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EARTHQUAKE PREPARATION PROCESS REVERBERATION IN ELECTROMAGNETIC FIELDS VARIATIONS

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Abstract: *Aiming at earthquake precursors apportionment the earthquake preparation display of Noemberyan (Armenia, 20.06.2008, M=3.4), Azerbaijan (28.07.2010, M=3.6) and Georgia-Armenia border (27.09.2011, M=4.3) earthquakes in time-series have been studied using the geomagnetic, ionosphere and Irreversibility of Non – stationary Processes (INP) techniques. Aiming at purpose earthquake forecasting the anomaly in the ionosphere plasma are investigated by a radio-astronomical method. There were earlier 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. There were earlier received some results, allowing to make out the difference f seismogenic anomalies of ionosphere between the longer anomalies connected to magnetic activity of and the time series of E parameter of INP method energy release (absorbtion) . For concidering the geomagnetic field are used high accuracy proton magnetometers, which are measuring the T inductivity of geomagnetic field each 5 minutes. The monitoring of INP method is making by NPVP – 4 device periodically by 25 msec. rectangular impulses. There have been used the following time – series Saravand (ionosphere), Aruch (geomagnetic field) and Gumri, Qajaran, Exegnadzor (electromagnetic fields) stations.*

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 (Balassanyan S.Yu, 1990).The results obtained earlier allow to make out the difference between activity of ionosphere,by the method of vertical reconnaissance of ionosphere [2-6]. 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 (Balassanyan S.Yu. 1990). Much attention is given during the last several decades to study the ionospheric precursors of the earthquakes. Various authors (Gokhberg M. B. 2000, Liperovski V. A 1992) have proposed models of the physical interaction mechanisms between lithosphere and ionosphere. However the whole system of issues related with these bonds still remain unclear. The monograph (Liperovski V. A 1992) describes in detail almost all known types of ionospheric precursors of the earthquakes. It is shown, in particular, that electronic concentration and density variations occur in all layers of ionosphere above the seismically active regions prior to earthquakes, with characteristic time of several hours. These perturbations, in their turn, have impact on propagation of HF and VHF electromagnetic waves. Physical mechanisms of these processes are considered in the paper (KimV. P., Pulinets S. A., Khegai V. V., 2002). It is shown that the initial source of ionospheric perturbations preceding the strong earthquakes is the perturbation of vertical electric field on the Earth's surface, initiated by physical and chemical processes at earthquake source. It should be noted that atmospheric perturbation study, aimed at detection of possible earthquake precursors is carried out mostly by the active ground and satellite methods using artificial signal sources. At the same time, the radio astronomical observation method where the signals from natural stellar sources are used, was not so popular. The paper (Voinov V.V.,Gufeld I. P., Kruglinov V. V., et al.,1992) analyzing the effects in ionosphere and atmosphere

preceding the Spitak earthquake may be considered as the first such publication. 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.

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 of these sources by the local meridian is 3 hours and 30 min.

The Method and Technique of Researches

The time – series of geomagnetic field tension of T full vector and energy release (absorbtion) 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 [6]. High accuracy proton magnetometers [7], 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 making by NPVP–4 device periodically by 25 μs rectangular impulses [8].

Results

The results of the retrospective analysis of ionosphere observation data before Noemberyan (Armenia, 20.06.2008, M=3.4), Azerbaijan (28.07.2010, M=3.6) and Georgia-Armenia border (27.09.2011, M=4.3) revealed the following basic types of anomaly (Fig. 1-5):

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.

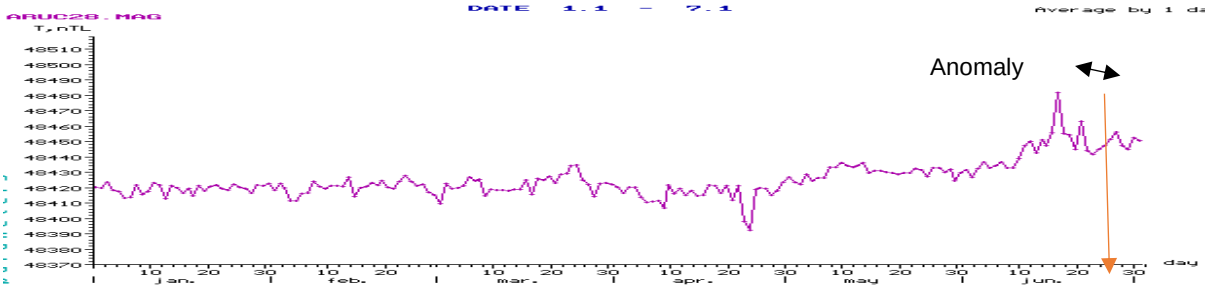

Fig. 1. The time – series of the geomagnetic field (Aruch station) for the of Noyemberyan (Armenia, 20.06.2008, M=3.4) earthquake

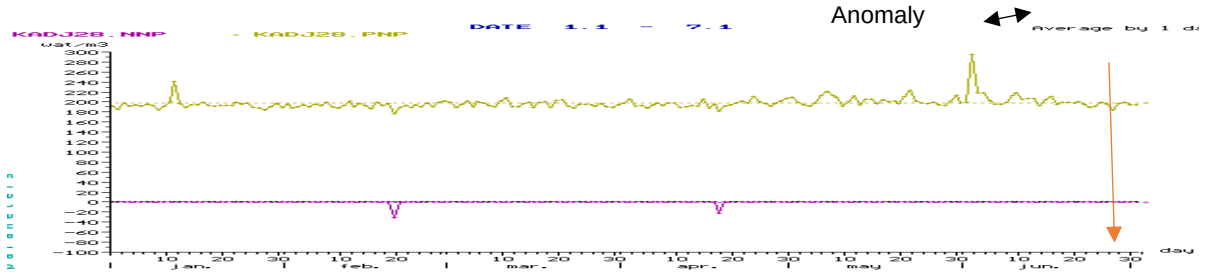

Fig. 2. The time – series of the electromagnetic field (Qajaran station) for th of Noyemberyan (Armenia, 20.06.2008, M=3.4) earthquake

