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Relativistic electron microbursts driven by whistler chorus: GEMSIS-RBW simulations

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Electron microbursts, which are bursty enhancements of precipitated electron flux during several tens ms, are likely to make an important contribution to high-energy electron flux loss in the outer radiation belt. The SAMPEX satellite frequently observed that the relativistic electron microbursts (>1MeV) were accompanied with the lower band whistler chorus (Lorentzen et al. (2001)). The observations suggest that whistler chorus not only accelerate radiation belt electrons, but also decrease the electron flux. As discussed in Horne et al. (2003), relativistic electrons with small pitch angle close to a loss cone resonate with the lower band whistler chorus at relatively high magnetic latitudes (> 30 deg.). Considering that the whistler chorus propagates at the high magnetic latitudes, we investigate wave-particle interaction process between the whistler chorus and the relativistic electrons bouncing along the magnetic field lines using the GEMSIS-RBW code. This code is a three-dimensional relativistic test particle simulation code demonstrating electron scattering by whistler chorus in a realistic time and spatial scales. We show that a rising tone of whistler chorus scatters electrons at the high magnetic latitudes and produces a bursty enhancement of relativistic electron precipitation flux. The duration of the burst corresponds to that of the rising tone, which are several tens ms. Our simulation results suggest that whistler chorus propagating at high magnetic latitudes precipitates the relativistic electrons showing the relativistic electron microbursts.

Keywords: wave-particle interaction, relativistic electron microburst, test-particle simulation