CLOUD SEISMOTECTONIC INDICATORS AND ANOMALIES OLR AS FORERUNNERS OF EARTHQUAKES

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ABSTRACT

Seismotectonic cloud indicators (STCI) play an important role in the empirical scheme of short-termed earthquake prediction by the Scientific Center for Operative Monitoring of the Earth (SCOME), they are usually clearly visible on the pictures from satellites. Location of STCI and their characteristic size allow to localize the place of future earthquakes and to calculate their potential value of magnitudes M.

STCI together with spots of anomalies Outgoing Long wave Radiation (OLR) are relatively new and quite informative types of earthquake precursors.

System analysis of STCI and OLR anomalies in conjunction with other lithospheric-atmospheric-ionospheric (LAI) signs of preparation of earthquakes can (in some cases) get answers to important questions about the starting time, place and the magnitude of preparing strong seism activities in the Earth with magnitude M6+. Among LAI signs of global nature abrupt changes in the Earth's rotation and the associated variations of Chandler trajectories of the poles and gravity anomalies are of special importance.

And for the practical implementation of short-term forecasts on the scheme by SCOME from all extensive knowledge, model approaches and understanding of classical seismology only the data about the location of the boundaries of lithospheric plates are important and needed. This is due to the fact that the most informative signs of the preparation of strong earthquakes are well recorded by means of space monitoring for anomalous perturbations of the natural environment in the top gas shells of the planet. Such signs in the lower atmosphere are STCI and OLR, slightly above - ozone anomalies, and in the ionosphere – anomalies Total Electron Content (TEC)

KEYWORDS

Short-term earthquake prediction, seismomagnetic meridian, seismotectonic cloud indicator, ozone anomalies, outgoing long wave radiation, total electron content.

THE MAIN SIGNS OF EARTHQUAKE PREPARATION AT THE TOP GEOSPHERE SHELLS OF THE PLANET

The work is written in a concise manner according to the principle: it is better to see once than to hear ten times. Therefore, the main emphasis with minimal explanation is made on the examples of visualization of the signs of the preparation of strong earthquakes, recorded by means of space monitoring in gas shells of the planet.

In the empirical scheme by SCOME of short-term earthquake prediction [1,2] with M6+ important role belongs to seismotectonic cloud indicators (STCI) - very informative and quite a new type of earthquake precursors. STCI not only provide additional localization places along a chain of possible earthquakes in zones of intersection of seismomagnetic meridians (SMM) with the boundaries of lithospheric plates, but also allow to assess the potential value of M with accuracy of ±0.2 of future earthquakes in accordance with simple formula [1,2]

$$L/L_0 = \exp M \Leftrightarrow M = \ln L/L_0\,, \quad L_0 = 1km \qquad (1)$$

where L is the maximum linear size of STCI.

The topological view of SMM and the algorithm of their calculation are presented in [1], and the most likely dates d_* of the possible sequences of earthquakes according with the scheme by SCOME in the areas of SMM are determined by the formula

$$d_* = d_s + \left[\left(7 \vee 14 \ \vee \ 21\right) \pm 2\right] \qquad (2)$$

where d_s is date of geoeffective events on the Sun such as flashes or coronal mass ejections.

The morphological STCI-classification is described in [3], where 5 main types are marked out: 1) linear or angular, 2) triangular or rectangular, 3) asymmetrical, 4) comb-shaped, 5) in the kind of clear sky gaps in dense clouds. The last two STCI types are observed significantly more rarely than the first three ones. Rarer STCI subtypes in the kind of rectangular gaps with a cloud diagonal are also possible. The optimal STCI detecting method (this procedure of the SCOME scheme hasn't been automatized yet) is the visual analysis of consecutive space photos synthesized in visible and infrared ranges.

On the space photo composite (Fig. 1) from the satellite MTSAT-2 there is a typical example of the analysis of cloud and seismomagnetic conditions in terms of the SCOME scheme before the mega-earthquake in Japan, March 11, 2011. In the bottom (zone C) you can see a linear STCI (in the infrared range) of the length L_1~1500km at 12.32 UT and L_2~2000km at 14.32 UT. According to the formula (1) potential magnitude 7.3≤M≤7.6 was derived. Underline that this linear STCI was not observed in visible range, but on Febrary18, 2011 one can have seen the gap (zone A) in dense clouds which turned into an asymmetrical STCI (zone B) (little budged to the North –East) in the clear sky.

