

## **ABOUT POSSIBLE INFLUENCE OF SOLAR ACTIVITY UPON SEISMIC AND VOLCANIC ACTIVITIES: LONG-TERM FORECAST**

\*Khain V.E., \*\*Khalilov E.N.

\*Moscow State University named after M.V.Lomonosov,

\*\*International Academy of Science H&E (Austria, Innsbruck)

*It has been determined that in the period of solar activity increase (11-year cycles) there increase seismic and volcanic activities in the compression zone of Earth and at the same time there decreases the activity in the tension zones of Earth. On the basis of the discovered stable 11-year and 22-year cyclicalities in the seismic and volcanic activities and their high correlation with solar activity there has been made the long-term forecast until 2018. The next maximum of seismic and volcanic activity with very high amplitude for the compression zones of Earth is forecasted for the period 2012-2015.*

### **1. VOLCANISM AND SOLAR ACTIVITY**

The attempts of detection of statistical connection between solar activity and volcanic manifestations were made in the number of works of A.I.Abdurakhmanov (1976), N.K.Bulin (1982), Y.A.Gadjiyev (1985), N.I.Guschenko (1985), Sh.F.Mekhtiyev, E.N.Khalilov (1984, 1985), S.V. Tzirel (2002).

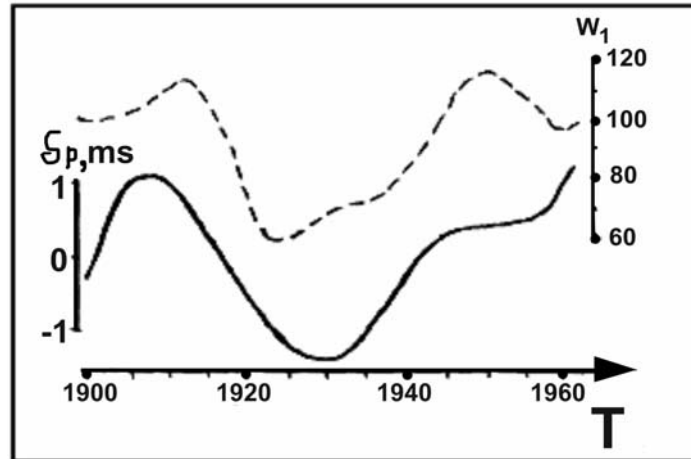
Thus, A.I.Abdurakhmanov, P.P.Firstov and V.A.Shirokov (1976) made a guess about connection of volcanic ejection with 11-year cyclicity of solar activity. In the opinion of the authors, the years unfavorable for volcanic eruptions are located in the neighborhood of maximum solar activity whereas the most favorable years for eruptions are located not far from minimum solar activity, mainly, in the middle and in the end of solar cycles decay.

Stoyko A. and Stoyko N. showed in their works the high correlation of duration of days and dates of short-moving sunspots, pic.1 (Stoyko A. and Stoyko N., 1969).

On the basis of study of Akhtal (Georgia) mud volcano activity B.M.Valyayev and others came to a conclusion about existence of statistically sure

connection between Akhtal mud volcano activity and solar activity, (Valyayev and others).

However, the results of the research reflect the mud volcanoes activity of only one small region of our planet. The detection of connection between mud volcanoes activity and solar activity reflecting better the specific character of solar-terrestrial connections is of certain interest.



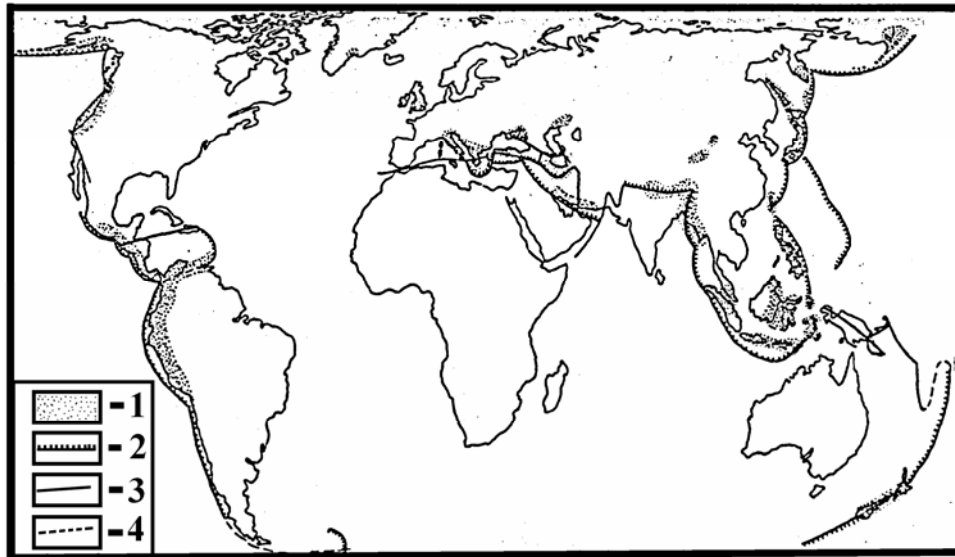
**Pic.1. Changing of the duration of days with the excluded linear trend (solid line) and dates of short-living sunspots (dashed line) in accordance with the data of A.Stoyko's works (1969).**

For detection of possible connection between solar activity and activity of mud volcanoes of the world we have analyzed the data about eruptions of the largest mud volcanoes of the world and built a diagram characterizing the change of mud volcanoes activity in time. When building a diagram there were used data of more than 300 mud volcanoes eruptions of the world (Mekhtiyev Sh.F., Khalilov E.N., 1985).

Practically, all mud (M-type) volcanoes of the world are located in the zones of subduction and collision and, consequently, reflect the activity of compression processes of Earth. Pic.2.

As it was mentioned above, the attempt of detection the connection between the activity of the Sun and magmatic volcanoes activity was made by the number of scientists. However, there was not taken into consideration that the volcanoes are

divided into geodynamical types and each type of volcano reflects the activity of various processes: C-type volcanoes characterize the compression processes of Earth (due to subduction); R-type volcanoes characterize the tension processes of Earth (due to spreading).

