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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 areclose to the edge of the radio transparency frequency range of the ionosphere. Asymptotic formulasfor the group delay time of the transionospheric radio signal are derived and an example of how theyare implemented if there is a localized large-scale electron density inhomogeneity in the ionosphereis presented. Techniques for detecting large-scale ionospheric inhomogeneities, which are based onnumerical-asymptotic synthesis of disturbed distance-frequency characteristics of decametric signalsradiated from a low-orbiting or geostationary satellite are suggested.

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

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