also discuss how often and under what conditions the dipolarization region expands.