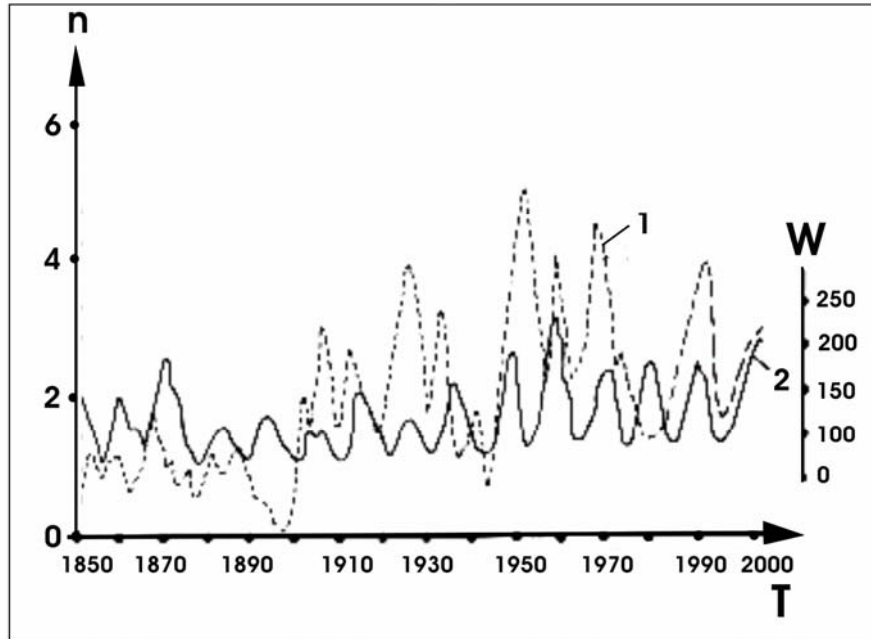


**Pic.2. Location scheme of mud (M-type) volcanoes and subduction zones of the world.**

1 – zones complicated by mud volcanism; 2 – subduction zones; 3 – transform ruptures; 4 – supposed ruptures.

Thus, making conclusions about the periods of volcanoes activation on the basis of general diagram for all types of volcanoes, the researchers proceeded from the suggestion of activation simultaneity of all volcanoes, i.e. from the suggestion of simultaneity of compression and extension of Earth whereupon its radius would remain unchangeable.

Comparison of the built mud volcano activity diagram with Wolf numbers characterizing 11-year cycle of solar activity showed that 9-12-year periods of mud volcano activity, mainly, coincided with 11-year cycles of solar activity (Pic.3.). Thus, increase of activity of mud volcanoes of the world corresponds with the solar activity increase Sh.F.Mekhtiyev, E.N.Khalilov (1985).

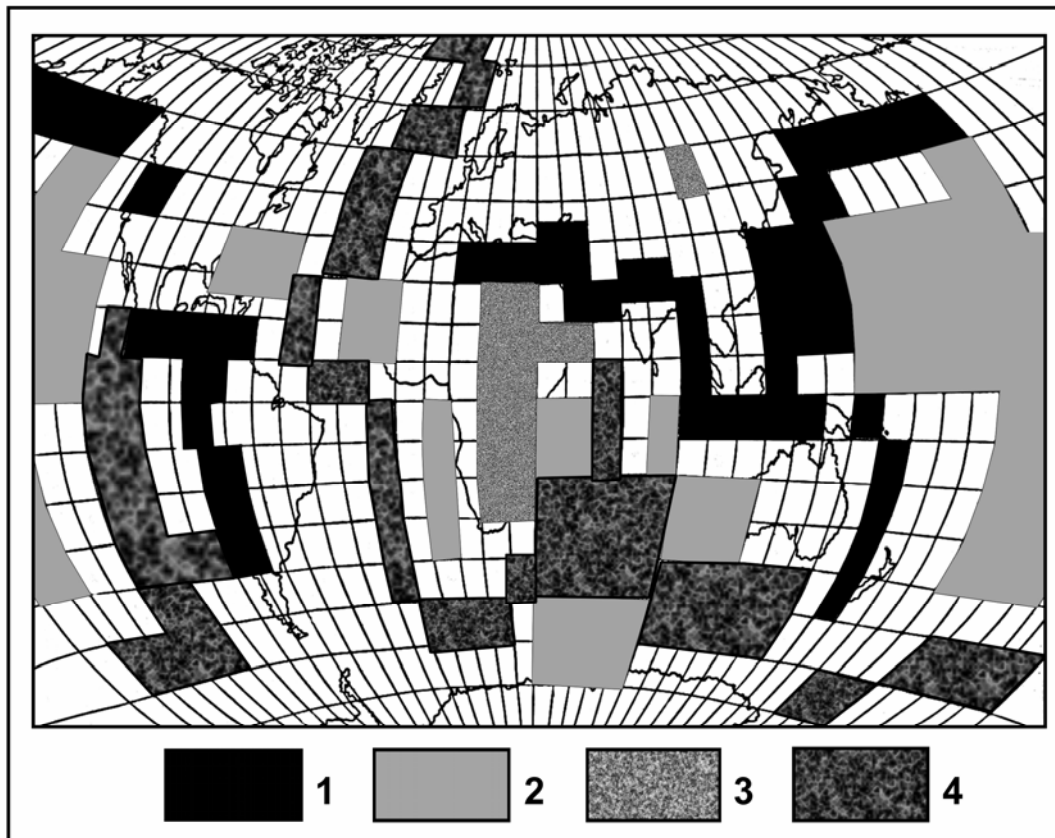


**Pic.3. Comparison of solar and mud (M) volcano activities diagrams.**

I – mud volcano activity diagram; II – solar activity diagram (Wolf number); n – average number of ejections

For ascertaining of more objective picture in magmatic volcanoes activity there were built diagrams separately for C and R-type volcanoes. For this purpose we have created the map of geodynamic zones of Earth where the entire planet is divided into four basic zones of geodynamic type: compression zones – type C; ocean rift zones – type OR; continental rift zones – type CR; ocean internal plate zones of minor seismicity and volcanism – type OI, pic.4.

