ENHANCED SCATTERING AT SELECTED ELECTRON ENERGIES BY DISPERSING LIGHTNING WHISTLERS

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The usual frequency-time dispersion of lightning-generated whistlers propagating through the magnetosphere between conjugate hemispheres leads to an evolving distribution of wave frequency over magnetic latitude which in turn presents a systematic variation in the resonance condition presented to particles traversing the wave field. For certain conditions identified herein, this variation in frequency along the field-line counter-balances the change in gyrofrequency, leading to extended interaction lengths and enhanced scattering at selected resonant parallel velocities and corresponding energy/pitch-angle combinations. Calculations using proven formulations for first-order wave/particle gyroresonant scattering indicate that peak pitch-angle deflections caused by otherwise nominal ~10pT whistler wave intensities can approach ~1° for certain cuts in electron phase-space density. Furthermore, this degree of scattering appears possible over a broad range of L-shells and for non-ducted and ducted whistlers alike, leading to the implication that perhaps the most readily observable loss-cone precipitation flux detected by satellites and most prominent D-region disturbances inferred via subionospheric vlf remote sensing may in fact be associated with a relatively small fraction of precipitating electrons carved from a limited slice in electron phase-space density. In addition, since these extended interaction lengths are seen to cause significant gyrophase bunching at the point of electron exit the wave field, the possibility for wave growth and further enhanced scattering from regions beyond the critical wave/particle encounter latitude is explored. Finally, implications for electron lifetimes and the possible formation of electron phase-space holes are discussed.