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Numerical study of high frequency modulation of electron precipitation by a whistler chorus element observed by Arase satellite

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Bursty precipitation of >tens keV electrons can be a source of pulsating aurora which has quasi-periodic on-off switching of luminosity. Besides the on-off switching, relatively high frequency (>>3Hz) modulation is found to be embedded during the on-time [1]. A cause of electron bursts for the pulsating aurora is whistler chorus waves. Intermittent enhancement of whistler chorus elements at magnetic equator scatters radiation belt electrons in pitch angle and energy through the cyclotron resonance process. A lower band chorus element has a duration of less than a second and varies its frequency in time. Furthermore, amplitude of magnetic fluctuation in the element is actively changed in time as observed by Van Allen Probes spacecraft [2]. Although amplitudes of whistler chorus elements are usually below 100 pT, there are chorus waves with instantaneous amplitudes as high as one nT. Such a high amplitude is enough to make nonlinear effects which affect precipitation of radiation belt electrons into the atmosphere [3].

In this study, we focus on precipitation of radiation belt electrons associated with scattering by a whistler chorus element with the amplitude modulation and frequency change in time. We will show results of numerical simulations demonstrating scattering of radiation belt electrons by using wave form data of a whistler chorus element observed by Arase (ERG) satellite. We discuss influence of nonlinear effects associated with amplitude modulation on intermittent precipitation of radiation belt electrons associated with the high frequency modulation embedded in pulsating aurora.

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