The catalogues of magmatic volcanoes eruptions number approximately 1000 active volcanoes (Guschenko N.I., 1979). Regardless of the system of data collection about the ejection of the volcanoes there is no guarantee that there collected all the information about eruptions of volcanoes of the world within the recent period. The information losses are unavoidable, but they are of casual character at least.

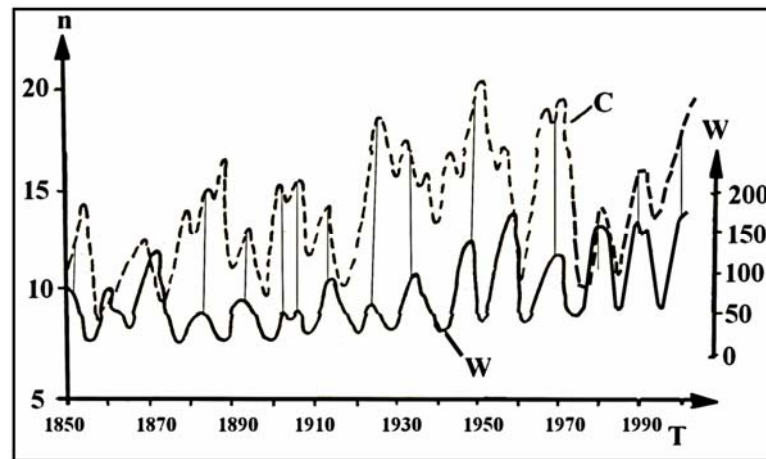


**Pic.4. The map of geodynamic zones of Earth.**

1 – compression zones of Earth – type C; 2 – ocean internal plate zones – type OI.  
3 – continental rift zones – type CP; 4 – ocean rift zones – type OR;

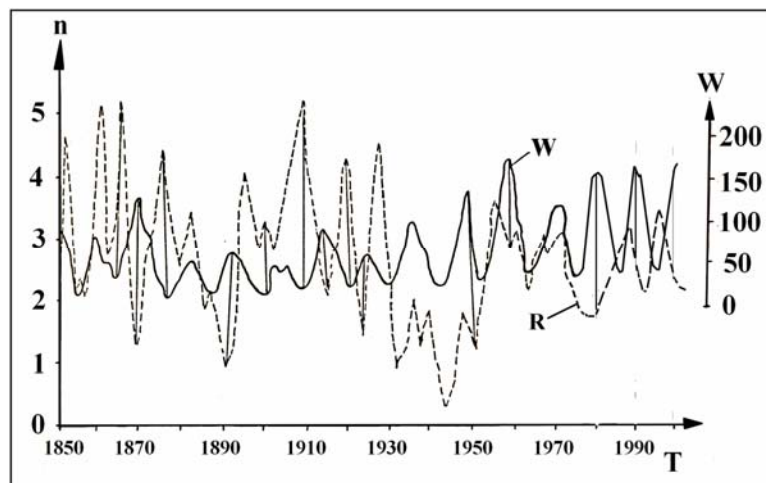
In order to reduce maximally the influence of possible losses of information there were chosen data about volcanoes eruptions within little time period (from 1850 to 2000), while in catalogues there are given data about volcanoes eruptions from 1500 BC to the present day.

Study of C-type magmatic volcanoes activity enabled to detect certain periodicity of ejections. 9-15-year cycles of magmatic volcanoes hyperactivity became apparent.



**Pic.5. Comparison of C-type volcanoes activity diagrams and solar activity.**

I – “C”- type volcanoes activity diagram; II - solar activity diagram (Wolf number).



**Pic.6. Comparison of “R”-type volcanoes activity diagrams and solar activity.**

R - “R”-type volcanoes activity diagram; W - solar activity diagram (Wolf number).

As follows from pic.5, the periods of C-type volcanoes hyperactivity coincide with 11-year periods of solar hyperactivity. At the same time, the comparison of "R"-type volcanoes activity diagrams with the solar activity diagram caused contrary conclusions. With the increase of solar activity there decreases R-type volcanoes activity (pic.6.).

The achieved results enable us to come to a conclusion that in the periods of solar activity increase, there increases the activity of volcanoes Earth compression zones while in the periods of solar activity decrease there increases the activity of tension zones volcanoes that should cause periodical change of Earth radius. The results of the researches enable to suppose that the compression periods of Earth (due to subduction) change into the periods of extension (due to spreading).

Thus, the researches of volcanoes activity conducted with the use of linear transformation of initial number of volcanoes eruptions through moving average enabled to establish on average 11-year activity cyclicity in various geodynamic types of volcanoes. The cyclicity of "C"-type volcanoes and mud volcanoes is dephased relative to "R"-type volcanoes activation cycles.

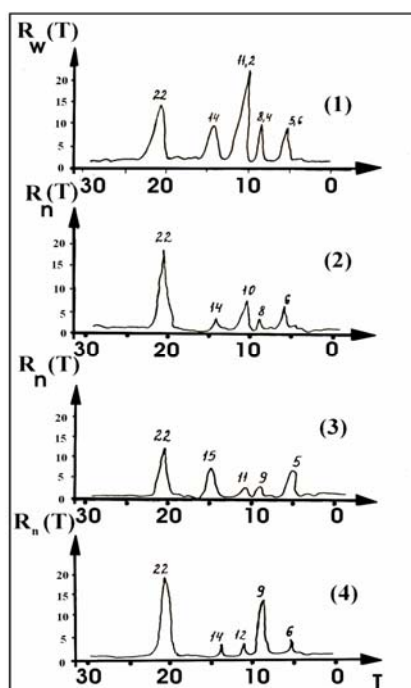
However, as it was mentioned above, the application of moving averages method for detection of activation cycles has a number of significant shortcomings. Thus, each variant of smoothing filters out the cycles with periods the duration of which is less or equal to the smoothing interval length. Consequently, for full analysis of stochastic processes and detection of various duration periods it is necessary to use a great number of smoothing variants of various smoothing intervals length. Nonlinear transformation of the initial number, for example, by Lanczos method or maximum entropy are more effective for conducting of such kind of analysis.

