Precipitation of ring current ions and outer belt electrons associated with EMIC waves

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It has been known that electro-magnetic ion cyclotron (EMIC) waves cause pitch angle scattering of hot ring current ions near the plasmapause. Theoretical studies suggest that EMIC waves also resonate with MeV electrons in the outer radiation belt and cause intense precipitations into the atmosphere. Sakaguchi et al. [JGR; 2007, 2008] showed the good correspondence between He+ EMIC waves and isolated proton auroras from ground-based observations at Athabasca (L=4.2), and they also identified precipitating ions using the NOAA/POES satellites. Jordanova et al. [2007a] simulated ring current ion precipitation during two detached proton arc events observed with the IMAGE satellite and demonstrated that EMIC wave scattering was the cause for these events. If EMIC waves are possible for scattering of MeV electrons, the NOAA/POES satellites should also detect precipitating electrons as well as ions. The NOAA/POES observations, however, showed absence and/or weak precipitation of MeV electrons associated with enhanced EMIC waves observed at Athabasca. With various ambient cold plasma densities, we estimate the pitch angle diffusion coefficient of MeV electrons with observed EMIC waves. The estimation indicates that observed EMIC waves have a significant diffusion rate for ions but have a very small rate for MeV electrons, which are consistent with the NOAA/POES observations. These results indicate, in agreement with Jordanova et al. [2007b] that MeV electrons-EMIC wave-particle interactions in the outer radiation belt does not always take place even though strong EMIC waves are observed, and its impact for total loss of the outer belt electrons may be smaller than expected in previous suggestions.

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