

COMPARATIVE ANALYSIS OF THE EARTH CRUST DEFORMATIONS OF THE GEOSYNCLINAL AND PLATFORM REGIONS

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By results of the fluidodynamical (emanation) monitoring of the geodeformation processes have been made in various geodynamic grounds of the former USSR, it was shown [1-3], that oscillatory movements of the East Europe Platform (EEP) influence change in the intense - deformed state of the rocks massive on the Caucasus, provoking liberation of seismic energy.

With the purpose of establishment of character of the geodeformation processes interconditionality in geosynclinal region (on the Caucasus) and in conditions of the East Europe Platform connected to it was carried out the comparative analysis of the deformometric measurements made in the Elbrus (on Baksan), and of the fluiddynamic monitoring data of the geodeformation processes made in conditions of Moscow sineclisa (in territory of Moscow).

Continuous measurements of deformations on the Caucasus are carried out with the help of the laser deformograf GAISH MGU with measuring base of 75 meters and resolution 2×10^{-13} , established in the neutrino observatories gallery [4]. Continuous measurements of the fluiddynamic regimen variations of Moscow sineclisa were carried out in a zone of dynamic influence of the faults of the "Krasnopresnya tectonic unit" on the emanations of radon and hydrogen [5] with use of the original technology providing registration of geodeformation processes at a tidal level, i.e. at a level of 10^{-8} .

On fig. 1 time series of the rocks deformation variations on Caucasus and variations of fields of hydrogen and radon in territory of Moscow are shown which are the fragment of simultaneous record of the named parameters, averaged in hour intervals, by the common duration of 13510 hours, i.e. more than 1.5 years. The beginning of record November, 11, 2004 is caused by the moment of the laser deformograf start, and the ending was determined by failure of the microprocessor registrar of the emanation measurements.

The submitted fragment of long-time measurements is interesting to that allows to estimate behaviour of the geodeformation fields in geosynclinal and platform regions during development of the global tectonic processes, provoked catastrophic earthquakes in Indian ocean on December, 26, 2004 and on March, 28, 2005. The Level of the seismic energy emission at these earthquakes has reached a 9-ball mark on the Magnitude Scale, that testifies to extraordinary character of the geodeformation processes participating in their preparation and, obviously, affected the earth's crust as a whole.

Research of the time series was carried out on a basis of the correlation and the spectral analysis as a result of which some common and individual characteristics of the measured parameters were established determining, in this or that measure, the reaction of geosynclinal and platform regions on the global geodeformation processes.

First of all, call attention that the trend component of the deformations on the Caucasus and the deformations determining conditions of the fluid-permeability in the tectonic structures of Moscow sineclisa, has seasonal (year) character that has found also display in results of the correlation analysis. And the seasonal component in the deformation measurements on the Caucasus practically for one month outstrips a course of the similar components of the time series of the emanation measurements in conditions of the platform. Correlation between deformometric and the hydrogen measurements data is positive, and between deformometric and radon measurements - is negative, that corresponds to the character of the emanations (radon and hydrogen) behaviour established earlier at ordinary (not abnormal) changes of the geodeformation processes influencing the fluid-permeability change of tectonic formations, used at emanation monitoring [5]. At this the field of hydrogen in Moscow sineclisa and the field of radon - with some advancing varies synchronously to the deformations of a mountain construction of the Caucasus.

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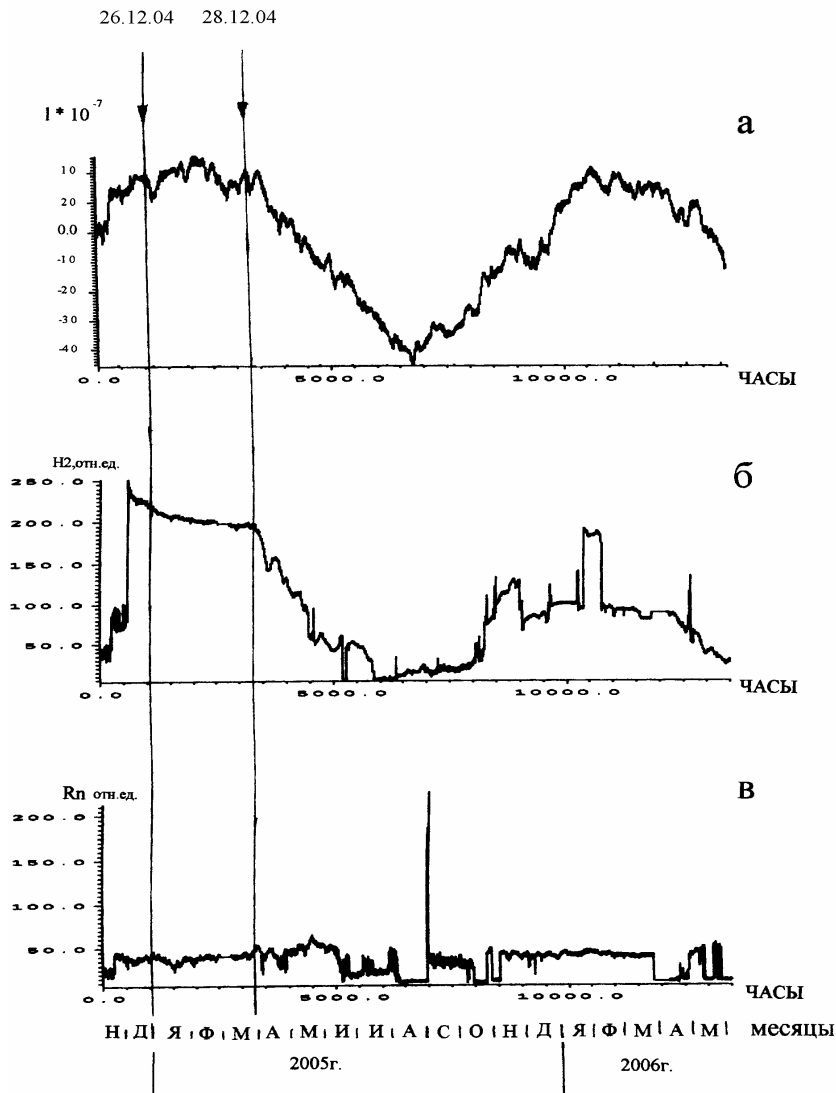