We have estimated the functions of spectral density of various types volcanoes eruptions as well as Wolf numbers by the method of maximum entropy. The estimations had interesting results. In the eruptions of all geodynamic types volcanoes there were detected activation cycles similar with solar activity cycles. In table 1 there are shown the volcanoes activation cycles periods and Wolf numbers.

Thus, there detected single cycles in the activity of all types of volcanoes and solar activity with the periods 5-6 years, 8-9 years, 10-12 years, 14-15 years and 22 years.

Table 1

No. No.	Activation cycles periods (in years)			
	Wolf numbers	“C”-type volcanoes eruptions	Mud volcanoes eruptions	“R”-type volcanoes eruptions
1	5,6	6	6	5
2	8,4	8	9	9
3	11,2	10	12	11
4	14	14	14	15
5	22	22	22	22



**Pic.7. Periodograms of volcanoes eruptions and changes of Wolf numbers.**

1– periodogram of changes of Wolf numbers; (2), (3), (4) – periodograms of volcanoes eruptions, “C”, “R” and “M” types correspondingly.



In pic.7. there can be plainly seen the similarity of activation cycles of various geodynamic types of volcanoes and solar activity. In Wolf numbers there distinguish 11-year cycles, in activation of “C”-type volcanoes – cycles the duration of which is 6, 10 and 22 years, “R”-type volcanoes – 15-year and 22-year activation cycles.

Evidently, 22-year cycles became apparent in all geodynamic types of volcanoes and it seems that they are genetically coherent by the influence of a single factor – 22-year cycle of solar activity consisting of two 11-year cycles.

Thus, spectral analysis of the volcanoes eruptions and solar activity enabled to examine their cycles in details and additionally detect cycles with various periods.

Is it possible to say that the similarity of solar activity cycles and activity of various geodynamic types of volcanoes is casual? From our point of view – no. Undoubtedly, it is quite possible that some of the detected cycles are connected with the purely endogenous global processes. Nevertheless, in our opinion, 11-year and 22-year cycles the most typical for solar activity have direct influence upon the earth’s processes, including volcanism and seismicity. One of the possible mechanisms of solar activity influence upon geodynamic processes is described below.

When solar activity increases the corpuscular emission and solar magnetic field strength increase rapidly as well, inducing ring currents in various layers of Earth, particularly, in lithosphere and asthenosphere. Currents in asthenosphere appeared as a result of solar activity increase cause mantle heating, its plasticity growth and as a result convection currents acceleration. Convection currents acceleration leads to spreading acceleration, and increase of mantle temperature – to its heat expansion while Earth extension is taken place due to spreading. In the periods of solar activity decrease the ring currents magnitude inducing in the mantle, decreases as well and as a result there decreases temperature and Earth compression, accompanying by the process of subduction. The difference in time from the moment of solar activity increase until spreading acceleration process is no less than 5-7 years that is connected with a number of processes starting from the appearance of ring currents and finishing by the increase of mantle temperature. The time period favors delay of Earth pulsation for half a period relative to 11-year cycles of solar activity. That leads to the activation of spreading process during solar activity decrease while subduction process is activating during solar activity increase.

Thus, the results of the researches described above enable to suppose that the periodicity of solar activity have an influence upon the periodicity of geodynamic processes.

## **2. SEISMICITY AND SOLAR ACTIVITY**

Setting of a statistic connection between the activity time of volcanoes and solar activity allows to deem the existence of such connection between solar activity and the seismicity of the Earth. The fact about existence of geodynamical and correlational connection between volcanism and seismicity serves a prerequisite for such a hypothesis.

As it follows from the results of above-stated researches, solar activity influences on activation of volcanic eruptions of rift zones, which reflect the activity of the processes of lithosphere release and also influences on the activation of the volcanoes of the compression rims of the Earth. As it known, the compression and release rims of the Earth are also characterized by high seismicity, that evidently predestinates, the same connection of seismicity with solar activity.

A range of works is devoted to the study of the connection between parameters of solar and seismic activities: Y.D. Bulanje (1984), G.Y. Vasilyeva (1975), Y.D. Kalinin (1973, 1974), O.V. Lusmanashnili (1972, 1973), A.D. Sitinsky (1963-1998), I.K. Gribbin (1974), F.A. Machado (1973), I.F. Simpson (1968), I.V. Ananin, A.O. Fadeev (2002) and others.

G.Y. Vasilyeva and V.I. Kojanchikov relying on the research about 2000 earthquakes occurred in different parts of the Earth for the period of one cycle of solar activity from 1962 to 1973, came to the conclusion that the number of surface earthquakes is increased as the solar activity increases, but the number of deep-focus earthquakes is decreased during the epoch of the maximum of solar activity. The seismic activity for all the earthquakes, as well as during the years of maximum and minimum of solar activity is higher on 10-30%, when the Earth crosses projection of the galactic magnetic field on the plane of the ecliptic. It is stated that the earthquakes have electromagnetic nature and connected to the structure of magnetosphere (G.Y. Vasilyeva, 1975). In Y.D. Bulanje's work (1984) a number of earthquakes are collated in seismic zones of USSR where the solar activity was observed, on the basis of this he made similar conclusions. Y.D. Kalinin, collating the earthquake data with the solar activity for the period of 1897-1958 and 1963-1968, marks out that the, zones of high seismic activity gradually appear within 11-year solar cycle on the

geographical latitudes, more and more remote from the North Pole. It's also suggested that the solar wind has influence on seismic activity (Y.D. Kalinin, 1973).

In his further work Y.D. Kalinin (1974), working on the proposed hypothesis, marks that, the shift of solar activity causes nonregular oscillations of the angular velocity of Earth rotation, that as a result influences on seismic activity.

In his work O.V. Lusmanashvili (1972) observed that, there is a possibility of influence of the Sun activity on earthquake distribution in the Caucasus. Observing the earthquakes in the Caucasus for the period of - 1900 to 1970, he comes to the conclusion, that there is a close connectivity between seismic activity of the Caucasus and the fluctuation of Caspian Sea level on the one hand and between the change of sea level and the Sun activity on the other hand. The comparison of spectra of the Sun activity and the repetition of large earthquakes in the Caucasus showed their similarity. (O.V. Lusmanashvili, 1972, 1973).

