Resonant scattering of energetic electrons by unusual low-frequency hiss

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Abstract

We quantify the resonant scattering effects of the unusual low-frequency dawnside plasmaspheric hiss observed on 30 September 2012 by the Van Allen Probes. In contrast to normal (~100–2000Hz) hiss emissions, this unusual hiss event contained most of its wave power at ~20–200Hz. Compared to the scattering by normal hiss, the unusual hiss scattering speeds up the loss of ~50–200 keV electrons and produces more pronounced pancake distributions of ~50–100 keV electrons. It is demonstrated that such unusual low-frequency hiss, even with a duration of a couple of hours, plays a particularly important role in the decay and loss process of energetic electrons, resulting in shorter electron lifetimes for ~50–400 keV electrons than normal hiss, and should be carefully incorporated into global modeling of radiation belt electron dynamics during periods of intense injections. It is also noted that while our study demonstrates that the unusual low-frequency hiss event is important for scattering ~50–200 keV energetic electrons during the short emission duration of a few hours in the dawnside plasmasphere, some other physical processes, including sustained electron injections and electron interactions with chorus waves during the nightside drift trajectory, were also in operation, which requires further careful investigations.