The paper is devoted to the development of theoretical basis and knoware of systems of ionospheric data analysis and to the detection of anomalous features appearing before strong earthquakes. Registered ionospheric data have complicated structure; they contain local peculiarities of different form and length. These features carry useful data on the process under investigation and they must be identified during the processing. The complicated structure of the features as well as the presence of disturbing factors make classical techniques of statistic data processing and analysis not effective. In the paper we suggest a technique of detection of anomalies in ionospheric data appearing during increased seismic activity; it is based on application of methods of wavelet-transform and neural networks. The technology allows us to detect local structures forming a signal, to analyze them, and to identify anomalies in automatic mode. On the basis of the suggested technology a neural-network system was developed; it includes the process of imaging of a signal into wavelet-space, adaptive noise removal and data prediction on the basis of three-level network of direct transfer. The process of detection of anomalies is based on the application of threshold functions for the components of data wavelet-transform. Identification of detection of data local structures is based on the analysis of function local smoothness by wavelet-methods.

The suggested technology is tested on real geophysical data registered at the Institute of Cosmophysical Research and Radio Wave Propagation FEB RAS. The obtained experimental results confirmed the effectiveness of the technology and allowed us to detect ionospheric data anomalies appearing before strong earthquakes in Kamchatka. Applying this theoretical mechanism, a system was developed to analyze and to predict the data of ionospheric F2 layer critical frequency.