A.D. Sirinsky in his range of works (1963-1998), P.M. Sichov (1964), V.D. Talalayev (1980) also try to set a connectivity between the Earth seismicity and solar activity. In particular, they mark out that the common Earth seismicity, expressed in terms of total energy of earthquakes and the number of large earthquakes for the period of one year, depends on the 11-year solar cycle phase. It also indicated that the earthquakes, substantially occur 2-3 days after the active zone crosses the central solar meridian. In the A.D. Sitinsky's work (1973) is marked out, that the connection of the seismicity with solar activity is carried out by wide-planetary atmosphere processes. The mechanism of dependency is that in connection with the amplification of the solar activity the perturbation of quasistationary state of the atmosphere occurs, that leads to the redistribution of atmosphere mass on the Earth, that is center-of-gravity motion of Earth – atmosphere, and consequently, deformation of the Earth.

So, A.D. Satinsky (1998) notes that the seismicity dependency on 11-year cycle that he previously elaborated was checked and confirmed by experimental forecasting of common seismicity of the Earth and it's separate parts. The maximums of seismic activity of the Earth were forecasted for the period of 1963-1995. In their works I.V. Ananin and A.O.Fadeev (2002) come to the conclusion about existence of correlational link between the variations of seismic activity, average annual temperatures on the Earth surface and solar activity. Whereas, they consider this link as a possible proof of the influence of solar activity, both on average annual temperatures as on seismic activity.

A range of works of foreign researches is devoted to studying of connection between seismiscity and solar activity: I.K. Gribbin (1974), F.A. Machado (1973), I.F. Simpson (1968).

Thus, in I.K. Gribbin's work (1974) the subject of research is the reasons of destructive earthquake in San-Andreas fault in California in 1982. The reasons that serve as a triggering mechanism for San-Andreas fault is the confrontation of the main Planets of Solar System and increase of solar activity for the period of 11 years. It's also marked out about the influence of 11-year cycle of solar activity on seismicity of the Earth in the work of F.A. Machado (1973). In the work of I.F. Simpson (1968) the solar activity regards as triggering mechanism for the relaxation of the Earth interior.

In V.M. Latkher's work is marked, that course of changes of average interval between earthquakes is conforms to the changes of lengths of solar cycle. In particular it's noted that in the variations of solar activation the quasiperiodical component of approximately 60-100-year period is observed. At the same time it should be mentioned that there are some works that refute the possibility of existence of the connection between the solar activity and Earth seismicity. Thus Van-Jil, after the analysis of more than 20000 small earthquakes that happened from 1910 to 1945, he marked out the absence of the connection between solar activity and seismicity. Meanwhile, we would like to note, that 99% of seismic energy of the Earth is plated out during large earthquakes. For the purpose of detection of possible connection between solar system and the processes of the Earth seismicity, we conducted the following researches. A spectral analysis of time series of different geodynamical earthquakes was made: the rims of compression of the Earth – type "C", oceanic rift zones – type "OR", continental rift zones – type "CP" and oceanic inter-plate zones – type "OI".

It should be noted, that a separate studying of periodicity of small earthquakes ( $M < 7$ ) and large earthquakes with  $M \geq 7$ . 99% of the earthquakes with  $M \geq 7$  take place on the compression rims of the Earth, in regard to this, the studying of periodicity of large earthquakes was made only for "C" type.

Spectral analysis of time series of the earthquakes was carried out by the method of maximum entropy, using filters the lengths of which was selected taking into account the necessity of studying of high-frequency spectrum component (with  $T \leq 30$ ). The results of studying of spectral particularities of time series of the earthquakes with  $M \geq 7$  showed, that the major part of the harmonics in the spectra of earthquakes and Wolf number coincides. Picture 8 shows that character harmonics in

spectra are T=18-22 years, 10-11 years and 8 years. It should be noted, that in the spectrum, that covers time series of the earthquakes from 1600 to 2000, the indicated harmonics were detected more accurate, than of the same for the period of 1902-2000. According to our explanation that occurs because of specificity of the method applied, the effectiveness of which increases when increasing the lengths of original row.

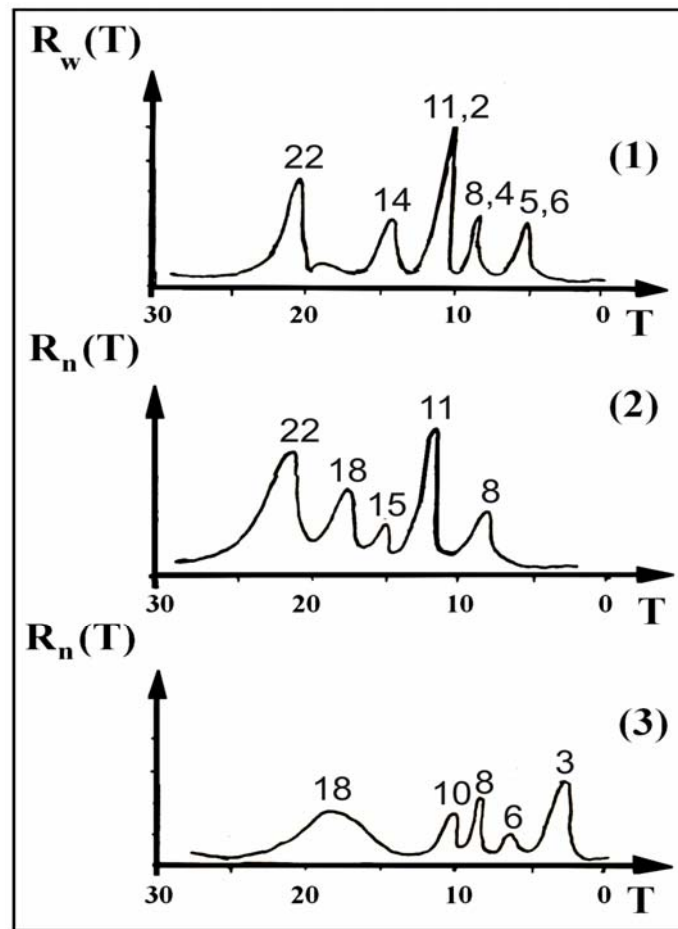
As you see from the shown spectra, the 11-year and 22-year cyclicity is appears more accurate.

