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Study of the height dependence of LS TID amplitudes derived from ionosonde data

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The height dependence of large-scale traveling ionospheric disturbance amplitudes was analyzed on the basis of data of nighttime observations of the ionospheric F layer at the Institute of Ionosphere (Almaty, 76˚55 E, 43˚15 N). Observations were performed since 2000 till 2007 using a digital ionosonde. Data processing allowed to obtain time variations in the electron density ($N_h(t)$) for fixed altitudes and variations of the F layer peak height (*hmF*). The 1166 observation sessions were carried out during the analyzed period, and 581 nights were characterized by wave activity. Nights with the maximum relative amplitude of $N_h(t)$ variations exceeding of 25% were selected for analysis. Large-scale traveling ionospheric disturbances (LS TIDs) with large relative amplitudes were selected in order to provide high accuracy in calculation of absolute amplitude height profiles ($A(h)$) even near the heights of the F layer bottom, which are characterized by small values of the background electron density ($N(h)$).Total number of such nights is 63. All these events were divided on two groups according the maximum magnitude of magnetic disturbances occurred during a period of observations and several hours prior to the beginning of observations. A low and high pass filtering was used to eliminate a high frequency noise and a trend caused by diurnal variation of analyzed parameters.

Regression relationships between $h_mF$and an altitude h_{Am} corresponding to the maximum absolute amplitude of the wavewere derived. The relationships indicated that: a) $h_{Am}$is always below h_mF,b) a good correlation exists between these parameters, c) the average distance between them varies from $\sim$ 45 km for h_mF= 280 km to $\sim$ 80 km for h_mF= 380 km under low magnetic activity conditions and from $\sim$ 45 km for h_mF= 280 km to $\sim$ 95 km for h_mF= 450 km under high magnetic activity conditions, and d) h_{Am} is in the range of 220 – 300 km under the low activity conditions and in the range of 230 – 370 km under the high activity conditions.

Regression relationships between the maximum amplitude of the variations of the electron density at fixed altitudes (δ_{Am}) and amplitude of the $N_h(t)$variations at the maximum of the F layer (δ_{hm}) were derived. The relationships indicated that a moderate correlation exists between these parameters. When δ_{Am}changes from 25% to 80% then the average value of δ_{hm}changes from 5.85% to 15.75% under low magnetic activity conditions, and from 7.7% to 14.3% under high magnetic activity conditions. This indicates that amplitude at the maximum layer is $\sim$ 4 - 5 times less than the maximum amplitude of variations at the fixed height.