Exactly this complicated dynamics of STCI which was observed in different wave ranges too gave rise to announce the forecast of earthquakes with M>7 on Japan until March 14, 2011 at the Gas and Wave Dynamics Department, MSU (V.L. Natyaganov, private message on SCOME data). Under line that the earthquake of March 09, 2011 with M=7.2 occurred in full correspondence with SCOME scheme, but on March 10, 2011 this already weakened zone was covered by new SMM. This event could cause the mega earthquake Tohoku(occurred in a day) with a strong tsunami and consistent anthropogenic accidents including AES-disaster.

For the first time it was stated about the need for joint analysis of STCI and OLR anomalies of both signs of earthquake preparation in [4], where the dynamics of OLR near the epicenter was considered, September 25, 2013, M7.0 in Peru. The epicenter (15.89ºS, 74.54ºW) was in fact in the area of intersection of one of the two critical meridians and near the critical parallel 19ºS.

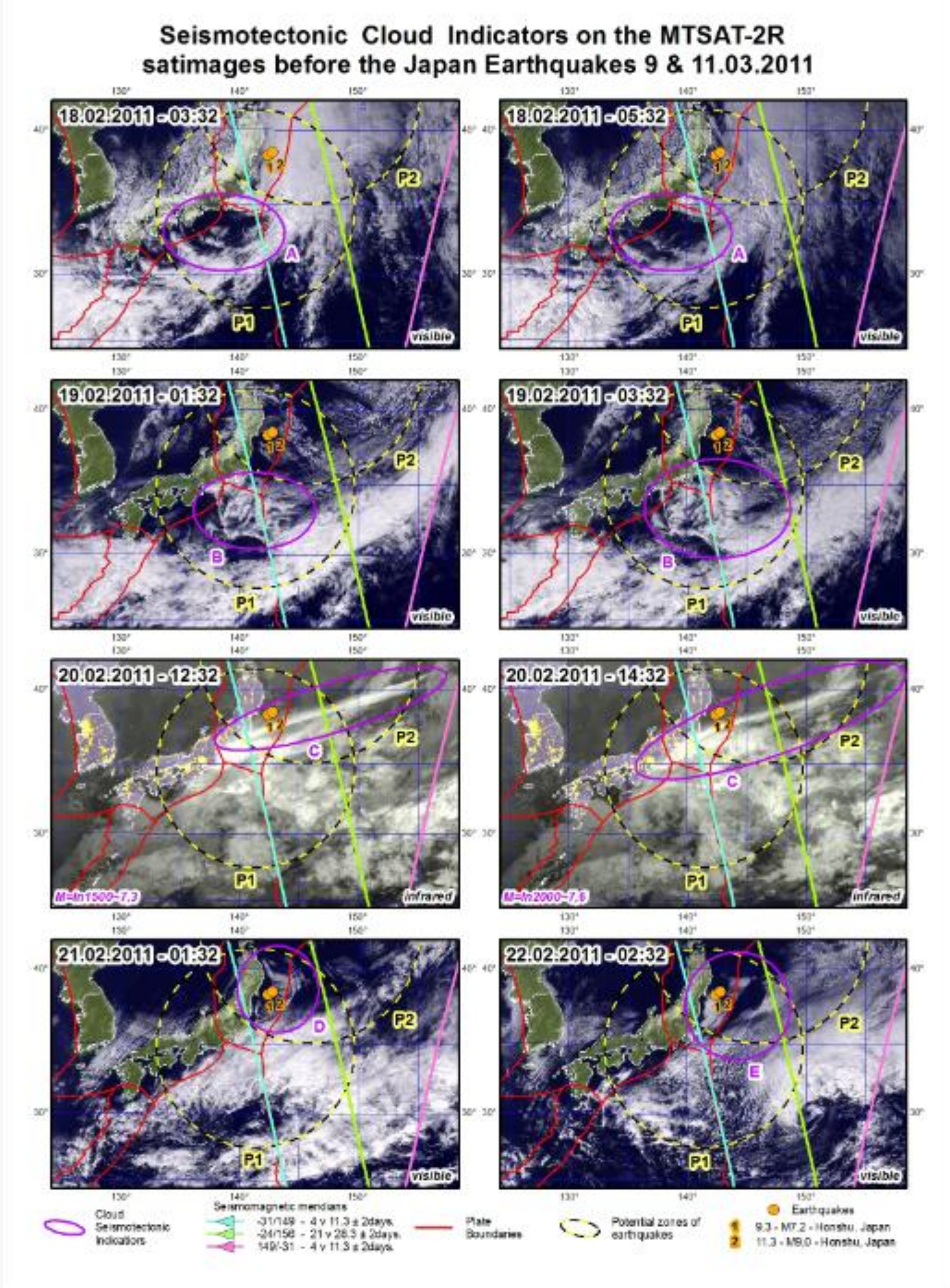
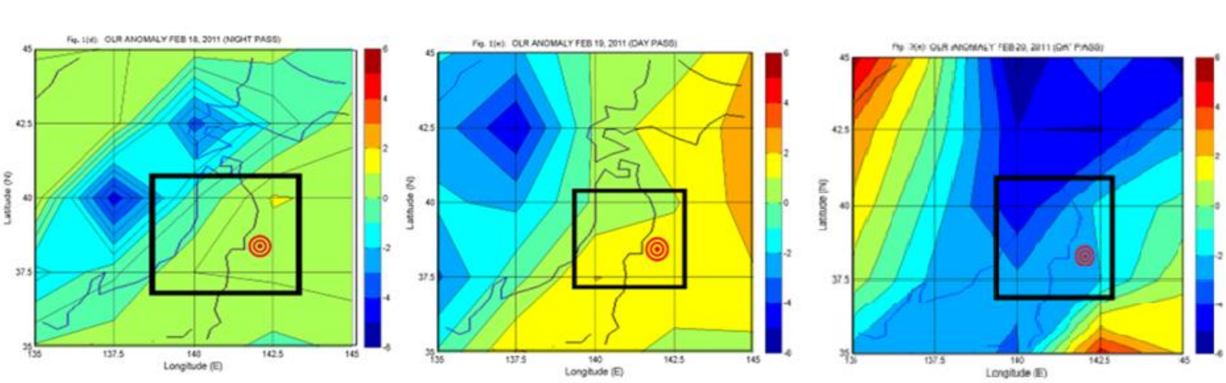


