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Electron collision frequency variations and electric field measurements in the ionospheric D-region

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It is well known that electric field may produce dig disturbances in lower ionosphere parameters. Our experimental results have shown that a possible cause for the apparence of big enough electron collision frequency variations is the influence of atmospheric electric field. This fact gives a chance to measure the electric field in the lower ionosphere using remote sounding facilities.

During 1978 - 1994 in Kharkiv State University, there were investigated variations of the effective electron collision frequency in the ionospheric D-region in different geliogeophysical conditions (seasons, zenith angle, solar and magnetic activity) by means of the partial reflection technique (operational frequency of the partial reflection facilities was f = 1.8-3.0 MHz, pulse length 25 mks , pulse repetition frequency F = 1 Hz). The differential absorption of ordinary and extraordinary modes was neglected at the altitudes 60-66 km. The signal-to-noise ratio was more than 5. The total number of records has exceeded 170 (the partial reflection amplitude records duration was 10-15 min).

It was obtained the distribution of the effective electron collision frequency changes at the altitudes 60-66 km (the error of determining the collision frequency in these heights interval was < 50 %). It was developed the technique for estimating atmospheric electric field variations on the lower boundary of the ionosphere using the experimental values of the effective electron collision frequency. We found, that the electric field to be E > 0.25 V/m in approximately 70 % cases. Our results correspound to undisturbed ionospheric and atmospheric conditions. Under disturbed conditions, the magnitude of E was approximately two times larger than the undisturbed one.

So these facts must be taken into account in the research of ionospheric processes, meteorological and propagation effects (for instance, during accidents at atomic power stations, the near-earth atmospheric layer condition may increase, wich results in decreasing a background electric field of the capacitor Earth-Ionosphere and in arising considerable disturbances of the lower ionosphere parameters (S.I.Martynenko, I.M.Fuks, R.S.Shubova, Geomagnetism i aeronomiya. V.34,N 2,pp.121-129, 1994)).