



Missouri University of Science and Technology
Scholars' Mine

International Conferences on Recent Advances
in Geotechnical Earthquake Engineering and
Soil Dynamics

2001 - Fourth International Conference on
Recent Advances in Geotechnical Earthquake
Engineering and Soil Dynamics

28 Mar 2001, 4:00 pm - 6:30 pm

Studying of Medium Manifestations Aspects in Relation to Some Recent Earthquakes

I. G. Kerimov

Scientific Center of Seismology of the Presidium of Azerbaijan Academy of Sciences, Azerbaijan Republic

A. N. Alizada

Scientific Center of Seismology of the Presidium of Azerbaijan Academy of Sciences, Azerbaijan Republic

Follow this and additional works at: <https://scholarsmine.mst.edu/icrageesd>



Part of the [Geotechnical Engineering Commons](#)

Recommended Citation

Kerimov, I. G. and Alizada, A. N., "Studying of Medium Manifestations Aspects in Relation to Some Recent Earthquakes" (2001). *International Conferences on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics*. 5.

<https://scholarsmine.mst.edu/icrageesd/04icrageesd/session10/5>

This Article - Conference proceedings is brought to you for free and open access by Scholars' Mine. It has been accepted for inclusion in International Conferences on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics by an authorized administrator of Scholars' Mine. This work is protected by U. S. Copyright Law. Unauthorized use including reproduction for redistribution requires the permission of the copyright holder. For more information, please contact scholarsmine@mst.edu.

STUDYING OF MEDIUM MANIFESTATIONS ASPECTS IN RELATION TO SOME RECENT EARTHQUAKES

I.G. Kerimov

Scientific Center of Seismology of the Presidium
of Azerbaijan Academy of Sciences.
H.Djavid av., 31, Baku, 370143, Azerbaijan Republic

A.N. Alizada

Scientific Center of Seismology of the Presidium
of Azerbaijan Academy of Sciences.
H.Djavid av., 31, Baku, 370143, Azerbaijan Republic

ABSTRACT

In June 1991 on the International Conference on Induced Seismicity in Baku and in August 1991, at International Congress of Geophysics and Geodesics in Vienna we introduced materials about strongest changes of microseisms starting from January, 15, 1991 on the territory of Absheron peninsula (Azerbaijan) which were connected with military activity in Iraq at the distance as far as 1000 km. In Turkey, Caucasus, Iran and other countries from January to June 1991 in comparison with previous 5 years frequency of earthquakes considerably increased.

It is possible to say that exactly the same situation appears after April, 20, 1999 when started the operations in Yugoslavia. The microseisms registered at the distances of 1200 km, 3000 km and 5000 km evidently witnesses of the considerable disturbances in their behavior.

What is more, these results say that if such disturbances appear at so big distances they can be distributed and influence everywhere. As a result of uncontrolled human activity the world Ecosystem has become exclusively sensitive and today even small impact has its response practically at any distances and all spheres.

On the basis of previous research and data received we can suppose that many seismic events that happened in last year may have an induced character : they may have been sufficiently increased in intensity and quicken in time of occurrence. Increased sensitiveness of the medium and intensity of uncontrollable influence on it requires the creation of world induced effects control system.

INTRODUCTION

The new approach to the problem of the induced phenomena is connected with understanding of the geophysical medium not as the static one, but which is very important as a dynamic one with permanently changing parameters and properties. Diagnostics of the medium condition using a seismic and other geophysical fields monitoring allows to determine dynamics of its changing under the influence of natural or artificial factors, more correctly evaluate a degree of seismic risk aimed at safe seismic resistant construction. And exactly for describing these very effects we determined terms "geophysical medium", "active geophysical medium", "tensosensitive medium", "tensosensitive points", "energy active fault", "energy non-active fault", "natural own seismicity", "natural induced seismicity", "energy pollution" and etc.

The studies led to a creation of new conceptions about the processes taking place in the seismic sources and the mechanism of the induced seismicity caused by external impact.