Table 2. shows the periods of Wolf numbers harmonic and earthquakes with  $M \geq 7$ .

*Table 2*

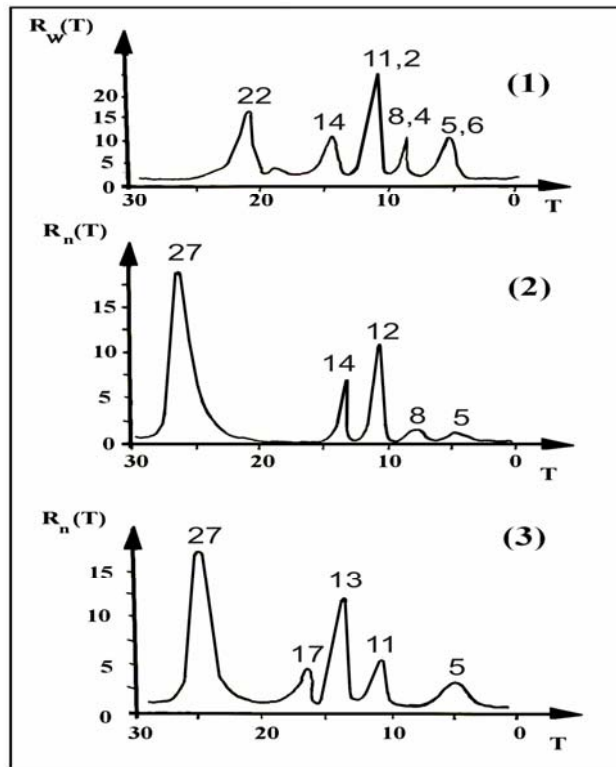
No. No. nn	Periods of Activation Cycles		
	Wolf Numbers	Earthquakes of "C" type with $M \geq 7$	
		1600-2000	1902-2000
1	5,6	-	6
2	8,4	8	8
3	11,2	11	10
4	14	15	-
5	22	22	18

Interesting results were also produced during the studying of earthquake spectra with  $M < 7$ . A large amount of small earthquakes created the conditions for making statistically objective processing of the data of the earthquakes of all geodynamical types: "C", "OR", "OI", "CR" for the period from 1902 to 2000. The pic. 9 shows the comparison of spectra of the "C" and "OR" types of earthquakes along with the graphic of solar activity. As it seen, the harmonics with T=5, 11-12, 13-14, 22-27 appear close in spectrum. Harmonics with T=8 appear only in spectrum of "C" type of earthquakes.



**Pic.8. Periodograms of changes of Wolf numbers and seismic activity (for “C” type earthquakes)**

(1)-periodogram of changes of Wolf numbers; (2)-periodogram of changes of seismic activity for the earthquakes with  $M \geq 7$ , for the period from 1600 to 2000; (3)-periodogram of changes during plating out of seismic energy of the “C” type of earthquakes with  $M \geq 7$ , for the period from 1902 to 2000.

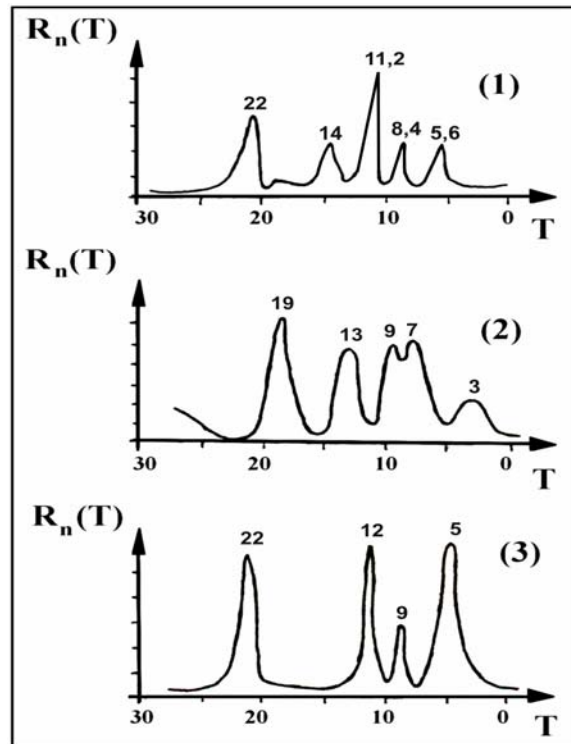


**Pic.9. Periodograms of changes of Wolf numbers and seismic activity.**

(1) - periodogram of changes of Wolf numbers; (2), (3) – periodogram of seismic activity, for earthquakes, respectively of “C” and “OR” types with  $M < 7$ , for the period from 1902 to 2000

The comparison of earthquakes spectra of “CR” and “OI” with the solar activity spectrum (pic.10) showed the existence of similar range of harmonics: 7-9 years, 9-12 years, 19-22 years. In the spectrum of the “CR” type of earthquakes the 5-year harmonic doesn’t appear, and as for the spectrum of “OI” type of earthquake – 14-year respectively.

At the same time it’s possible to note the similarity of between the spectra of “C” and “OR” types of earthquakes and also between “OI” and “CR” types (pic.10). Whereas, spectra of the “C” and “OR” types of earthquakes are less similar with spectra of “CR” and “OI” types.



**Pic.10. Periodograms of changes of Wolf numbers and seismic activity.**

1– periodogram of changes of Wolf numbers; (2), (3) – periodograms of seismic activity, for earthquakes, respectively of “CR” and “OI” types with  $M < 7$ , for the period from 1902 to 2000.

An identical mechanism was also observed on the low-frequency spectra of volcanoes eruption, manifesting high similarity in the manner of eruptions of the “C” and “OR” type of volcanoes, at the same time the spectra of eruptions of the “OI” and “CR” types of volcanoes were also identical.



