

Analysis of cosmic rays dynamics and ionospheric parameters during increased solar activity and magnetic storms

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Based on the ground station data, the paper makes complex analysis of cosmic ray dynamics and of ionospheric parameters during strong and moderate magnetic storms in 2015-2018. During the investigation, new methods of modeling and data analysis were applied. A neural network model for neutron monitor data classification was presented. This model makes it possible to evaluate galactic cosmic ray flux state and to detect periods of sporadic effect occurrences in automatic mode. By the use of this model, sporadic effects preceding and accompanying strong and moderate magnetic storms were detected. The model showed its efficiency when applied for data on-line analysis and for detection of sporadic effects including those of small amplitude. Ionospheric data were analyzed on the bases of multi-component modeling method and ionospheric parameter analysis [1, 2]. It allowed us to detect ionospheric disturbances of different intensity and to estimate their characteristics. The results of the work confirmed the possibility of ionospheric electron concentration increase effect preceding magnetic storm commencements [3]. Comparison with cosmic ray data showed the correlation of the effects in the ionosphere with anomalous changes in cosmic ray dynamics that was first mentioned in the paper [3].

1. Mandrikova O.V., Fetisova N.V., Polozov Y.A., Solovev I.S., Kupriyanov M.S. Method for modeling of the components of ionospheric parameter time variations and detection of anomalies in the ionosphere coupling of the high and mid latitude ionosphere and its relation to geospace dynamics // *Earth, Planets and Space*. 2015. Vol. 67. No 1. pp. 131-146. DOI: 10.1186/s40623-015-0301-4
2. O. Mandrikova, Yu. Polozov, V. Geppener Method of ionospheric data analysis based on a combination of wavelet transform and neural networks // «*Procedia Engineering*», Elsevier, Amsterdam, Netherlands, V.201, Pp. 756–766, DOI. <https://doi.org/10.1016/j.proeng.2017.09.622>.
3. Mandrikova O., Polozov Yu., Fetisova N., Zalyaev T. Analysis of the dynamics of ionospheric parameters during periods of increased solar activity and magnetic storms // *Journal of Atmospheric and Solar-Terrestrial Physics*. –2018. –Vol. 181. –Pp. 116-126. Doi: <https://doi.org/10.1016/j.jastp.2018.10.019>.

Keywords: cosmic rays, ionospheric parameters, data analysis