Understanding the Effects of Data-Driven Repetitive Chorus Elements on the Scattering Characteristics of Energetic Radiation Belt Electrons

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Whistler-mode chorus waves have been identified as a key element in driving radiation belt acceleration events, as well as precipitation in the form of relativistic electron microbursts. However, even though these chorus waves are often modeled as a uniform band of continuous low-amplitude, incoherent in quasilinear-theory based numerical simulations, they are in fact observed as a series of discrete, intense, narrowband rising or falling-tone elements. In this study we investigate the effects of this discreteness on the applicability of quasilinear theory to interactions between electrons and parallel propagating chorus waves in a dipole field using test particle simulations. We produce the most realistic description of a chorus element based on observed waves, including the effects of rising frequency, amplitude modulation (or subpackets) and finite amplitude, and run a large number of test particles through a repetitive sequence of such waves, noting the effects of nonlinear interactions versus strictly linear scattering. We present the results of our simulations and discuss the implications of chorus discreteness on the large-scale evolution of various electron populations.