Timescales of electrons wave-particle interactions with chorus and hiss in the outer radiation belts

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Electron scattering by chorus and hiss waves is an important mechanism that can lead to fast electron acceleration and loss in the inner magnetosphere. Making use of Van Allen Probes measurements, we present the factors found recently to affect the efficiency and control the predominance of the precipitation or acceleration regimes. The dependence of VLF waves frequency on latitude [1], so that the relative wave frequency goes down, leads to decreasing the electron scattering resonance latitudes. This provides an effective increase of wave amplitude due to whistler-mode wave amplitude distribution on latitude. High latitude wave extent and wave amplitude distribution on latitude determine the regime of scattering (higher latitudes) or acceleration (lower latitudes). Wave normal angle distribution and the existence of the significant oblique whistler population influence efficiency of electron scattering affects significantly the scattering rates and potentially shifts the wave-particle interaction regime during geomagnetic storms from mostly scattering to mostly acceleration [2]. Dynamics of plasma characteristics during disturbed periods, such as $\omega_{pe}/\Omega_{ce}$ decreases (especially in the night sector) sometimes leading to very short time scales for quasi-linear MeV electron acceleration in agreement with Van Allen Probes observations [3]. $\omega_{pe}/\Omega_{ce}$ dynamics in the plasmasphere increases the efficiency of electron scattering by hiss.

References