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Non-linear EMIC-driven electron scattering at sub-MeV energies: validation through observation and simulation

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In recent years, experimental results have consistently shown evidence of electromagnetic ion cyclotron (EMIC) wave-driven electron precipitation down to energies as low as hundreds of keV. However, this is at odds with the conventional understanding of the limits of EMIC resonance with energetic electrons expected from quasi-linear theory. Recent analysis using nonlinear theory has suggested that under certain conditions, the energy limit of this resonance may drop as low as hundreds of keV, consistent with the experimental results, although to date there is little in the way of experimental evidence to support this. In this study, we present concurrent observations from POES, RBSP, GPS, and ground-based instruments, showing concurrent EMIC waves and sub-MeV electron precipitation, coincident with a global dropout in electron flux. We demonstrate through test particle simulation that the observed waves are capable of scattering electrons as low as hundreds of keV into the loss cone through nonlinear trapping, consistent with the experimentally observed electron precipitation.