QUANTIFICATION OF VLF SIGNATURES OF LEP EVENTS

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Lightning-induced electron precipitation (LEP) events are a well-established contributor to the loss of trapped radiation belt electrons at mid-to-low latitudes. The Holographic Array for Ionospheric/Lightning Research (HAIL), a set of VLF receivers deployed at high schools and colleges across the United States, is well situated geographically to quantify the precipitation induced by lightning-generated whistlers. The multiplicity of VLF paths enables us to measure the spatial extent and temporal characteristics of the VLF perturbation. Using theoretical models of lightning generated obliquely propagating (nonducted) whistler-induced precipitation; we estimate the precipitation energy flux associated with LEP events for several case studies of thunderstorms over Texas. The resulting precipitation flux is then input into a Monte Carlo simulation of the penetration of energetic electrons into the ionosphere to determine the amount of secondary ionization produced by energetic electron precipitation as a function of altitude. The secondary ionization rates, together with the ambient ionization rate, are used to obtain electron density profiles for the region disturbed by the precipitation. The Long Wave Propagation Code (LWPC) is used to model subionospheric VLF wave propagation, incorporating the D-region disturbances associated with electron precipitation. By varying the ionospheric profiles input into the LWPC model, the results can be iteratively compared to the VLF amplitude and phase perturbations measured at multiple VLF sites. The effects of 1) causative flash current; 2) trapped radiation belt fluxes and magnetospheric conditions; 3) pitch angle distribution of trapped flux (a function of the Earths magnetic field); and 4) causative lightning flash location are all considered at varying levels of quantitative detail. We also discuss the extension of our analysis to regions outside of Texas, to estimate global loss of radiation belt electrons caused by LEP.

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2. H - Waves in Plasma

3. (a) S-H/G2

4. C - Contributed Paper

5. No special instructions