The scientific basis of the researches to be carried out is a previously unknown conformity with natural law of the behavior of weak high frequency seismic signals – microseisms, accepted as a discovery by the State Committee on Discoveries and Inventions of the former USSR in March, 17, 1988 as a scientific discovery under No. 8 with a priority from May, 28, 1979 (author – I. G. Kerimov) and from the new point of view demonstrating the physics of source processes and forms of transformation of the energy from the source.

Uncontrollable industrial activity on the territory with high strain sensitivity (tension-sensitivity), i.e. the strong reaction at the external influences, leads to the essential changes of the seismicity, activation of the tectonic processes, activation of the tectonic faults, to the increase of the environment stress state and to the origin of the vibration fields caused by elastic and non-elastic deformations of the medium. This was the reason for us to suggest in 1985 revising the maps of seismic zoning of different regions as well as the existing methods of computation of intensity of earthquakes, compiled without consideration of impact on the medium of the induced factors

that might exceed the computed intensity in the static condition by 1-2 marks and more.

As the statistical data accumulated it became clear that the artificial activation of some territory would not be limited by this territory, and after a certain period of time would cover much more larger areas and bring to the sufficient changes of medium specificity on this territories.

The most impressive were our results of studies of UNE (underground nuclear explosion) environmental impact which showed that they had practically touched all spheres of medium - lithosphere, hydrosphere, atmosphere, ionosphere.

Our studies in this field commenced more than 20 years ago, and their results allowed us to understand, to a certain extent, a physical mechanism of negative technogenic effects and come to the conclusion that environmental problems are more complicated and delicate that they seemed to be at first sight, and that any large scale industrial activity should be controlled to avoid a disturbance of natural balance and a significant economical damage caused by it.

ANALYSIS OF PREVIOUS INFORMATION

Abnormal behavior of some earthquakes attracted our attention first in 1978. Most characteristic in that plane are earthquakes occurred in Gazli, 1976. According to seismicity maps that region was treated as the zone of the intensities of 4, but the earthquakes happened caused the tremors of the intensity of 9.

Analyzing all data we came to conclusion that Gazli earthquake may have had induced character. We supposed that uncontrolled exploitation of gas-fields lead to changing of the state of medium and accumulation of considerable deformation energies which was triggered by UNE in Semipalatinsk. The following analysis showed that appearance of many strong earthquakes in Caucuses, Middle Asia and surrounding regions also can be connected with UNE.

The proof of UNE connections with the induced seismicity could be made by the fact that energies low than UNE under durable realisation can change the character of nature processes. That way seemed to be more acceptable and opened the opportunity to investigate a wide class of the problems of induced seismicity caused by large industrial activity, widen out notions of medium. Moreover it may allow to solve ecological and environmental problems and work out efficient and safe tactics of large industrial works.

Our results have reflected that researches and as an instrument of medium's investigation the analysis of microseisms records, their frequency-amplitude, polarization and other characteristics were used. The peculiarities of microseisms manifestation allowed us to come to conclusion how to estimate the stress state of medium and, in some extent, induced influences.

The following main conclusions connected with the studies of technogenic effects are:

- Under the repeated external influences even with the very weak energy the medium can change its characteristics, show high dynamic activity and appearance of induced seismic events can be caused by external impacts the power of which is extremely low in comparison with the power of the earthquake itself.
- Due to certain physical effects technogenic reactions differ from the natural by much higher power. The intensity of the earth surface shaking can hundred times and more exceed the supposed levels. It can lead to huge damages, as seismic-proof construction were considered against less intensive reactions.
- High power events can appear even in areas that were earlier considered as low-seismic or even non-seismic.
- Induced (technogenic) events cause such a significant economical damage also because they are accepted as natural, no measures are taken to control and prevent them. Since they have higher intensity of seismic events, they cause not only direct damages but for the following years lead to additional expenses because of an artificial rise of costs for seismic-proof construction. The necessary measures to control induced effects would cost much lesser.
- Divided into separate large, middle and small blocks, the medium has a different spatial-temporal reactions ("tensosensitivity") to external impacts depending on the degree of their stressed state. Also there was determined a periodicity of changes in mosaic of active and inactive faults.
- The right selection of territory with low tensosensitivity for location industrial objects - water reservoirs, civil and industrial construction, drilling etc. is one of the important ecological aspects for technogenic effects control.

