

Earthquake Process Reverberation through Electromagnetic Field Variations

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ABSTRACT

Aiming to apportion earthquake precursors, the manifestations of preparation of the Garni (Armenia, 18.06.2009, M=3.8), Van (Turkey, 23.10.2011, M=7.3) and Zakatala (Azerbaijan, 05.06.2018, M=5.5) earthquakes in the time-series have been studied using the [1,2] geomagnetic [4] ionosphere and [1,3] Irreversibility of Non-stationary Processes (INP) techniques. With the purpose of earthquake forecasting, anomalies in the ionosphere plasma are investigated by a radio-astronomical method. The same results produced earlier allow to distinguish seismic anomalies of the ionosphere from the longer anomalies related to the magnetic activity of the ionosphere by the method of vertical sensing of the ionosphere.

Keywords

Earthquake, ionosphere, radio-astronomical method, time-series, electromagnetic fields

1. 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 formed, 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, inductive 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. This configuration allows reception of signals from the point cosmic radio sources Swan and Cassiopeia-A, with nearly the same amplitudes of interference lobes. Time interval between of these sources by the local meridian is 3 hours and 30 min. Electromagnetic precursors of the earthquakes are characterized by the great variety of types, depending on the character of tectonic processes they reflect and frequency band of their observation, etc. The frequency range of electromagnetic waves emitted by the Earth's crust is essential, but still unstudied. Daily dynamics of the local electric and magnetic fields generated by tectonic zones, rich in minerals, was analyzed in monograph (see [1]).

2. THE METHOD AND TECHNIQUE OF RESEARCH

A new Methodology has been elaborated that provides a possibility to estimate the current Seismic hazard (its intensity, location and time) with a sufficiently great 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. The time – series of geomagnetic field tension of T full vector and energy release E+- index of INP method have been used. With the purpose of earthquakes forecasting the anomaly formations in the ionospheric plasma are investigated by a radio- astronomical method. High accuracy proton magnetometers, which are measuring the T inductivity of geomagnetic field each 5 minutes are used for considering the geomagnetic field. The monitoring of INP method is carried out by NPVP-4 device periodically by 25 μ sec rectangular impulses. The following time-series have been used: Saravand (ionosphere field), Stepanavan (geomagnetic field) and Artik, Eqheqnadzor (electromagnetic fields) stations.

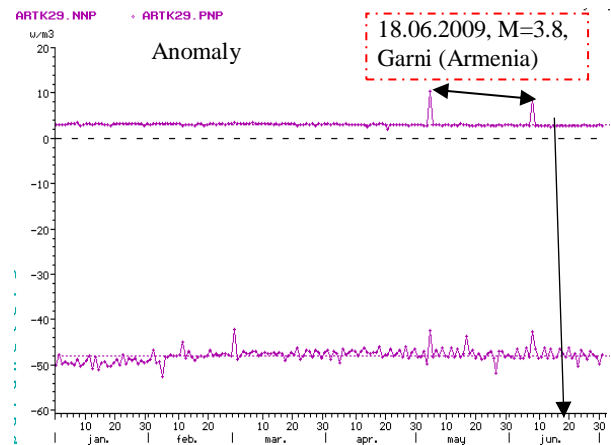


Figure 1. The time – series of the electropmagnetic field (Artik station) for the Garni (Armenia, 18.06.2009, M=3.8) earthquake.

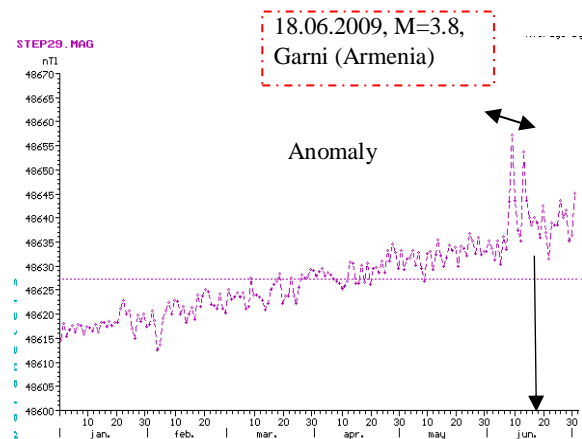


Figure 2. The time – series of the geomagnetic field (Stepanavan station) for the Garni (Armenia, 18.06.2009, M=3.8) earthquake.

From the data displayed in Figure 1 it is apparent that 3-50 days before those seismic events the «Artik» station observed intense parameter anomalies of the irreversibility of non – stationary processes (E+-). Variations of total strain vector of the geomagnetic field (ΔT) at «Stepanavan» station during the preparation of the Garni (Armenia, 18.06.2009, M=3.8) earthquake.

