Geophysical Research Abstracts
Vol. 19, EGU2017-1820-1, 2017
EGU General Assembly 2017

Behavior of Parameters of Nighttime Electron Density Enhancements of the Ionospheric F2 Layer

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There is known a wide class of disturbances of the F2-layer of the ionosphere, which are superimposed on the regular diurnal variations of the electron density. Different types of disturbances are characterized by different mechanisms of their generation. Traveling ionospheric disturbances appear to be the most characteristic features of the inhomogeneous structure of the ionosphere. Another type of ionospheric disturbances presents the nighttime electron density enhancements in the ionospheric F2- layer maximum (NmF2). This type of irregularities is described in numerous papers. There is a concept that, in spite of the various mechanisms of ionospheric disturbances generation a response of F2-layer parameters exhibits similar features associated with the upward lift and the simultaneous expansion of the layer and then its subsequent downward movement, including layer compression, which results in the formation of the electron density peak in the layer maximum at the moment of greatest compression.
The aim of this study is a verification of this concept on the example of disturbances related with the nighttime electron density enhancements, and the definition of precise quantitative relationships between the variations of different F2-layer parameters for such disturbances. By using the data of the ionospheric vertical sounding in Almaty, (76° 55'E, 43°15'N) during 2001-2012, analysis of the behavior the F2-layer parameters during the night electron density enhancements was carried out within framework of a single concept of effects of various types of ionospheric plasma perturbations in variations of height and half-thickness of the F2-layer, accompanied by increasing and decreasing NmF2 at moments of maximum compression and expansion of the layer.
For a quantitative analysis of the parameters of nighttime enhancements we have selected 20 nights characterized by low magnetic activity (Dst> - 50 nT) and evident manifestations of the nighttime electron density enhancements. A comparison of the behavior of the parameters of the F2-layer is carried out. Quantitative relationships between parameters including a) an enhancement amplitude in the maximum F2 layer and at the altitude, characterized by the maximum rate of enhancement, b) the variation amplitudes at the altitudes of the layer top and basis, the amplitude of variations of the half-thickness and NmF2 are found. Dependence on the altitude of enhancement amplitude is found, showing that the altitude of the enhancement maximum is below the altitude of the layer maximum. Based on comparison of behavior in time of night enhancements parameters, we made a conclusion that its characteristics repeat features, previously considered for several types of ionospheric plasma disturbances. Thus, we have expanded range of the F2-layer disturbances, the parameters of which, in spite of the various mechanisms of their generation exhibits similar features.