RESEARCHES AND EXPERIMENTS IN EIGHTIES

We made a study of influence of electrical signals on stressed state of the medium. Due to effect of magnetostriction the exceptionally small part of electric energy transforms into acoustic (seismic) radiation and it was shown that even such weak repeated impacts can influence to the medium: quantity of weak earthquakes increased in 2-4 times. in comparison with previous years.

The following studying were concern of interconnection of seismicity of different regions. They allowed us to specify categories of natural own and natural induced seismicity. This made it possible to look into and clarify the variations of precursor manifestations of geophysical fields and give possible explanation of their appearance or absence in period of preparation of earthquakes.

Subsequent researches and experiments, allowed to work out methodical basis of analyzing and control of the medium state

and to expose the significance of influence on mediums water reservoirs, mines, exploitation of oil and gas fields and other induced effects caused by non-controlled industrial activity even at a remote distance (for example, on the territory of other countries), at determining of geophysical parameters of the medium.

As an example we can show our analysis of four earthquakes, which occurred in Ismaili district of Azerbaijan in November 1981. These earthquakes were strengthened and quickened as a result of seismic works by means of strong power explosions conducted by Ministry of Geology of USSR in order to study of the crust structure. Before beginning of the works we made strong objections against their conduction. We could not accept their way of conduction and supposed that in very sensitive seismic zone such kind of work has to be controlled and done very carefully. Our previous researches showed that uncontrolled periodical impacts on the medium, particularly in seismic zone, can lead in 3-6 months to a strong seismic event.

Because our opinion were not taken into account we organised in Ismaili district our own seismic network and registered all changes that occurred in the medium during these work and as a result of the mentioned explosions. We made a complete analysis of seismisity before beginning of the works and after their conduction and also made a study of the medium stress state before earthquakes and in several months after their occurrence.

On the basis of that there was established a government commission of the former USSR, which after considering our materials made a decision to recommend Ministry of Geology of the USSR and other organizations stop carrying out explosions in seismic zones.

Further we analyzed tenth and tenth of that kind of events occurring throughout the world. At making of impacts the periodicity of explosions (or vibro-impacts) should be chosen in the way so that the energy is able to redistribute and dissipate. If it does not happen, then in a radius from several tenths to several hundreds kilometers in a certain local area starts a quick gathering of the energy and at that, beginning from a some energy level, the process takes an irreversible character and in 3-6 months it may end in a strong seismic event. And its energy may by several orders exceed the energy of events that were previously observed in that territory.

A characteristic example of the last time is the strongest earthquake occurred on Sumatra Island at the beginning of June 2000. Several months ago on that Island by means of two powerful vibrations were conducted uninterrupted long time impacts on oil deposits. The aim of the works was an increase of extraction. Consequent and catastrophic result of these uncontrolled impacts was the occurred earthquake.

RESEARCHES AND EXPERIMENTS IN NINETIES

However, there is a considerable difference between the way it happened in the previous years and how it happens today. Ten years ago the sphere of influence was limited to 2-3 thousand of kilometers from the area of impact and strong disturbances appeared at these distances for 4-6 months.

For example in June 1991 on the International Conference on Induced Seismicity in Baku and in August 1991, at International Congress of Geophysics and Geodesics in Vienna we introduced materials about strongest changes of seismological fields on the territory of Absheron peninsula (Azerbaijan) which were caused by military activity in Iraq in the distance as far as 1000 km. We showed that despite the fact that this military activity happened in so big distance and continued for less than two month environmental disturbances due to that activity were observed on seismological data for many month. One of the characteristic signs of induced effects is an appearance of peculiar trains of oscillations having the form of harmonic signals of long duration, which reflects stimulation of separate layers or groups of layers.