Table 3

No. No. nn	Periods of Activation Cycles				
	Wolf Numbers	Type "C"	Type "OR"	Type "CR"	Type "OI"
1	5,6	5	5	-	5
2	8,4	8	-	7	9
3	11,2	12	11	9	12
4	14	14	13	13	-
5	22	27	27	19	22

In our point of view, it's wrong to simplify the interpretation of the link between tectonic processes and solar activity. It's known that the solar activity influences on climate processes, changes of the ocean level, that in turn has the influence on the energetic condition of lithosphere and mantle, and as a result, on the tectonic processes. Thus, G.S. Ivanov-Kholodniy marks out, that processes of ionization of ionosphere initiated by solar activity have different character depending on the altitude. A theory of calculation of the influence level of solar flare on the ionization processes of different layers of ionosphere was suggested. At the same time it's noted, that the mechanism of influence of solar activity on geophysical processes is rather multifarious and requires detailed and many-sided study (Ivanov-Kholodniy, 2000).

In our opinion, the fact of existence of cycles in tectonic processes comparable with the period of solar activity is very important. Taking into consideration the complexity of interrelations and inertness of many physical and chemical processes, the shift of one part of cycles comparatively with another becomes evident.

### 3. RESULTS

It's necessary to note that during the detailed analysis of high-frequency components of spectra of time series of volcanoes eruption and earthquakes, were calculated with different filters length, the following was clarified:

1. The most stable high-frequency components of the spectra are the harmonics with  $T \approx 22-24$  years and  $T \approx 10-12$  years.
2. During the studying of spectra of time distribution of volcanoes eruption the following was determined:
  - a) High-frequency components of volcanoes eruptions of "C", "R" and "M" types are similar with each other as well as similar with the spectrum of Wolf numbers, meanwhile the period of harmonics in different spectra differ from each other, as an average for the period of 1 year.
  - b) On all spectra of volcanoes eruption and Wolf numbers a single-valued harmonic with  $T=22$  years is marked out.
3. The studying of spectra of time distribution of earthquake number showed the following:
  - a) In large (with  $M \geq 7$ ) and small (with  $M \leq 7$ ) spectra of earthquake the only the harmonics with  $T \approx 20-23$  years are marked out.
  - b) In the spectra of earthquakes with  $M \geq 7$  and Wolf numbers similar harmonics with  $T \approx 10-11$  years and  $T \approx 8$  years were also marked out.
  - c) Special analysis of time series of small earthquakes showed, that the most close spectra character possessed by the type "CR" and "OI" of earthquake. These results conforming with the determined mechanisms of volcanoes eruption, especially in low-frequency components of spectra (with  $T \geq 20$ );
  - d) The spectra of time series of small earthquakes contain harmonics with the periods relevant to the spectrum of solar activity:  $T \approx 22-24$ ,  $T \approx 12-14$ ,  $T \approx 10-12$ ,  $T \approx 5$ .

These researches allow us to suggest about different influence of 11-year and 22-year cycles of solar activity on the manifestation of modern tectonic activity in the compression and release rims of the Earth expressed by volcanoes and earthquakes. In particular, during the periods of increased 11-year cycles of solar activity the activity of the earthquakes and volcanoes of compression zones of the

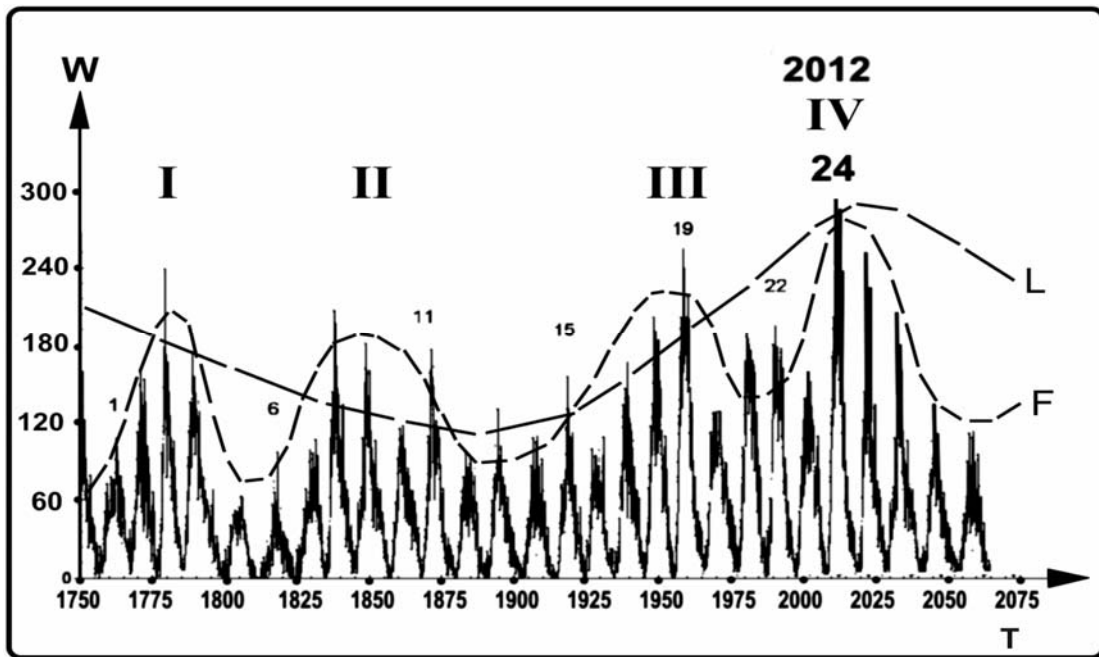
Earth also increases, but during the periods of decreased solar activity the activity of the earthquakes and volcanoes increases in the release zone of the Earth.

#### **4. LONG-TERM FORECAST**

The detection of cyclicity inside the seismic and volcanic activity and their correlation link with the solar activity and other cosmic processes is of great importance for understanding of interaction of different cosmic and geodynamical factors and creation of single conceptual system of cosmo-earthly interaction.

