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CHARACTERISTICS OF GUIDING VLF WAVES BY FIELD-ALIGNED IRREGULARITIES IN THE MAGNETOSPHERE

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It is well known that under reasonable initial conditions an electric field in the equatorial plane can produce electron density enhancements and depressions in the magnetosphere. Plasma diffuses along field lines rather than across them, so enhancement or depression in plasma density tends to be field- aligned. The first ray theory of VLF waves propagation shows that trapping is possible by irregularities manifested as enhancement or depression of electron density

In our ray tracing calculations we have supposed that VLF waves propagate in two dimensions in inhomogeneous cold plasma. The electron density and ion densities used here are represented by a field-aligned isothermal diffusive equilibrium model. The electron density at any point in the magnetosphere is calculated from electron, ion (H^+, He^+ and O^+) and temperature profiles at a reference level of 900 km altitude. In this paper the geomagnetic field is assumed to be a dipole field.

In the present paper we have examined the guiding of VLF waves by troughs (waveguide with depression of electron density to the background of electron density) which are located in different models of the magnetosphere. The main feature for a trough extending along the geomagnetic field line is very variable electron plasma frequency and electron gyrofrequency along its length. Electron gyrofrequency is approximately $\sim$ 1MHz near the ends of trough in the bottom of the magnetosphere. As VLF wave is trapped and travels up to the equatorial region the gyrofrequency slowly decreases and has values comparable with wave frequency.

The principal idea of our work is calculation of the absolute value of group velocity for wave frequencies, which are in different ratio to the minimum value of gyrofrequency along ray path. In many practically important cases of guiding VLF waves we are also interested in the direction of group velocity with respect to direction of geomagnetic induction or wave normal.