Fig. 1.Seimotectonic Cloud Indicators before Japan earthquakes March 9 and 11, 2011



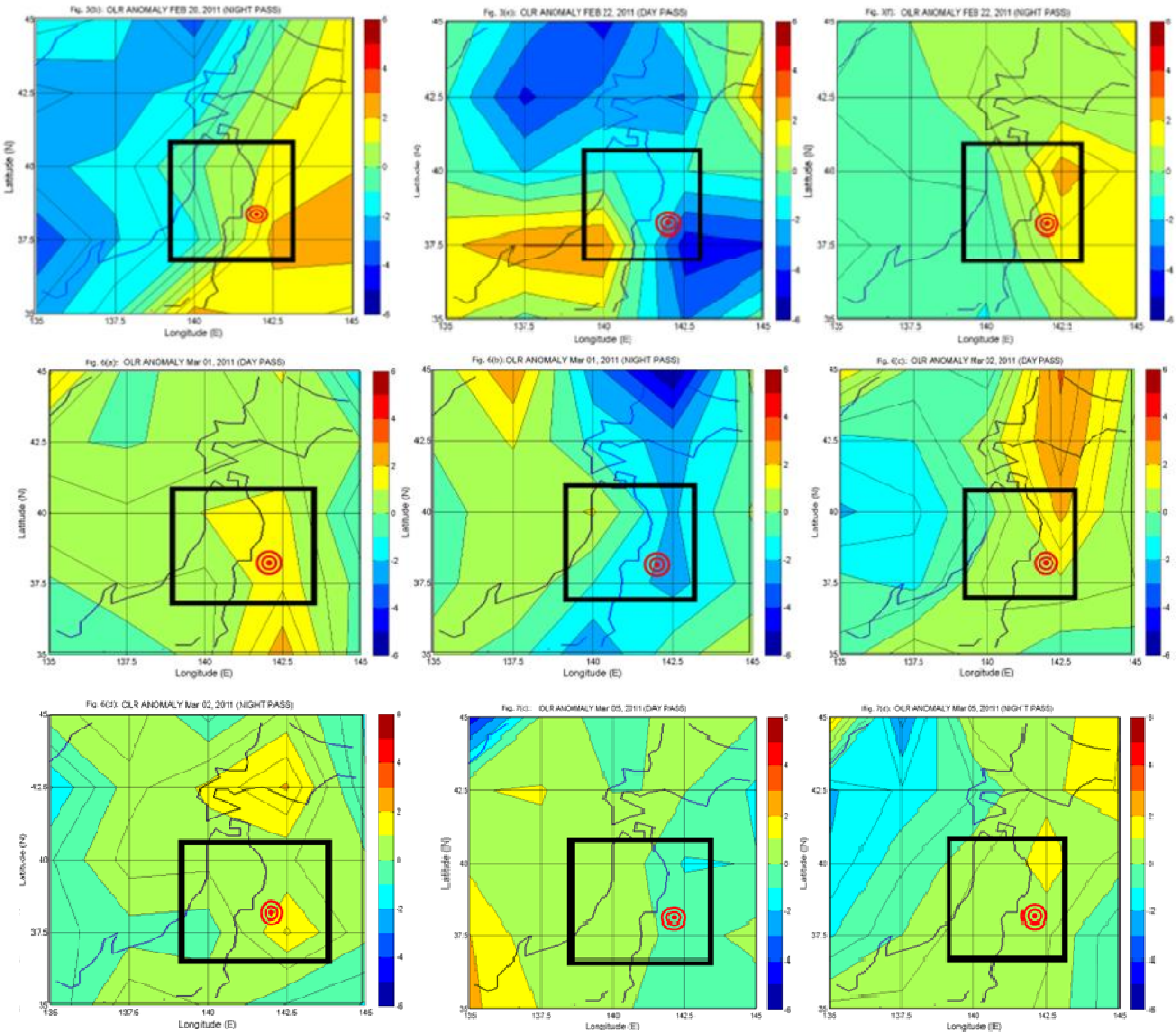


Fig.2.OLR Anomalies in the region of the epicenter of the earthquake Tohoku March 11, 2011

OLR anomalies before the earthquake Tohoku were analyzed in the known paper [5], where in Fig. 2 according to the data of NOAA/AVHRR there is a serious abnormal OLR on March 08, but there is visible weaker OLR anomaly at the date of the new moon March 05, 2011, although in the next two days anomalies were absent. However, a retrospective analysis of the same data of NOAA/AVHRR revealed that for the first time OLR anomalies over the epicentral region began to appear simultaneously with STCI on the date of the full moon, February 18 (Fig. 2) and continued in a flickering mode (day or night) until February 22, 2011. OLR anomalies again began to appear in flickering mode in the period of March 01-05, 2011, and in the following days retrospective analysis confirms the known results from [5].

The special role of dates near the new moons and full moons in the implementation of strong earthquakes and appearing in the upper gas geosphere shells of the planet of various anomalies or signs (STCI, OLR anomalies, TEC and ozone) preparation of seism activities was noted by many researchers. Let us remind of the most famous of these large earthquakes with M7+, which were predicted or retrospectively tested with SCOME scheme: Sumatra, December 26, 2004 (Fig.3); Haiti, January 12, 2010 ([1], table 1, № 25); Chile, February 27, 2010; Japan, March 11, 2011 (Fig. 1,2) and deep-focus earthquakes in the sea of Okhotsk, Kamchatka November 17, 2002; July 05, 2008; November 24, 2008 (STCI in [6] in Fig.1); August 14, 2012, May 24, 2013 (Fig. 4).

