

Measurements of drift velocity of artificial small-scale field-aligned irregularities using multi-position HF radars

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In report the results of multi-position radar measurements of Doppler frequency shift (DFS) scattered signals by artificial small-scale field-aligned irregularities (FAI) are presented. In measurements two pairs of bistatic configurations HF radars have been used: Kaliningrad (54.7°N, 20.6°E) – SURA (56.1°N, 46.1°E) - IZMIRAN (55.3°N, 37.2°E) (path 1) and RVÌ (55.8°N, 38.3°E) - SURA - Rostov-Don (47.2°N, 39.6°E) (path 2). Such geometry of paths has allowed to determine the value and direction of drift velocity of FAI in a plane orthogonal to magnetic field. Observations were carried out in March 2005 in the evening hours from 16:00 to 19:00 UT. On the first path the probing transmitter operated at frequency 9300 kHz in a pulse mode ($\tau = 100\mu s$, $F_{rep} = 25$ Hz), on the second path as the probing transmitter was used the RVÌ station of precise times which operated at frequency 14996 kHz in continuous carrier mode. The heating facility SURA operated in a mode: 5 min – radiation and 5 min - pause on pump wave frequency f_p close to critical frequency of F-layer, $f_p \leq f_oF2$. According to results of spectral measurements in an operating time of heating facility on both paths scattered signals from artificial small-scale field-aligned irregularities were observed. On the basis of DFS measurements of the scattered signal (SS) we have calculated value (V) and direction (azimuth A) of the irregularities drift velocity. It is obtained that during moderate disturbance period (magnetic activity index $K_p = 3$) the drift velocity of the ionospheric irregularities at heights of F-region of a mid-latitude ionosphere was $V \sim 105$ -113 m/s and had a direction close to westward with an azimuth $A \sim 270$ -290°.

In some cases the quasiperiodic variations of the DFS SS with period ~ 60 s and amplitude ~ 1 -1.2 Hz were observed. These quasiperiodic variations DFS SS are connected to transverse MHD waves propagation. There are various assumptions of MHD waves generation mechanisms. Some from them are connected to natural generation mechanisms in conditions of geomagnetic disturbances, others with work of the powerful transmitter. The decision of this question demands additional researches with attraction of geophysical measurements of a magnetic field variations.