Seismic radiation transferring through focal zones stimulates the processes in medium, appearance of seismic emission and, consequently, vibration processes in separate layers, that is reflected on Fig.1 (a, b).

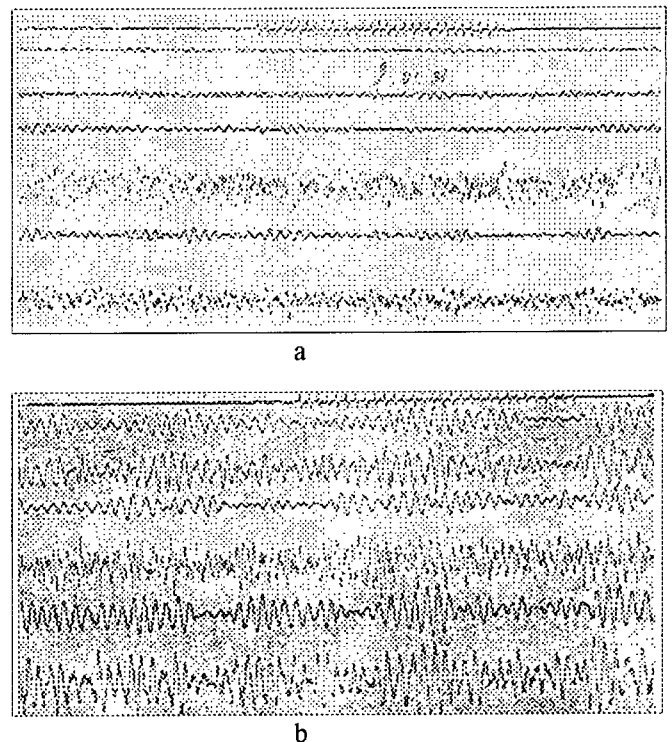


Fig.1. The levels of microseismic fields registered in Baku in midnight on January, 9, 1991 (a); before beginning of war actions in Persian Gulf and January, 18, 1991 (b), after beginning of war actions in Persian Gulf.

On the basis of our data there was organized International Commission which made a request to many countries asking to analyze geophysical and other information for the given period of time. In particular, analyze of seismological levels

on the territory of Turkey, Caucasus Republics, Iran and other countries showed that in period from February to June 1991 comparison with previous 5 years frequency of earthquakes increased in 2-4 times.

It is possible to say that exactly the same situation appears after April 1999.

But nuclear tests made by France, India, Pakistan few years ago showed that the sphere of impact considerably extended and covered much more big territories. They caused strong environmental catastrophes not only for India, Pakistan and surrounding countries but for many others in different parts of the World.

The war in Yugoslavia showed that today the mechanism of development of events is completely different. Perhaps as a result of the whole strong increase of medium stress state. First appears a strong stressed zone round the center of the disturbances in a quite large space. The discharging looks as edge effects as strong natural catastrophes sometimes at long distances from the center of the impact.

But then after discharging the edge regions the gathering of the processes takes place and disturbances cover the near zone. The beginning of this following stage of the development of the process we observed during last several months and it was particularly strong at the end of December, 1999. In the near zone these processes may continue for the near 6-8 months.

The aim of the Scientific Center is create a system by means of which it would be possible to control the state of the medium in the that or another territory. We think that these researches are very important for any country. Today, it is necessary to control not only what happens in your own territory but also what is going on in near and even distant and far zones because an uncontrolled artificial impacts lead to a huge ecological and economical damages.

In following years these effects will become stronger. Because according to our suppositions the sensitivity of the medium to external impacts will increase due to natural and technogenic course. And in due course the creation of such general system will become necessary.

As a result of uncontrolled human activity for many years (particularly in respect of underground nuclear explosions) the World ecosystem, from our point of view, has become exclusively sensitive and today even small impact has its response in all spheres of the Glob practically from any distance of the center of the event.