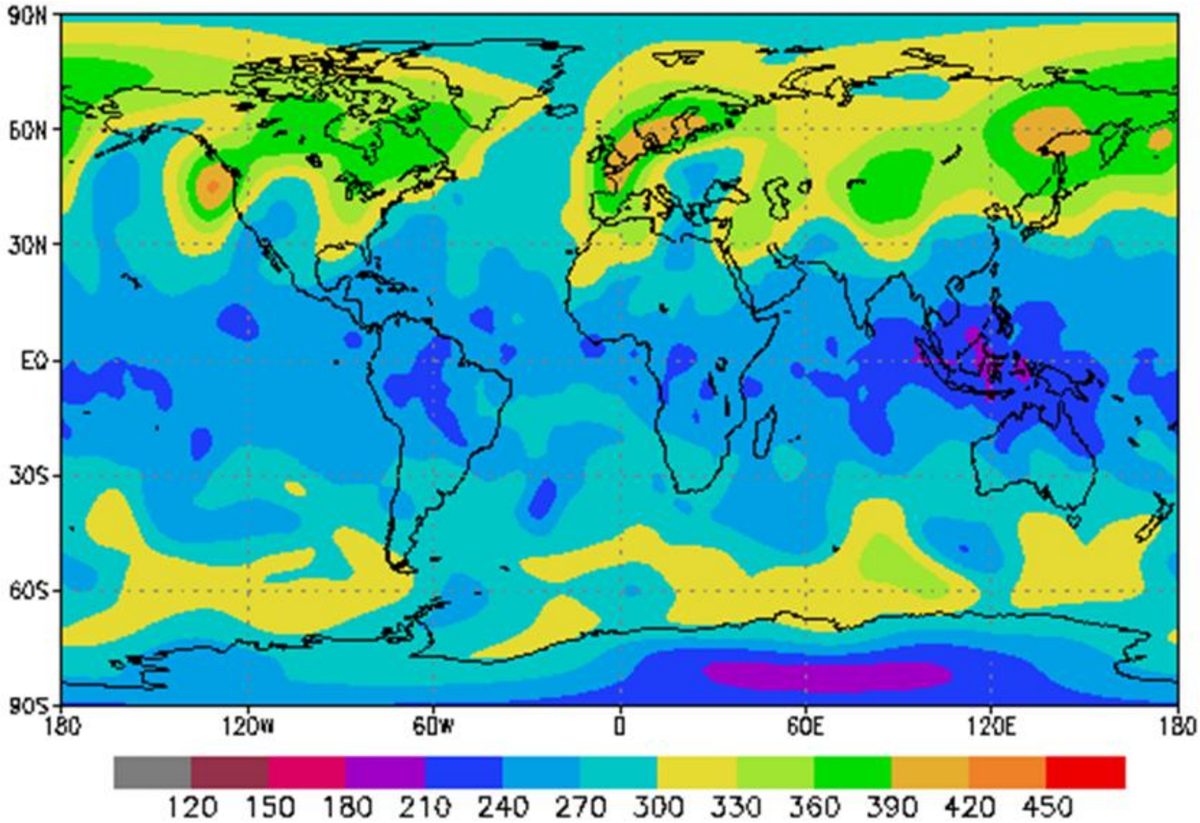


Fig.3. TOVS Total Ozone Analysis (Dobson units) December 26, 2004

We emphasize that all these strong earthquake except Tohoku happened at the date of the new or full moon ± 3 days, often the first signs of preparation of such seism activities appeared 12-14 days before, i.e. again near these specific phases of the moon. In particular, positive abnormal OLR before the earthquake in the sea of Okhotsk on November 24, 2008 was noticed first on November 10 in the epicenter area, then till November 16 it shifted through the Kamchatka Peninsula to the South-East, where STCI was observed of linear forms [6] and length of 1,200 km (according to the formula (1) it gave value of M=7.1±0.2);and on November 22, 2008 OLR anomalies sharply reached the maximum in the epicenter area and took a huge area stretched along the latitude from 148ºE almost 20º to the East.

In this and most other cases OLR anomalies typically have shimmering nature in time and mosaic distribution in space, occupying large areas. It is because of the large areas of signs of strong variations OLR, TEC (Fig.4) and ozone anomalies (Fig. 3) they cannot serve as a reliable natural markers on the localization of the epicenters of future earthquakes.This role is best performed STCI at the intersection of zones of action of the boundaries of lithospheric plates. But it is well justified for crustal earthquakes, whereas for all listed deep-focus earthquakes with M7+ in the sea of Okhotsk the observed STCI had quite diffuse, short time of existence (a few hours) and they did not always get into the zone of action with the width of $\pm 3^{o}$ of relevant SMM, that essentially made difficult to predict these events by the SCOME scheme. However, due to the systemic analysis of the whole complex interdependent LAI signs [1,2,6] the SCOME scheme proved effective for deep-focus earthquakes in the sea of Okhotsk. Forecasts of possible seism activities were registered in the Russian Expert Council on earthquake prediction (REC) and implemented in all three parameters of the forecast: time, place (sometimes with greater error than 3 degrees)and magnitude.

