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Search for heliospheric disturbances and Forbush decreases in time series of matrix data of the URAGAN hodoscope using decision rules for sequences of confidence intervals

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A method for searching for heliospheric disturbances and Forbush decreases in time series of two-dimensional data matrices of the URAGAN muon hodoscope (MEPhI) using decision rules for sequences of confidence intervals is considered. A sequence of two-dimensional angular matrices of the muon hodoscope are interpreted as time series of random numbers, which are distributed according to the Poisson law. Formulas for calculating confidence intervals for estimating the mathematical expectations of observations of random Poisson numbers are given. The method for searching for heliospheric disturbances and Forbush decreases is based on calculating sequences of confidence intervals for estimating the mathematical expectations of the matrix hodoscope data for the reference and current time sites of observations. An algorithm for decision rules for detecting anomalies in muon data has been developed, depending on the given values of the confidence probabilities and the implementation of the comparison of the sequences of the reference and current confidence intervals. An algorithm for searching for local anomalies of the muon flux, based on the decision rules procedure, is proposed. The results of testing the method of searching for local anomalies of the muon flux for model observations of the matrix hodoscope data are presented, which confirm its satisfactory efficiency. The work of the proposed algorithm was tested on experimental observations of the URAGAN hodoscope, and acceptable results were obtained in the search for heliospheric disturbances and Forbush decreases.

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