Editorial

Waves Propagation in the Upper Atmosphere

Propagation of very long planetary waves in the upper atmosphere of the Earth is investigated. A new exact solution of the magnetohydrodynamics equations of the ionosphere in the spherical coordinate system is found taking into account the Earth’s rotation and geomagnetic field. The general dispersion equation for the planetary waves in the E and F regions of the ionosphere is derived and propagation characteristics of these waves in weakly ionized ionospheric plasma are studied.

The problem of transionospheric sounding with satellite radio signals at frequencies that are close to the edge of the radio transparency frequency range of the ionosphere. Asymptotic formulas for the group delay time of the transionospheric radio signal are derived and an example of how they are implemented if there is a localized large-scale electron density inhomogeneity in the ionosphere is presented. Techniques for detecting large-scale ionospheric inhomogeneities, which are based on numerical-asymptotic synthesis of disturbed distance-frequency characteristics of decametric signals radiated from a low-orbiting or geostationary satellite are suggested.

With the potential use of SuperDARN radars in mind and to test the theoretical predictions for dependence of the phase velocity of Farley-Buneman waves on radar frequencies in the HF range, a statistical analysis was made of over 11,000 specifically selected spectra from multi-frequency observations by the SuperDARN radar in September-October 2000. Good qualitative agreement was found between the observed and predicted frequency dependence for slightly disturbed magnetic conditions. Assuming that increased magnetic activity (higher Kp) manifests itself via enhanced electron temperature and applying the algorithm of the control parameters, it was shown that in agreement with observations, the dependence of the Farley-Buneman waves phase velocity on the irregularity wave number (radar frequency) should decrease with increasing electron temperature (Kp). The results make it clear that specially designed multi-frequency SuperDARN experiments would be a valuable tool in studying the HF Farley-Buneman waves at high latitudes.

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