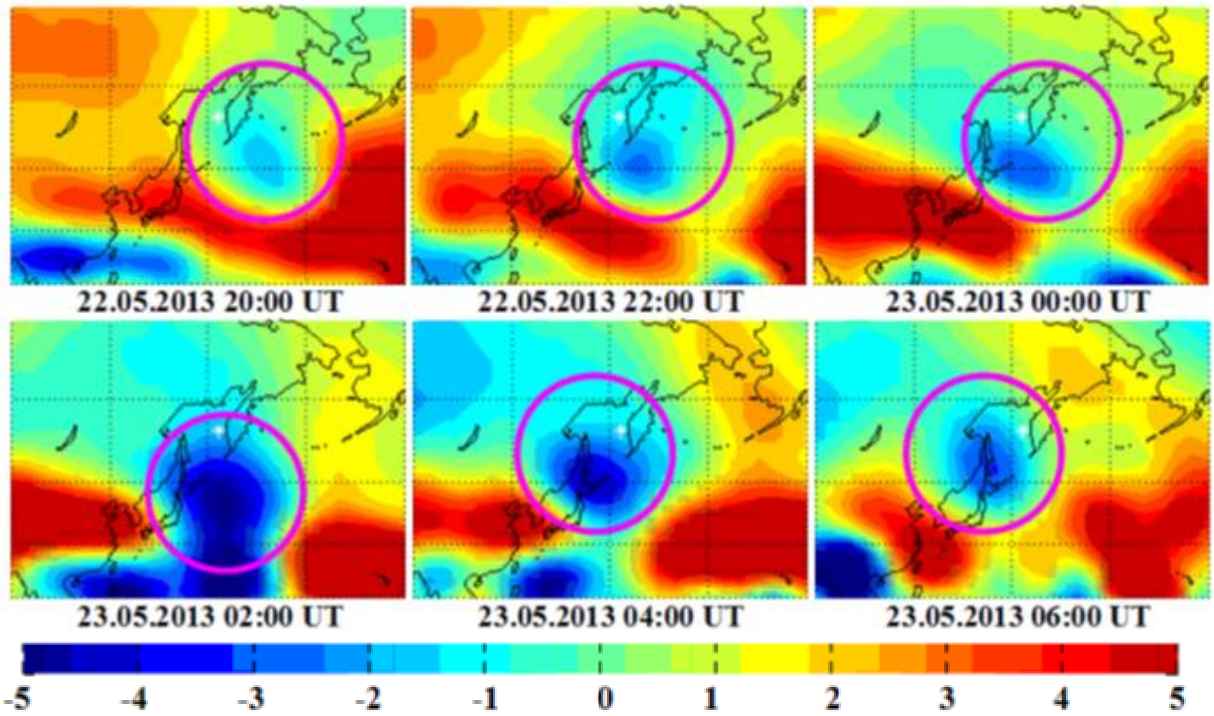


Fig. 4. Dynamics of the ionospheric anomaly on parameter TEC before the earthquake 24.05.2013, in the sea of Okhotsk with magnitude M 8.3.

The earthquake in the sea of Okhotsk on May 24, 2013, M8.3 was the strongest deep-focused earthquakes with depth of focus H>=400 km for all period of instrumental observations from 1960, and its seismic repercussions were felt at distances up to 9000 km, they were registered in Tula (Russia) on the system torsion balance [7, Fig. 8] with synchronization of records by seismograph.

Let us list briefly the main LAI signs, the analysis of which has allowed topredict earthquakes May 24, 2013 with the SCOME scheme (details on the website nadisa.org, the message May 31, 2013). Registered in REC April 26, 2013 original forecast asked the following parameters: up to May 17, 2013 ± 2 days, in the zone (52N-159E)$\pm 3°$ there were probable earthquake with M6.6+.

For the duration of the forecast there happened a number of unusual events. In Tula (Russia) April 25-28, 2013 powerful gravity anomalies were registered; anomalous STCI appearedon May 02, 2013 on the southern boundary of the Okhotsk plate near Tokyo Bay and it was observed about for 6 hours in the form of a thin semicircle (Fig. 5), and May 01, 2013 about 21 UT on Kakioka Magnetic Observatory was registered powerful leap atmospheric electric field(Fig. 5, at the top).