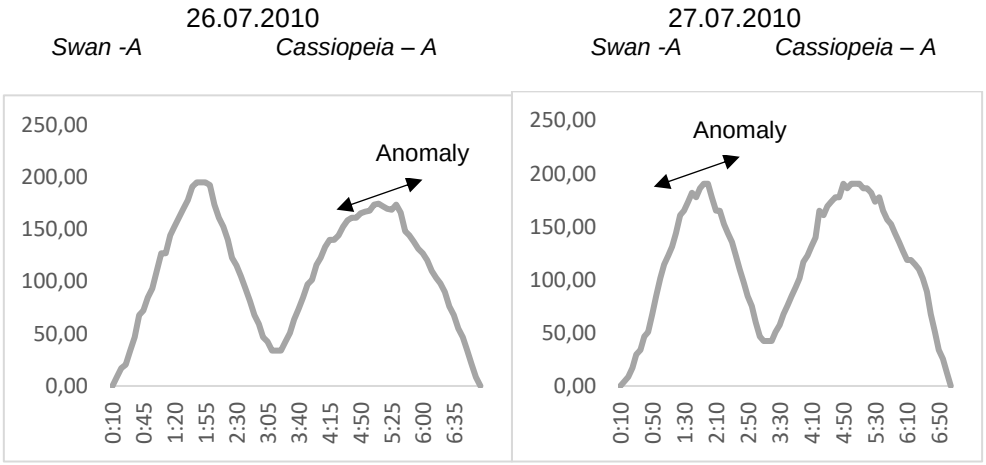

Fig. 3. The representation of time – series of the ionosphere field (Saravand station) obtained by Radio astronomical method for the Azerbaijan (28.07.2010, M=3.6) earthquake

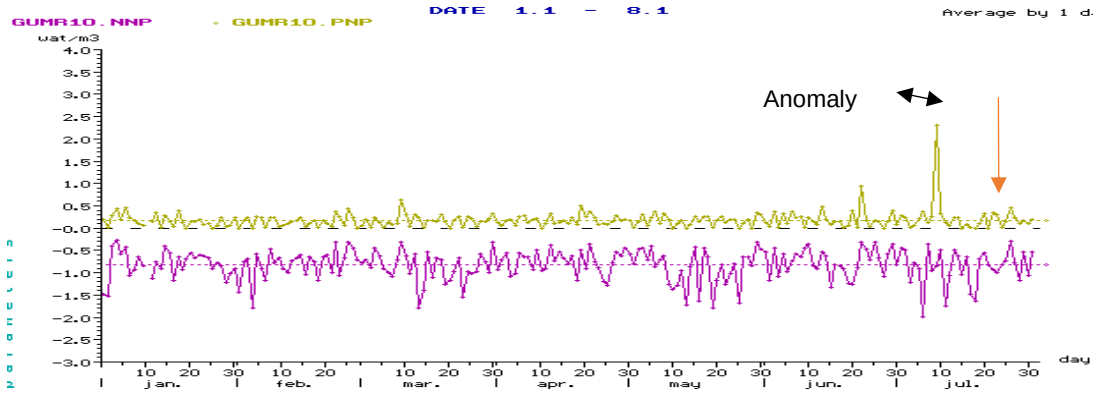

Fig. 4. The time – series of the electromagnetic field (Gyumri station) for the Azerbaijan (28.07.2010, M=3.6) earthquake

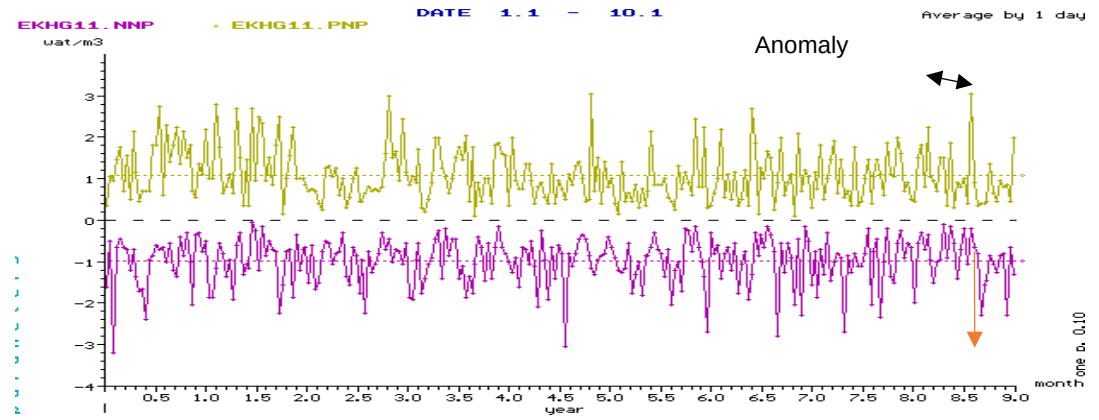

Fig. 5. The time – series of the electromagnetic field (Exeqnadzor station) for the Georgia-Armenia border (27.09.2011, M=4.3) earthquake

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