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## ASTRONOMY CHRONOGRAPH OF STRONG EARTHQUAKES AND VOLCANISM

### Empirical scheme

- In the Scientific Centre of Operative Monitoring of the Earth (SC OME) there was developed an empirical scheme for short-range forecast of earthquakes with  $M \geq 6$ .
- Today this scheme gives us from 80 to 95% of realization for earthquakes with  $M \geq 6$  with errors  $\pm 2$  days for possible dates,  $\pm 3$  degrees for the place with  $\pm 0.3$  for the magnitude.
- This scheme was confirmed by the forecasts which were officially registered in the Russian Expert Consul for earthquakes prediction and assessment of seismic danger and risk or shown on the site of the SC OME and later it was realized in different seismically hazardous regions of the planet.
- The efficiency of the scheme was checked by the retrospective way by using data of about 700 earthquakes with magnitude  $\geq 6$ .

### Geophysical patterns

This scheme is based on next main positions:

- In average earthquakes take places on the 14 or the 21 day (predict date of earthquake) after geoeffective phenomena on the Sun (coronal mass ejections or solar flares);
- The spread of the seismogenic process is directed along the projection on the geoid of the most perturbed set of the geomagnetic field flux tubes, i.e. earthquakes occur at the intersection of seismomagnetic meridians and plate boundaries (predict zone of epicenter of earthquake) when there are save up to release of elastic energy potential of stress and strain;
- The connection of the magnitude of earthquakes and the maximum length of these clouds has been discovered near activated seismic place (predict intervals of magnitude of earthquake).

### Method of calculation

If we take into consideration these geophysical patterns we'll be able to predict the date, place and power of the possible earthquake:

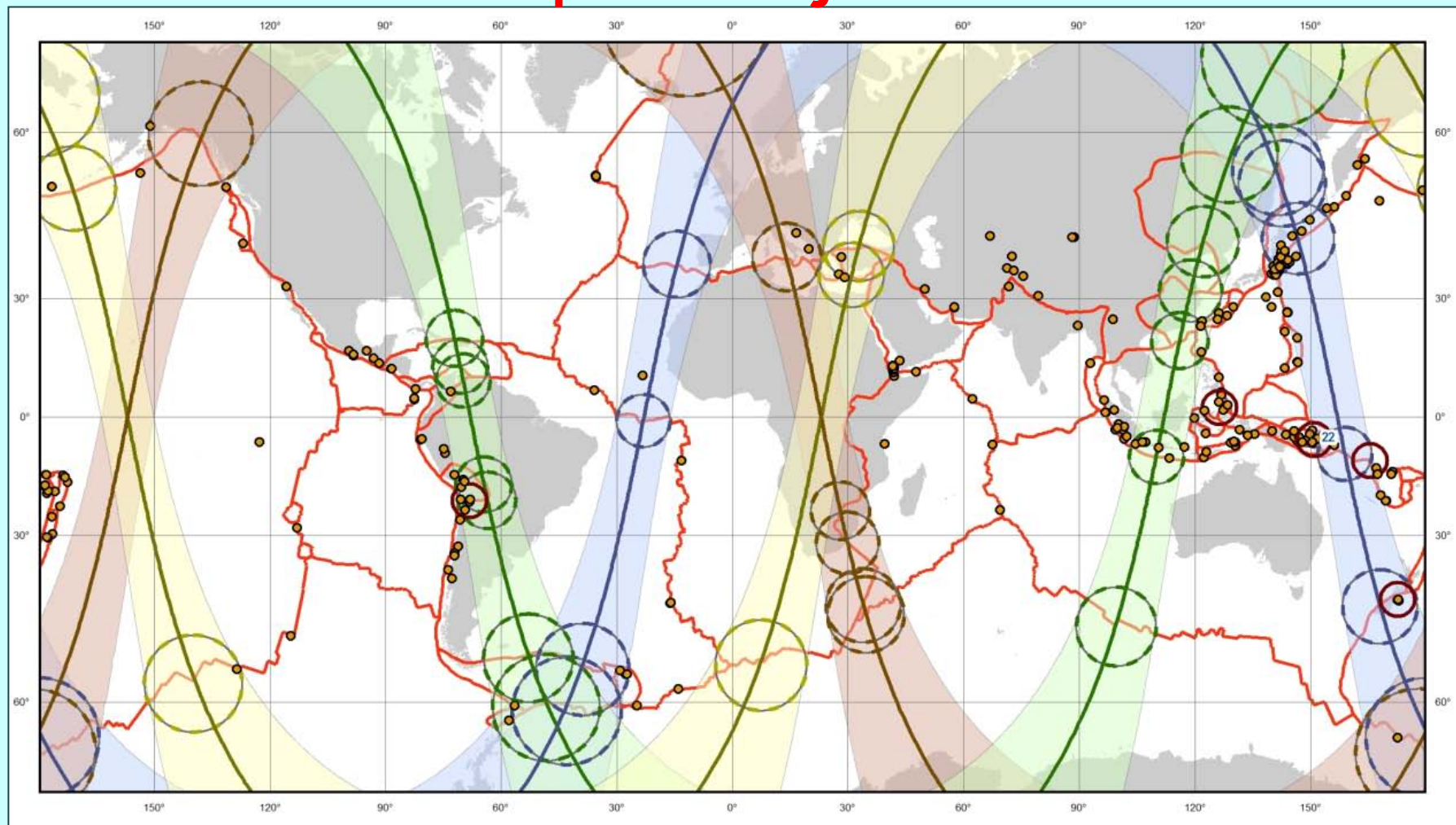
$$d = d_s + [(7 \vee 14 \vee 21) \pm 2] + 27n \quad (1)$$

