DETECTING EARTHQUAKE PRECURSORS BY MATHEMATICAL MODELLING OF IONOSPHERIC TIME SERIES

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Abstract: *Aiming at earthquake precursors apportionment the earthquake preparation display of SEVAN (Armenia, 28.03.2014, M=2.6) earthquakes in time-series have been studied using the geomagnetic and ionospheric tools. Aiming at earthquake forecasting the anomaly in the ionosphere plasma is investigated by a radio-astronomical method. There were received some results, allowing to make out the difference of seismogenic anomalies of ionosphere between the longer anomalies connected to magnetic activity of ionosphere by the method of vertical reconnaissance of ionosphere.*

Introduction

It is known, that the geophysical environment, including seismically active zones, is made up of solid, liquid and gaseous phases. It is known as well that in the zone of two phases separation a Zone of Separated Changes (ZSC) is forming, or as they are called in physical chemistry, double ionic (electric) layers. Depending on their structure, each of the ZSC of geophysical environment is characterized by capacity, inductivity and resistance (see [1]).

The results obtained earlier allow to make out the difference between activity of ionosphere, by the method of vertical reconnaissance of ionosphere.

Radio astronomical monitoring method makes possible, along with immediate detection of electromagnetic emission from the Earth's depth in the selected frequency band, to observe other types of lithospheric impact on the atmosphere, such as aerosol, electrostatic, acoustical/gravitational, etc.

Those sources ultimately create anomalies at different altitudes of the atmosphere, high affect the propagating radio astronomical signal. Radio astronomical monitoring method has the following clear advantages over the active sensing methods: 1) Cosmic radio sources (Galactic background, discrete radio stars, etc.) are used instead of man-made radiation sources, often powerful, which are able to affect the observed layers of atmosphere; 2) Cosmic radio sources generate noise-like signals, which makes possible observation of the same source at several wavelengths (this is increasing the informative ness of monitoring); 3) Since the signals from the stellar radio sources pass through all layers of the atmosphere, their informative ness is high; 4) The radio astronomical instruments are highly sensitive and able to detect the smallest changes in the state of the atmosphere; 5) The method allows monitoring of solar activity by direct measurement of solar radiation density in the receiver waveband; 6) The cosmic source's power in the radio-frequencies range (over 10 MHz) is stable and known with high accuracy, while stability of the receiver system is provided by a controlled noise power source. This configuration allows reception of signals from point cosmic radio sources Swan and Cassiopeia-A, with nearly the same amplitudes of interference lobes. Time interval between these sources by the local meridian is 3 hours and 30 min(see [2]).

The method and technique of research

A new Methodology has been elaborated that provides possibility to estimate the current Seismic hazard (its intensity, location and time) with a sufficiently big probability. The elaborated methodology was used for analysis of data received in the process of perpendicular ionosphere from "Swan - A" and "Cassiopeia - A" point radio sources by radio astronomy methods. Aiming at the

earthquake forecasting the anomaly formations in the ionospheric plasma are investigated by a radio - astronomical method Saravand ionospheric stations.

Results

The results of the retrospective analysis of ionosphere observation data before SEVAN (Armenia, 28.03.2014, M = 2.6), revealed the following basic types of anomaly Fig.1:

1. Blinking of ionosphere active radio-source Swan – A on the frequency of 74 MHz.
2. Anomaly of above – mentioned precursors is coming out up to 40 days before earthquake.

Conclusion

The results of analysis by used methods show that the anomalies generally appear on 1- 40 days before the earthquake.

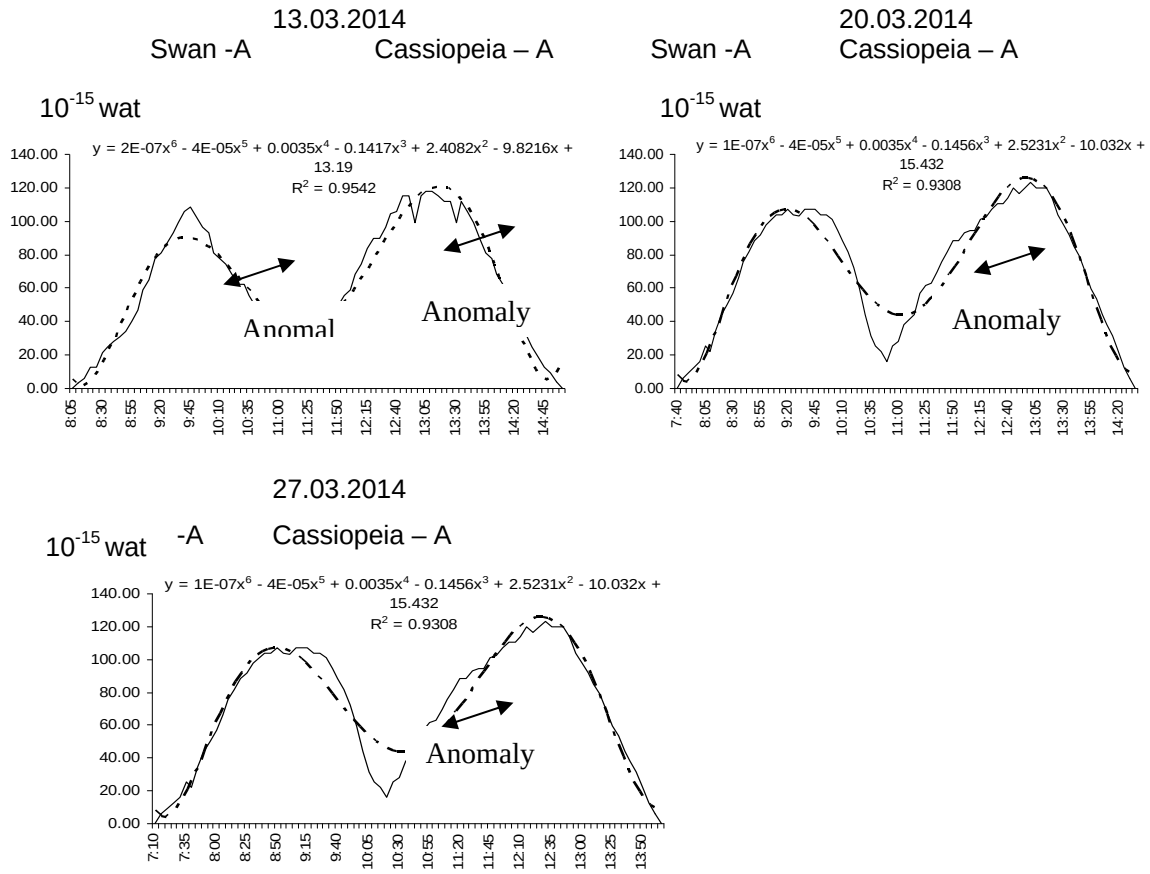

Fig. 1. The time–series of the ionosphere field (Saravand station) obtained by Radio astronomic method for the SEVAN (Armenia, 28.03.2014, M = 2.6) earthquake

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