WHISTLER-MODE ILLUMINATION OF THE PLASMASPHERIC CAVITY VIA IN-SITU INJECTION OF ELF/VLF WAVES

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Abstract Submission Form

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It has recently been suggested by Inan et al. (U.S. Inan et al., Controlled precipitation of radiation belt electrons, *Journal of Geophysical Research-Space Physics*, **108 (A5)**, 1186, doi: 10.1029/2002JA009580, 2003.) that the lifetime of energetic (a few MeV) electrons in the inner radiation belts may be moderated by in situ injection of whistler mode waves at frequencies of a few kHz. The efficacy of this method depends upon the radiation efficiency of electric dipole antennas in the magnetospheric plasma, the propagation of the injected wave energy along raypaths as determined by the magnetic field and cold plasma gradients, and the lifetime of the injected waves as determined by Landau damping. We use the Stanford 2D VLF raytracing program (coupled with an accurate estimation of the path-integrated Landau damping based on measured distributions of suprathermal electrons) to determine the distribution of wave energy throughout the inner radiation belts based on injection location, wave frequency and initial wave normal angle. To determine the total wave power injected and its initial distribution in k-space (i.e., wave-normal angle), we apply the formulation of Wang and Bell (T.N.C. Wang and T.F. Bell, Radiation resistance of a short dipole immersed in a cold magnetoionic medium, *Radio Science*, **4 (2)**, 167-177, February 1969) for a short electric dipole placed at similar locations throughout the inner radiation belts. For a large number of wave frequencies and wave normal angles the data demonstrate that the majority of the radiated power is concentrated near the resonance cone. The combined use of the radiation pattern and efficiency and ray-tracing including Landau damping allows us to make quantitative estimates of the magnetospheric distribution of wave power density for different source injection points. On the basis of our results we estimate the number of individual space-based VLF transmitters necessary to fill the plasmaspheric cavity with enough VLF wave power to significantly affect the lifetimes of energetic electrons in the radiation belts. Specifically, we present data that show how wave energy spreads among the L-shells for an injection source located at a number of different L-shells (from L = 1.8 to L = 3.0), at a range of latitudes up to 20 degrees from the geomagnetic equator, and for a wide range of wave frequencies and wave normal angles. Initial data indicate that whistler mode waves injected at the magnetic equator at L = 2 with a frequency of 2.53 kHz (the local lower hybrid resonance frequency) can project wave power on L-shells of up to L = 2.4.

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2. H - Waves in Plasma
3. (a) Radiation Belt
4. C - Contributed Paper
5. No special instructions