$$\lambda = \lambda_s - 45^\circ \eta = \lambda_s \pm \varphi \operatorname{tg} 11^\circ \quad (2)$$

$$M = \ln L / L_0, \quad L_0 = 1 \text{ km} \quad (3)$$

If you want to get more information about empirical prediction scheme of the Earthquakes, please use the digest [1-3] or visit site of the Scientific Centre of Operative Monitoring of the Earth : <http://www.ntsomz.ru>.

### Seismomagnetic meridians and chains of earthquakes on june 2011



### Comment

Unfortunately, geophysics (including seismologists and volcanologists) still do not know or ignore strong evidence of statistical analysis [4] about the laws of the temporal distribution of seismicity and volcanic activity, depending on the specific astronomical configurations, i.e. relative position of the Earth to the Moon, the Sun and other nearby planets of the solar system: Venus, Mars and Jupiter.

Without going into details discussed in [4], let's pay attention to the cases of extraordinary manifestations of tectonic activity, which occurred from the beginning of the XX century in the date of the special astronomical configurations featuring planet Earth.

In sequence of reducing of tidal effects on the Earth from the other bodies of the solar system we have following sequence: Moon, Sun, Venus, Jupiter, Mars ...

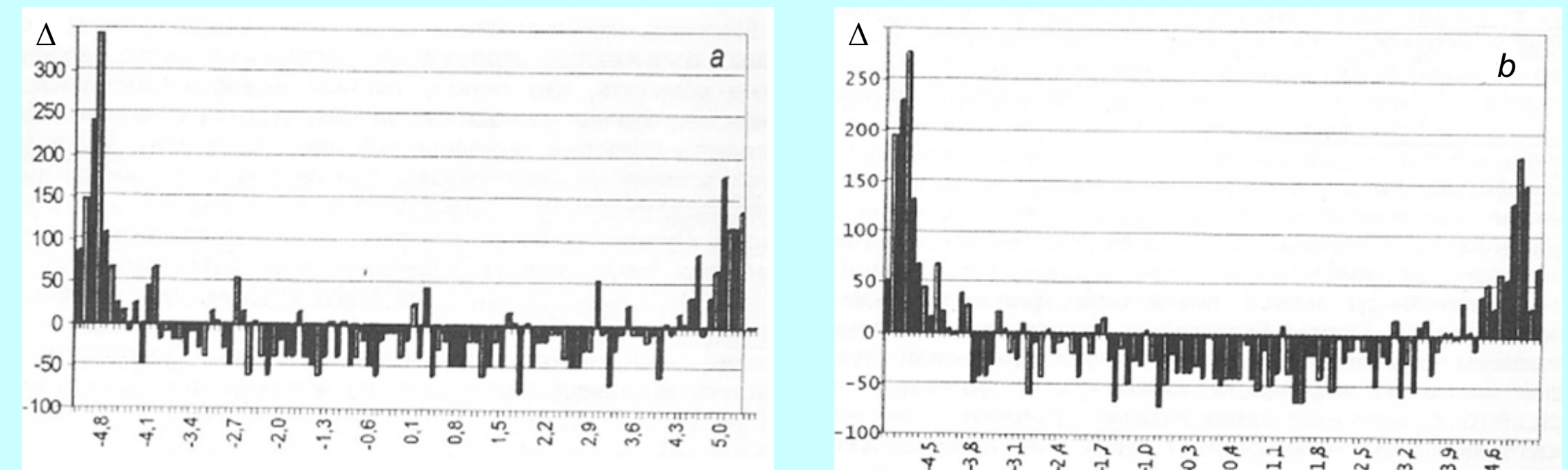
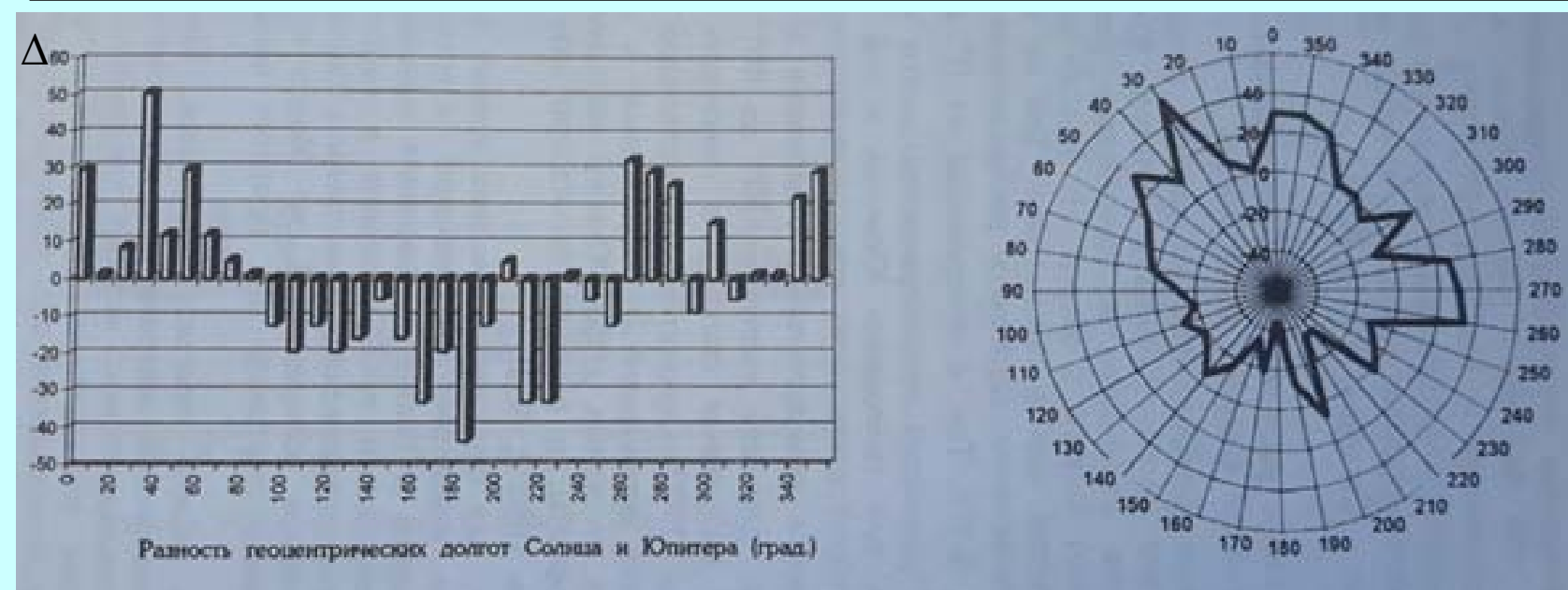


Fig. 1. Distribution histograms of volcanic eruptions (a) and earthquakes (b) depending on the ecliptic latitude of the Moon. On the horizontal axis - the ecliptic latitude of the Moon

