Spatial-time features and dynamics of ionospheric disturbances during magnetic storms in 2015-2018

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Ionospheric disturbances are formed as a result of ionosphere reaction to the increase in solar and geomagnetic activity (solar flares, coronal emissions, geomagnetic storms and substorms).They can have different intensity and duration and lead to the occurrences of positive and negative ionospheric storms. The ionospheric storm dynamics has complex spatial-time characteristics, depending on geographic location (polar and auroral zones, mid-latitude and equatorial regions), geomagnetic storm force, local time, and other factors. Ionospheric storms have negative impact on modern technical systems; therefore, their timely detection and prediction are an important task. In spite of the intensive development of technical tools and data analysis methods, the question of effective solution of this problem remains open [ex. 1].
In the paper, we modeled and analyzed the ionospheric parameter time course according to the ground station network (the resource http://wdc.nict.go.jp was used). Spatial-time features and dynamics of ionospheric disturbances were studied during magnetic storms which occured in 2015-2018. In the paper, a method proposed by the authors was used to model and to analyze ionospheric data. The method is based on wavelet transform [1]. The method allowed us to study the ionospheric parameter dynamics in detail, to detect ionospheric disturbances and to estimate their characteristics (Fig.1). The method was implemented numerically and adapted for real-time (as data are recorded). Comparison with the traditional approaches [2, 3] (median methods, IRI model) showed high efficiency of the proposed method and the possibility to apply it for on-line analysis of ionospheric data and to detect of ionospheric disturbances.

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