Study of altitude characteristics of the striation spectrum by SEE measurements and modelling

E. N. Sergeev (1), M. M. Shvarts (1), **S. M. Grach** (1,2), V. L. Frolov (1) and P. V. Kotov (2)

(1) Radiophysical Research Institute (evg@nirfi.sci-nnov.ru), (2) State University of Nizhny Novgorod

Spatial features of HF pumped ionospheric F-region were investigated experimentally at the SURA facility (Russia) by means of the stimulated electromagnetic emission (SEE). SEE, recall, appears as a result of conversion of HF pump-driven plasma waves off the geomagnetic field aligned plasma density irregularities (striations). A specially designed pumping scheme was elaborated to study an influence of the striations, created by powerful pump wave at a frequency f_h on spectral and temporal evolution of the diagnostic SEE (DSEE) generated by a pulse or weak continuous diagnostic wave at a frequency f_d at altitude shifted from the center of the pumped volume. Two-channel digital receiver allowed to analyze the SEE around the frequencies f_h and f_d (i.e. from the both altitude ranges) simultaneously. For simulation of the SEE evolution, a model of the broad continuum SEE feature generation [1] has been used. The data of the rocket experiments [2] and back scattering measurements [3], as well as plasma thermodiffusion processes have been taken into account to elaborate a semi-empirical dynamics model of 3-dimension striation spectrum for modelling. A comparison of the SEE measurements and computer simulations allowed to study a dependence of the DSEE dynamics and variations of the striation spectrum on a frequency mismatch $|f_h - f_d|$ (which can be easily translated to the altitude displacement), on offsets of the frequencies f_h and f_d from electron gyroharmonics, and on the daily conditions. It is found that a slow (time scale of 1–10 s) dynamics of the DSEE, namely, characteristics of its slow overshoot and undershoot effects are determined by the spectral shape and intensity of the striations at, respectively, the development and relaxation stages. Then, the striation spectrum flattens in meter scale range for f_h between 3^{th} and 4^{th} gyroharmonics in comparison with larger f_h; for f_h just above 4^{th} gyroharmonic in comparison with f_h just below 4^{th} gyroharmonic; in the center of the pumped volume in comparison with its periphery. It's shown also that the vertical extension of the pumped volume increases with an altitude of its center and with a transition from day to night conditions.

The work was supported by INTAS grant 03-51-5583 and RFBR grants 04-02-17544 and 06-02-17334.

[1] S.M. Grach, Radiophys. Quant. Electron., Engl. Transl. 28, 470-477, 1985.

[2] L. Franz, M.C. Kelley, A.V. Gurevich, Radio Sci. 34, 2, 465-475, 1999.

[3] V.L. Frolov, et al. J. Atmosph. Solar-Terr. Phys., 59, 2317-2333, 1997.