Let's give special astronomical configuration of the Earth, the Sun and Venus, since the beginning of the twentieth century on the main lines of the Earth's orbit: apses (aphelion, perihelion), the equinoxes and solstices. In 1916, the conjunction with Venus was going through the apses, and the Earth was at aphelion of its orbit at a maximum distance from the sun. For  $\pm 4$  years (in 1912 and 1920 years) the opposition are on this line, and for  $\pm 8$  years (1908 and 1924 years) the conjunctions were near the line of apses where tidal effects on Earth from Venus are maximal. In 1956 the connection was realized through the solstices. Similar special configuration of the Earth, the Sun and Jupiter in the same period occurred two times: in 1913 and 1996 connection occurred through the apses when the Earth was at aphelion orbit, and in 1919 and 2002, when the Earth was at perihelion. Precise conjunctions on line solstices took place in 1960.

And on the line of the equinoxes was in 1969.



$$\Delta = \frac{N_s - N_s}{N_s} * 100\%$$

Fig.2. The difference between the geocentric longitudes of the Sun and Jupiter (degrees). Histogram and cyclogram of volcanic eruptions in the difference ecliptical geocentric longitude of Jupiter and the Sun.

Near the above dates were the great opposition of Mars in 1909, 1924, 1956 and 2003; and in December 2012 the Earth, Mars, Jupiter and Saturn actually lined up in one line. Next concisely lists known cases of strong earthquakes, volcanic eruptions and other extraordinary manifestations of endogenous activity of the Earth which occurred close to these dates ( $\pm$  half a year), with brief comments.