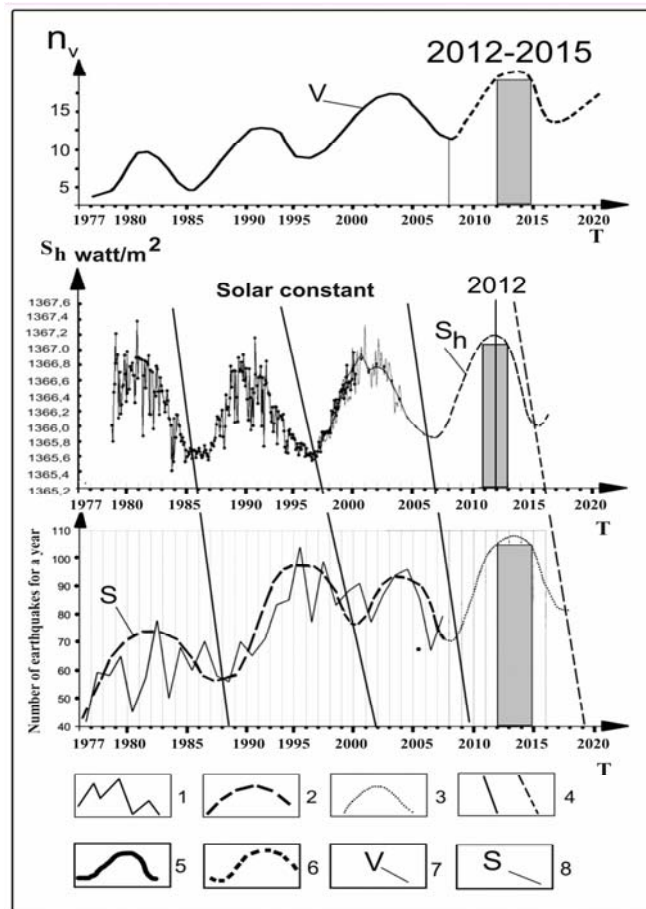
The attempt to forecast the next 24<sup>th</sup> cycle of solar activity is quite interesting. First of all, for any forecasts there are created models of processes on the basis of which the forecast is realized. A more exact model of sunspots origin was elaborated in 2004 by the group of scientists, worked under the direction of Mausumi Dikpati from National Center of Atmosphere Researches USA (NCAR). By their reckoning, the magnetic structures, that form the sunspots are initiated from the equator line of the Sun. They become impressed in plasma and along with it moves to the poles. Reaching the pole, plasma plunges into the star on the depth of about 200000 km. From here it flows back to equator reaching a speed of 1m per second. Such a circle is equal to the cycle of solar activity of 17-22 years. This model was called by the researches "model of dynamo-transportation of magnetic flux". Now we are at the beginning of 24<sup>th</sup> 11-year solar cycle. Building into the model data about 22 solar cycles preceded the 23<sup>rd</sup>, scientists considered what like the 23<sup>rd</sup> cycle would be. The result coincided with the result we observe on 98%. By this way checking out their model scientists in the beginning of 2006 calculated 24<sup>th</sup> cycle of solar activity, the peak of which will fall on 2012. According to the forecast the 24<sup>th</sup> cycle of solar activity will 1,5 times powerful than the previous 23<sup>rd</sup>.

Hereunder shown a forecast graph of solar activity that was made by authors on the basis of analysis of existing previous data and forecast of American researchers.



**Pic.11. Forecast graph of solar activity.**

As it seen from the graph in 2012 not only the peak of the 24<sup>th</sup>, that is more powerful, 11-year cycle of solar activity is expected by scientists but also a peak of the 4<sup>th</sup> 75-85-year cycle (F). This cycle is shown in the form of envelope of maximums 11-year cycles of solar activity. As it seen from the graph, one more maximum of a more large, approximately, 300-year cycle of solar activity (L) falls on the same period, the fragment of which is also shown on the graph. The amplitude of 24<sup>th</sup> cycle is overrated by the authors up to 20% comparing with forecast of NCAR, that can be explained by special reasons in the result of putting cycles of three order.



**Pic.12. Forecast graphs of solar activity, seismic and volcanic activity of compression rims of the Earth.**

1- graph of real numbers of earthquakes of compression rims of the Earth with  $M \geq 5$ ; 2-circumflexing graph of seismic activity of compression rims of the Earth with  $M \geq 5$ ; 3-forecast part of the graph of seismic activity of compression rims of the Earth; 4-lines connecting the minimal indexes of solar and seismic activities and showing the delay of seismic activity against solar; 5-graph of volcanic activity of compression rims of the Earth; 6-forecast part of the graph of volcanic activity of compression rims of the Earth; 7-drawing up of volcanic activity graph for zones of type C; 8-drawing up of seismic activity graph for zones of type C.

Thus, the research of the mechanisms of cyclic volcanism and seismicity gives an opportunity to solve a practical problem – the realization of long-term forecast of the activity of volcanoes and earthquakes. That is the reason of why it's so interesting and important for us the realization of such a long-term forecast on the basis of the results of a large-scale and laborious work devoted to the study of spacious mechanisms of modern manifestation of volcanism and seismicity.

Pic.12. shows forecast graphs for the period until 2018, for solar activity, as well as for seismic and volcanic activities of compression rims of the Earth.

As it seen from the picture, we haven't the curve of Wolf numbers in the capacity of the index of solar activity, but the graph of changes of solar constant, because exactly this characteristic has the energetic expression.

(<http://www.kosmofizika.ru/ucheba/sun/564.jpg>  
<http://www.kosmofizika.ru/ucheba/sun/68.jpg>).

It should be noted that the solar constant has a high correlation with Wolf numbers, that is logical.

Even visual comparison of graphs gives an opportunity to catch a high likeness and some delay of cycles of seismic and volcanic activities of compression rims of the Earth against solar activity. The time of delay is fluctuating from 1,5 to 2 years. The reasoning of such a mechanism of delay was given above.

Starting from 2008, forecast parts of graphs were given, that were built on the basis of usage of previous, stable for a long period of time, mechanisms.

On all the graphs show another cycle of activity, equal on the average period to 11-12 years. As graph shows, the maximum of the cycle of high solar activity falls on 2012. Thus, the maximums of the cycles of volcanic and seismic activity of compression rims of the Earth fall on 2012-2015, taking into account previously observed time shift. The longest period of volcanic and seismicity activity (4 years), in comparison with solar activity, can be explained by sufficient inertness of geodynamical processes on one hand, and by influence of a whole range of other factors as well as endogenous and cosmic, excepting solar activity on the other hand.

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