At present time when one year has past since Yugoslavia events all our conclusions became more evident. If observe all events which have been happening in the World during the last months (earthquakes, floods, quantity of unusual meteorological events, landslides, and also considerable number of different collisions) and compare them with the

previous 5-10-15 years for the same period of time there will not be doubt in their anomaly.

During the latest months we conducted special researches connected with this problem and results received considerably changed our opinion about how today the disturbances influence to appearance of such events and reflect in their periodicity, distances, intensities and etc.

We analyzed behavior of seismic fields registered at the distances of 1200 km (Ukranian stations), 3000 km (Azerbaijan station) and 5000 km (Tatarstan stations) from the place of military operations in comparison to their parameter before and after the beginning of war in Yugoslavia.

All this data evidently witnesses of the considerable disturbances appeared in lithosphere. Due to that military activity big changes were observed on seismological data for very long time.

CONCLUSIONS

What is more, these results say that if such disturbances appear at such long distances they can be distributed and appear practically at any distance.

Therefore, many strong and strongest earthquakes of the last time, which are the subject of the present conference (Grease, Turkey, Taiwan and others) can have (and have) an induced character. It means that they appeared to be increased in many times and quickened. A widely known common approach will not allow explanation of their some unusually characteristic features.

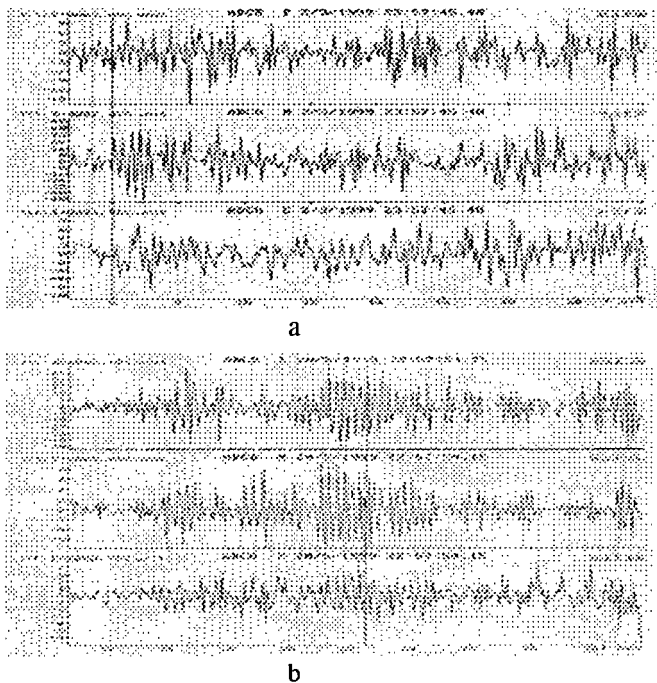
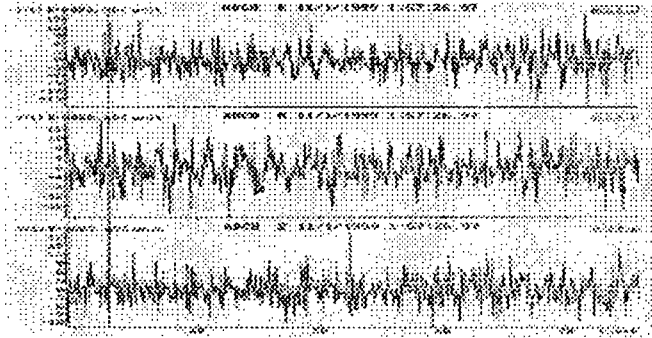
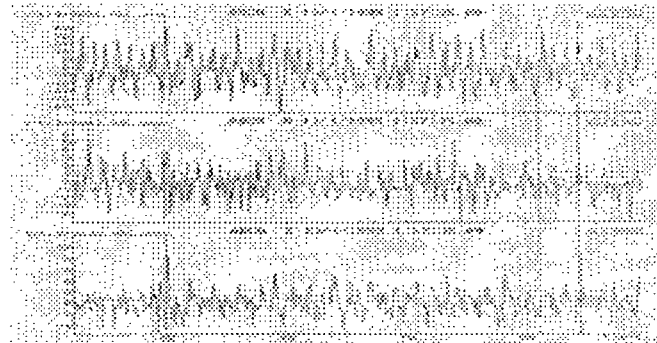


