MAGNETOSPHERIC WAVE POWER DENSITY FROM GROUND-BASED VLF TRANSMITTERS

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The 3D magnetospheric wave power density between adjoined conjugate regions associated with ground based VLF transmitters is deduced from paired measurements of wave field intensities acquired by the low-altitude DEMETER satellite within respective hemispheres.

Measured wave power data for regions both directly overhead the transmitter and within the conjugate hemisphere are imposed as boundary conditions to a hybrid full-wave/WKB raytracing procedur, in order to determine the minimal set of primary and secondary electromagnetic (EM) and quasi-electrostatic (ES) waves which are necessary to reproduce the respective wave power distributions at each end.

Notable features include (i) significant wave reflection and wave power loss occurring throughout the first ~1500 km propagation path above the transmitter, (ii) incidental reflected EM and ES waves occurring thereafter along much of the remaining path, (iii) an ensemble of forward scattered, birefringent EM and ES waves generated viz linear mode coupling (ray splitting) within the vicinity of the magnetic equator, (iv) correct mapping from the nominal overhead transmitter wave power distribution to the spatially spread and poleward shifted power distribution in the conjugate region, (v) no requirement for ad hoc field aligned cold plasma density irregularities, but only for nominal, smooth cold plasma density gradients.

Results will be presented in terms of inferred regularized behavior of VLF wave power density throughout the magnetosphere for any equivalent source, with brief discussion regarding implications for radiation belt loss calculations.