Fig.1. Fragments of time series: а) deformometric measurements on the Caucasus (Baksan), б) and в) emanation (hydrogen and radon, accordingly) monitoring of the geodeformation processes in conditions of Moscow sineclisa. Arrows mark the moments of catastrophic earthquakes in Indian Ocean on December, 26, 2004 and on March, 28, 2005.

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The spectral analysis of the all time series of the deformometric measurements (which detailed analysis is given in work [6]), and the subsequent spectral analysis of time series of the correlation functions of radon and hydrogen fields within the limits of the allocated fragment, have allowed to identify the long-period spectral components of the measured parameters (tab. 1) and of the variations caused by the lunar-solar tides (tab. 2). Analogousness of spectral components of the analyzed time series testifies to adequacy of display of global geodeformation processes in the measured parameters of the geosynclinal and platform regions.

Table 1

Significant ($P > 0.95$) spectral peaks of the long-period components of the time series of the laser deformometry on the Caucasus and emanation measurements in the EEP conditions (with duplication of measurements by the gauges established in 30 meters from basic)

Name	Day	Day	Day	Day	Day	Day	Day	D	D	Day	D	D	D	D	D
Def.	22.8	20.1	17.1	15.9	13.9	11.2	10.0	9.5	8.8	8.13	7.8	7.5	6.6		4.9
1rad/d.	23.5	20.1	18.4		13.9	11.2		9.5	8.5	8.13	7.8	7.5	7.0	5.9	5.3
1hyd/d.	23.5	20.7	18.9	14.5		11.2	10.2			8.13	7.8	7.5	7.0	6.4	5.9
2rad/d.	22.8		17.1		13.9	11.2		9.5		8.13			6.6	5.6	4.9
2hyd/d.	22.8	20.7		15.9	14.5	11.8	10.0	9.5	8.5	8.13			7.0	6.4	4.9

Table 2

Significant ($P > 0.95$) spectral peaks of the lunar-solar tides of time series of the deformometry on the Caucasus and emanation measurements in the EEP conditions

Name	T hour	Ampl. (rel.) $\cdot 10^{-3}$	T (rel.)	Ampl. (rel.) $\cdot 10^{-3}$	T hour	Ampl. (rel.) $\cdot 10^{-3}$	T hour	Ampl. (rel.) $\cdot 10^{-3}$	T hour	Ampl. (rel.) $\cdot 10^{-3}$	T hour	Ampl. (rel.) $\cdot 10^{-3}$
Def.			25.75	0.7	24.0	0.7	12.7	0.13	12.4	2.6	12.0	0.5
1rad/d.	26.9	0.08	25.75	4.9	24.0	0.35	12.7	0.1	12.4	0.6	12.0	0.17
1hyd/d.	26.9	0.04	25.9	0.2	24.0	1.1	12.7	0.02	12.4	0.15	12.0	0.09
2rad/d.	26.9		25.75	0.6	24.0	1.1	12.7	0.16	12.4	0.5	12.0	0.6
2hyd/d.			25.75	0.13	24.0	0.93	12.7	0.04	12.4	0.2	12.0	0.3

At the same time, as it is possible to see, spectral structure of time series of the emanation fields a little bit rich of the spectral structure of the deformometric data that is connected with the technology of the emanation measurements, providing extraction of the information on volumetric deformations of the rock massif. Probably, this character the emanation fields reaction (fig.1) on global changes in the tense - deformed state of the earth's crust, provoked liberation of seismic energy near to island Sumatra on December, 26, 2004 and on March, 28, 2005 when in the field of hydrogen of the Moscow sineclisa practically one month prior to tragic events there was a sharp jump, five fold exceeded the concentration level of previous months. In a field of radon this effect was on the contrary noted more than double (on fig.1 it is not shown because of the truncated time series) reduction of a level of concentration [5].

After realization of the earthquake on 28.03.05 within 3 months there was a decrease of concentration of hydrogen up to initial, and the next months practically up to a zero level. Concentration of radon on an initial level has not returned, that speaks descending trend in time series of the emanation fields, connected with influence of wave geodeformation processes of higher hierarchical level [7].

In the data of the deformometric measurements the effect of global change in the tense - deformed conditions of the earth's crust was showed as a result of the joint analysis of the records received on Caucasus and in it the settlement Protvino (the Moscow region) [8] in which the period of preparation and realization of earthquakes is characterized by uniformity of change of the registered parameters.

Hence, in accordance to the data of the deformometric measurements in the geosynclinal region conditions and to the data of the fluiddynamic (emanation) monitoring of the geodeformation processes in the EEP conditions in the preparation and realization of the catastrophic geodynamic events such as, for example, the earthquakes which have occurred near to island Sumatra on December, 26, 2004 and on March, 28, 2005, processes of global change in the intense - deformed state of the earth's crust are involved. Thus, the rational use of the deformometric measurements data in conditions of the geosynclinal region and in conditions of the platform connected to it, is equal as the variations measurements of the fluiddynamic regimen of geostructural formations of the platform allows to supervise these processes and to predict periods of the areas formation of the rocks massive seismotectonic destruction.

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