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Investigation of cosmic ray cutoff rigidity changes caused by the disturbed geomagnetic field of the storm in March 2012

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One of important factors determining the space weather are cosmic rays the cutoff rigidities of which vary appreciably under the influence of disturbances in the interplanetary space and the Earth's magnetosphere. This report is concerned with changes in the geomagnetic cutoff rigidities (thresholds) of cosmic rays computed for the period of a strong geomagnetic storm of March 2012. This disturbed period was characterized by the solar wind speed of more than 700 km/s and Dst-index at the minimum Dst-variation equal to -143 nT. The theoretical vertical effective geomagnetic cutoff rigidities were calculated for a number of stations by using the Tsyganenko TS01 model and trajectory tracing method in a magnetic field of a disturbed magnetosphere. The theoretical cutoff rigidities were compared with the experimental ones obtained by the global spectrographic survey method on base of the data from the worldwide neutron monitor network. The correlation coefficients between the theoretical and experimental thresholds for different stations were 0.5 – 0.7. Combined analysis of temporal variations in the theoretical and experimental geomagnetic thresholds and their relations with the solar wind and IMF parameters showed that the change in the theoretical geomagnetic thresholds correlated well with the Dst and Bz variations at all the stations under study. The correlation of the experimental geomagnetic thresholds with the Dst-variation and Bz was much lower. At the same time, the correlation of the solar wind velocity V with the changes in the experimental thresholds was better than with the theoretical thresholds. A similar situation was observed for the storms of November 2004 and September 2005.