Fig. 2. Korec station, Ukrainian before beginning of the war March, 2, 1999 (a) and after beginning of the

war May, 20, 1999 (b)



a

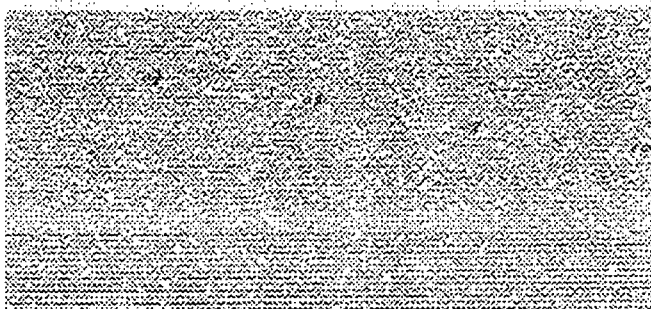


b

Fig. 3. Belzkaya volya station, Ukrainian before beginning of the war January, 11, 1999 (a) and after beginning of the war April, 5, 1999 (b)

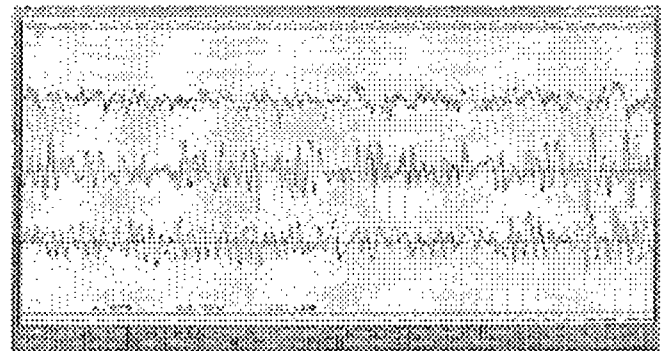


a

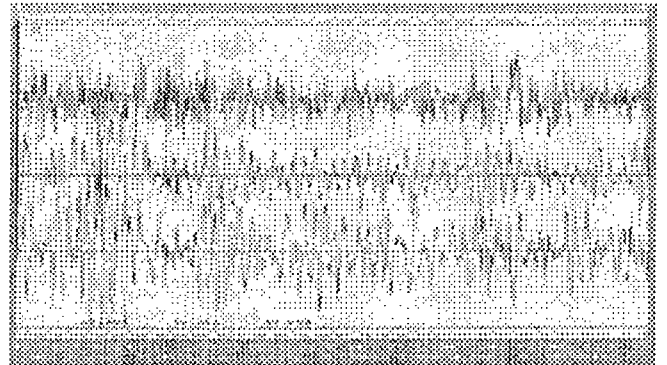


b

Fig. 4. Baku station, Azerbaijan before beginning of the war March, 14, 1999 (a) and after beginning of the war April, 6, 1999 (b)