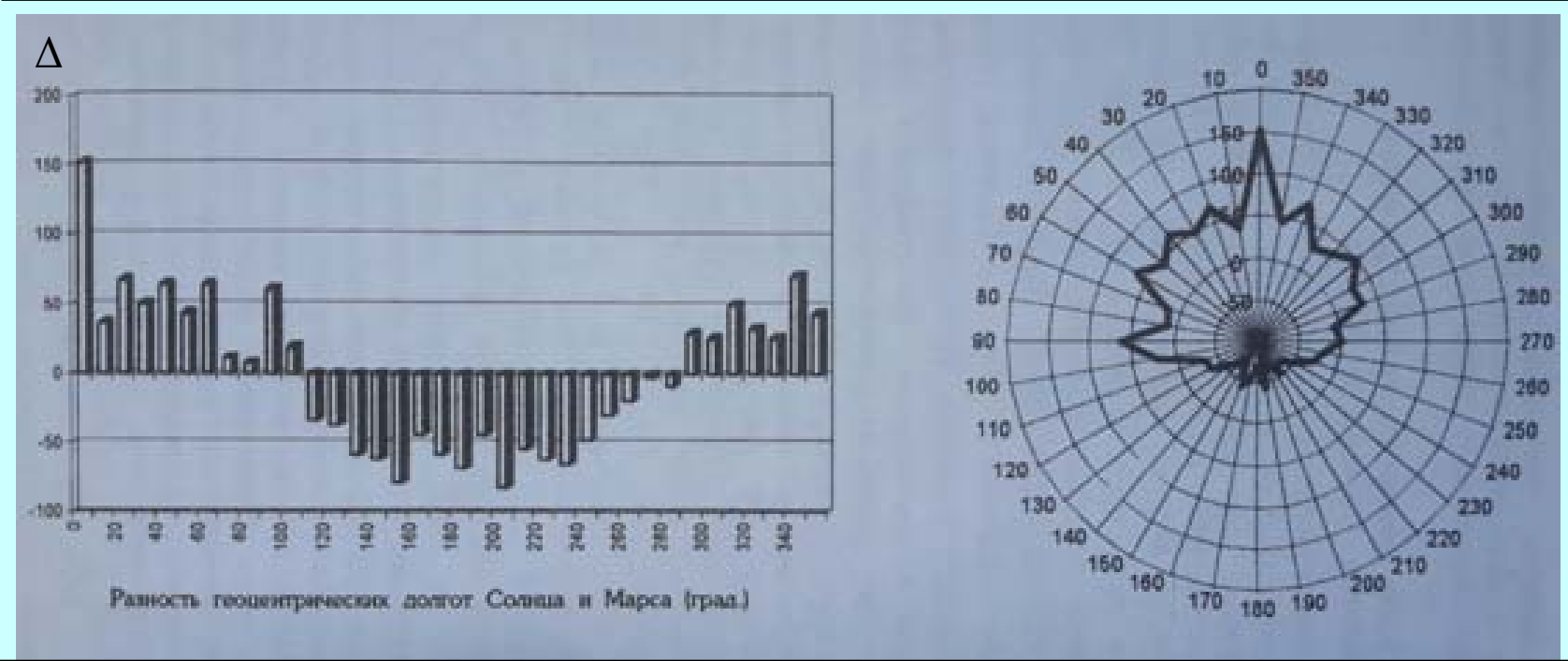


Fig.3. The difference between the geocentric longitudes of the Sun and Mars (degrees). Histogram and cyclogram of volcanic eruptions in the difference ecliptical geocentric longitude of Mars and the Sun.

The strong earthquake with a magnitude of  $M > 7$  occurred:

- 12.28.1908, in the Strait of Messina (between Italy and Sicily) near the critical latitude of  $35^\circ \text{ N}$  with  $M = 7.5$  and the formation of a tsunami with wave heights up to 12 m; and 2 months before in Messina there was an unusual glowing mist in the sky: a fiery cross, the blood-red rain dropped 2 times;
- In 1912 and 2002 in the sparsely populated Alaska near latitude  $62^\circ \text{ N}$  a strong earthquake occurred, the latter caused a perceptible vibrations of the earth's surface and new geysers appearance at distances up to thousands of kilometers;
- In 1920, China was shaking badly near  $35^\circ \text{ N}$ , and in 1923-1925 in the process of a sharp rise in seismicity Japan was drawn after a powerful  $M = 7.9$  09.01.1923 Tokyo city earthquake, triggering a wave of tsunami with height of 10 m and the loss of about 150 thousand people; Many of these earthquakes in China and Japan preceded by a light earthquake precursors of various geometric shapes and colors; and 05.16.1968 in Japan about  $40^\circ \text{ N}$  latitude the most powerful of the twentieth century earthquake with  $M = 8.2$  and  $M = 7.7$  strong aftershocks took place;
- 05.29.1960 in Chile about  $35^\circ \text{ S}$ , as a result of a powerful earthquake, tsunami formation, rock falls and landslides the city Kompenson, Valdivia, Puerto Montt and lots of villages were severely damaged; in some places along the coast the band of 20 km width was under water at a depth of 2 m;
