The regular seasonal variations of electron density profile for the day-time low middle-latitude ionosphere (50 – 70 km) on base of VLF propagation data and on a photochemical model in the quiet and SID conditions.

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The regular seasonal variations of the effective characteristics of ionization processes in the lower ionosphere are estimated by three ways: on the base of the multicomponent photochemical model; on the base of large total combination of VLF-data for the geophysical quiet conditions [2] and on the base of inverse problem solution for SID conditions by SPA [3]. The models of ionosphere [1 - 3] essentially differ from each other. Therefore a coefficient b was calculated for these models. It was determined according to the relation $b = q^m / N_o$ for [1, 2] (value q was accepted from the published data). For SID conditions coefficient b was determined according to the VLF inverse problem solution in which a following model of disturbed electron density was used: $N_d = \left[N_o^{1/m} + \Delta q \cdot b^{1/m}\right]^m$ [3]. In these relations N_o and q are a density of electrons and a rate of their generation in the quiet conditions, N_d is the density of SID maximum (N_d was calculated from an increment of the ionization rate Δq which was calculated according to the solar X-ray flare data). Parameter m was equal to 0.55 on the base of numerical calculations by the photochemical model [1]. Near 500 SID events which had been fixed in Inubo for the signals (13,6 kHz) of radio navigation stations C, D, G were the input data for the inverse problem. The corresponding method is described in [3].

The highest accuracy of parameter b determination in problems [2,3] is achieved near the effective height of VLF reflection (60 - 62 km). In quiet conditions the only ionization source at this altitude, as a rule, are the galactic cosmic rays. From the comparison of b estimation, obtained by three ways for the near noon conditions in middle and low latitudes it follows:
- the differences of b estimations from some average values not exceed the factor 2.5; this result is quiet satisfactory although the used models are very deferent;
- the relation of summer b value to winter one were obtained for 50° latitude by the VLF analysis and was equal to 2, whereas the value 0.6 followed from the theoretical modeling. The revealed difference of seasonal variations is rather important and demands the additional researches.

References
1. Petrova G.A., Brunelli B.E. The ion chemistry model of D-ionosphere region // PGI preprint 90-09-77, Apatity: Cola Science Centre of USSR Science Academie, 1990, 46p.
2. Azarnin G.V., Kolsanov V.A., Orlov A.B. The problems of waves diffraction and propagation. Iss. 21. L., 1987. P. 112-130.
3. Orlov A.B., Pronin A.E., Uvarov A.N. Geomagnetizm and Aeronomy. 1998. V.38, N 3, C.102-110.