FUZZY LOGIC METHODS FOR GEOMAGNETIC EVENTS DETECTIONS AND ANALYSIS

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A geomagnetic field is subject to fluctuations of different time scales. In order to describe the magnetic activity in the planetary scale there were established geomagnetic indexes: 24 hours' C-index, three hours' Kp-index, hourly indexes Dst, AE and others. Let us note that the principal idea of the introduction of these indexes was to give equal estimation of relative strength of disturbances in various observatories. However the more detailed study of the morphology of geomagnetic disturbances and their sources shows that various indexes of geomagnetic activity used nowadays show an activity of a geomagnetic field not on the whole Earth surface but in its separate regions. In the process of research of solar-terrestrial phenomena there emerged the necessity of simultaneous determination of the strength of geomagnetic disturbances in all observatories of the world stations' net i.e. an introduction of new parameters independent of geomagnetic latitudes and longitudes becomes necessary. To solve this problem a new geo-informational approach named "Discrete mathematical analysis" (DMA), FCARS algorithm in particular, is suggested. The DMA is based on fuzzy logic methods and is meant to study multidimensional arrays and time series. The FCARS represents an attempt to model the logics of an interpreter who identifies "by eye" anomalies in records. This algorithm is supposed to be used for the purpose of further automated analysis of great arrays of data not analyzable by manual processing. The algorithm gives an estimation of limits of anomalies sought and conducts morphological review of these anomalies in form of initial, central and final stages with separation of strong and weak phases in the central stage. A sufficient "flexibility" of the algorithm is provided by a wide set of "rectifications" which appears during modelling of the work of an interpreter. As the result of the execution of these works based on algorithms of separation and analysis of anomalies in time series using fuzzy logic methods there were: introduced concepts of inner and outer strength of an anomaly of a geomagnetic variation; suggested an analysis of geomagnetic events based on data from the global network of observatories Intermagnet; described a new way of study of the dynamics of geomagnetic disturbances spreading.

Fuzzy logic, geomagnetic field, data analysis

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