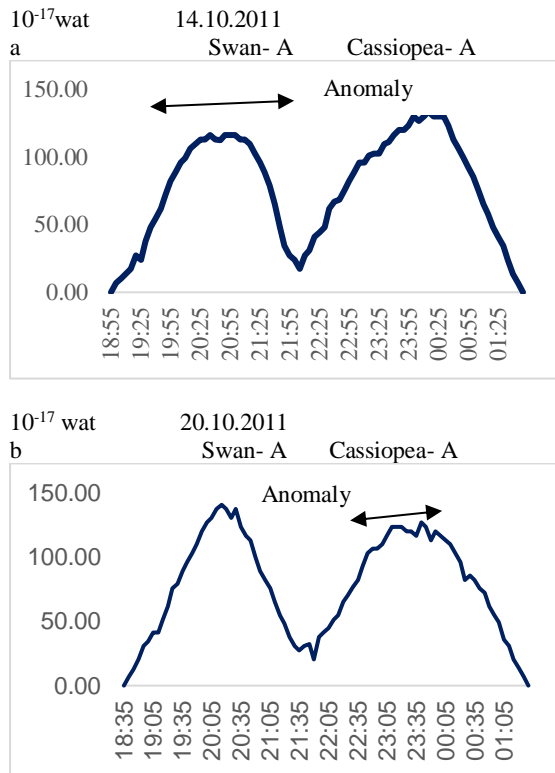


Figure 3. The time – series of the ionosphere fields (a,b) (Saravand station) obtained by Radio astronomic method for the Van (Turkey, 23.10.2011, M=7.3) earthquake preparation.

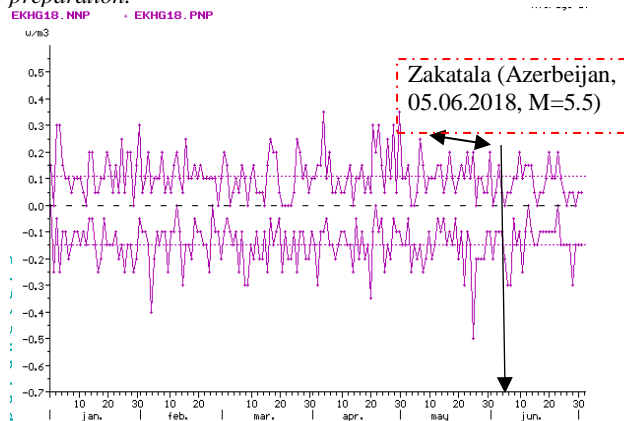


Figure 4. The time – series of the electromagnetic field (Eqheqnadzor station) for the Zakatala (Azerbaijan, 05.06.2018, M=5.5) earthquake. From the data displayed in Figure 4 it is apparent that 5-12 days before those seismic events the «Eqheqnadzor» station observed intense parameter anomalies of the irreversibility of non – stationary processes (E+-).

4. RESULTS

The results of the retrospective analysis of ionosphere observation data before Garni (Armenia, 18.06.2009, M=3.8), Van (Turkey, 23.10.2011, M=7.3) and Zakatala

(Azerbaijan, 05.06.2018, M=5.5) revealed the following basic types of anomaly (Fig. 1-4):

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

5. CONCLUSION

The results of analysis by the mentioned methods (Irreversibility of Non-stationary Processes -INP, radio-astronomical), show, that the anomalies generally appear on 1-50 days before the earthquake.

REFERENCES

- [1] Sergey Balassanian. 1990. Dynamic Geo-electricity. Novosibirsk, NAUKA, Siberian Department.
- [2] Adibekian M. V. 2003. The analysis of ionospheric, Geomagnetic and electromagnetic time series with the purpose of forecastin strong the purpose of forecasting strong earthquakes. *Sapporo*, Japan, abstract. IUGG 2003. p. A470.
- [3] Сергей Баласанян. Грачя Петросян, Ашот Аванесян, Маргар Адібекян. Некоторые Результаты наблюдений методом необратимости нестационарных в период подготовки и реализации Ноемберянского землетрясения (18.07.1997). *Сейсмостойкое строительство*, М., N1, 1999, с.40-43.
- [4] Marghar Adibekyan. Detecting earthquake precursors by mathematical modelling of ionospheric time Series. *Seventh International Conference on Computer Science and Information Technologies* 28 September-2 October, 2009, Yerevan, Armenia. Pp 112-114.