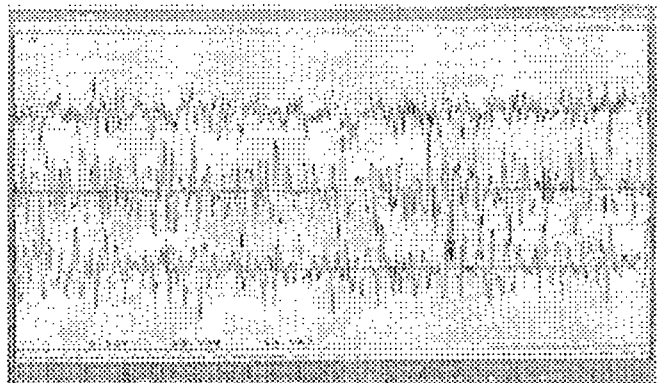


a

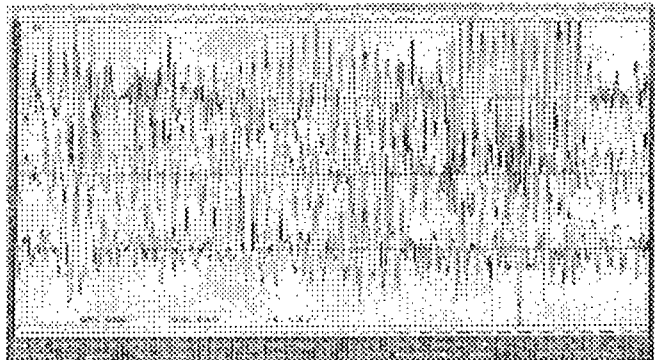


b

Fig. 5. GZU-307 station, Tatarstan before beginning of the war March, 17, 1999 (a) and after beginning of the war April, 5, 1999 (b)



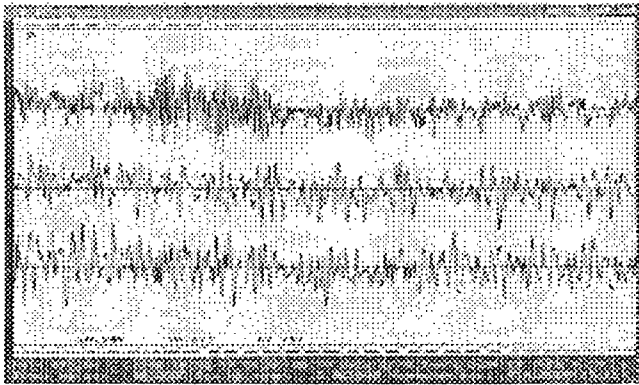
a



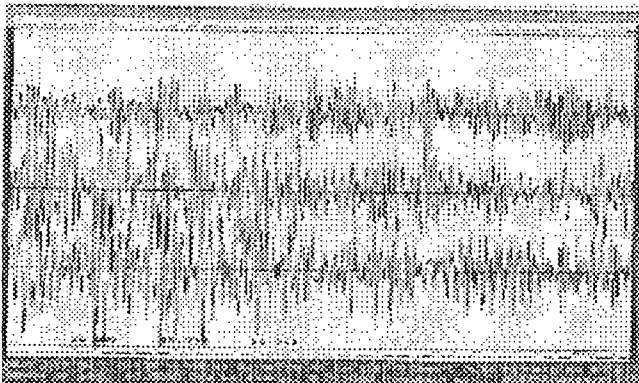
b

Fig. 6. Damba station, Tatarstan before beginning of the war March, 17, 1999 (a) and after beginning of the war April, 5, 1999 (b)

Kerimov I.G. [1994]. *Weak signals influence on the stress state of medium.* @ Proc. of the NATO advanced Research Workshop, November, Moscow.



a



b

Fig. 7. Bizyaki station, Tatarstan before beginning of the war March, 18, 1999 (a) and after beginning of the war April, 19, 1999 (b).

We think that taking into account increased sensitiveness of the medium and intensity of uncontrollable industrial works conducted everywhere or other strong impacts on the medium the creation of induced effects control system is a more important and actual issue than system of seismic events registration. The introduced data witness of insistent need of its presence.

REFERENCES

Kerimov I.G. [1994]. *Estimate of microseisms role in the study of source physics and earthquake prediction.* @Proc. of the XIX General Assambly of the European Seismological Commission, October, Moscow.

Kerimov I.G., Ahmedov N.A. [1992]. *Induced seismicity.* @ Proc. of the First Conference on Tectonic.Geophys. and Seismotectonic Problems, 21-24, October, Tabliz

Kerimov I.G., Ahmedov N.A. [1994] *Industrial activity in the tension-sensitive regions.* @ Proc. of the Second International Conference on Earthquake Resistant Construction and Design, 15-17 June, Berlin.