



Automatic fuzzy-logic recognition of anomalies of different morphology in long data rows: Application to volcanic activity monitoring data

Gvishiani A. (1), Agayan S. (1), Bogoutdinov Sh. (1), Graeva E. (1), Le Mouel J-L. (2), Zlotniki J. (3), Rodkin M. (1),

(1) Geophysical Centre RAS, Moscow, Russia, (2) Institut de Physique du Globe de Paris, France, (3) CNRS, Clermon-Ferrand, France

To mitigate the losses from natural hazards monitoring systems with a large number of sensors are used. A visual expertise of such enormous volumes of data becomes a difficult problem. Besides, the criterion used for recognition of beginning of hazardous activity rather frequently is vague because the examined systems are complex and nonlinear and their behavior is partly unknown. It means that the procedure of automatic pattern recognition should ensure examination with vague patterns. Besides, the possibility of easy change of searched patterns should be provided. The alternative to the manual visual signal recognition is presented. This approach is based on the use of fuzzy logics algorithms and morphology analysis. It includes a few algorithms providing the choice of segments of data rows with a given specific character of morphology. The searched pattern can be constructed according with an expert decision on the searched anomaly character, or some typical part of the obtained earlier record can be used as a sample. The algorithms were examined using a number of model data rows. After the testing the method was applied to the data of electric self-potential (SP) monitoring of the volcanic activity of La Fournaise volcano (Reunion Island). It was shown that the presented algorithms can provide an automatic recognition of anomalies with a different typical character of morphology. For the case of electric SP monitoring data the anomalies with character of morphology presumably typical of caused by storm rains and typical of hydrothermal activity were recognized and subdivided. The algorithms can be applied as well in other cases when an automatic recognition of segments with a given character of morphology is to be performed in long data rows.