- 1996 has a maximum number of earthquakes with  $5.6 < M < 6.2$ , and 1997-98 has its clear decline and the subsequent jump in the trend of earthquakes with  $M > 6$ , which coincided with the so-called geomagnetic impulse, a sharp change in the parameters of the geomagnetic field and the acceleration of the drift of the magnetic pole from Canada through the Arctic Ocean in the direction of the East Siberian magnetic anomaly;
- 08.19.2002 there has been a rare event: two relatives deep earthquake with  $M = 7.7$  which are among the ten most powerful earthquakes of all time instrumental record since 1960; 11.17.2002 in the Okhotsk Sea off the coast of Kamchatka with  $M = 7.3$  the first of six official forecasts of the Kamchatka seismic zone was realized, and the implementation of the last two forecasts of the empirical scheme [3] of SCOME occurred as a result of deep-focus earthquakes of 08.14.2012 with  $M = 7.7$  and 05.24.2013 with  $M = 8.3$ ;
- 04.11.2012 on the west coast of North Sumatra had happened even more powerful earthquake with  $M = 8.6$  and strong aftershocks  $M = 8.2$ , but this time there were no tsunami waves.

As Extraordinary manifestations of an unexpected volcanic activity can be considered the abnormal cases of awakening in the crosshairs of critical parallels and meridians of long-extinct volcanoes: Puyeu 06.06.2011 in Chile ( $35^\circ \text{ S}, 70^\circ \text{ W}$ ) and 06.30.1908 Kulikovskii paleovolcano ( $61^\circ \text{ N}, 102^\circ \text{ W}$ ) in the midst of the famous Tunguska, the causes and nature of which are still hotly debated [5]

### Conclusions:

Earth's tectonic activity is largely determined by cosmo-geophysical factors, primarily gravitational tidal interactions [4], and according to the scheme of short-term prediction [1-3] earthquakes are usually triggered by geomagnetic disturbances resulting from sharp variations in solar activity such as flares or coronal mass ejections.

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### References

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