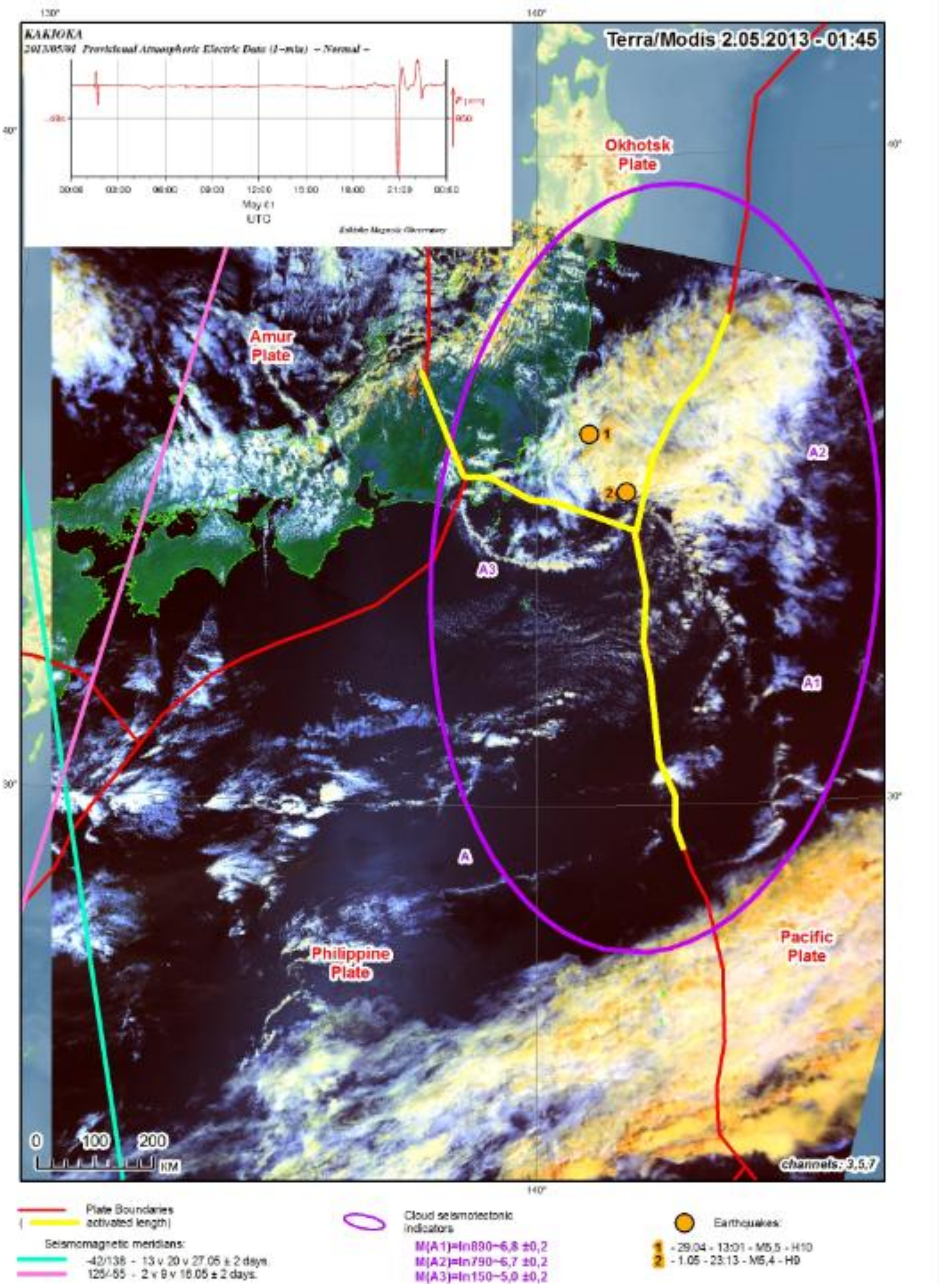


Fig. 5. Seismotectonic cloud indicators in Japan

As was shown in a retrospective analysis, a powerful positive anomaly OLR also suddenly appeared in the night from May 01 to 02, 2013 (Fig. 6). Then in a flickering mode (day or night) positive and negative OLR anomalies occurred on May 03-07, 2013; positive anomalies in the North of the epicenter was marked at the date of the new moon May 10, 2013, and in a flickering mode was observed on May 14, 18 and 22, 2013.

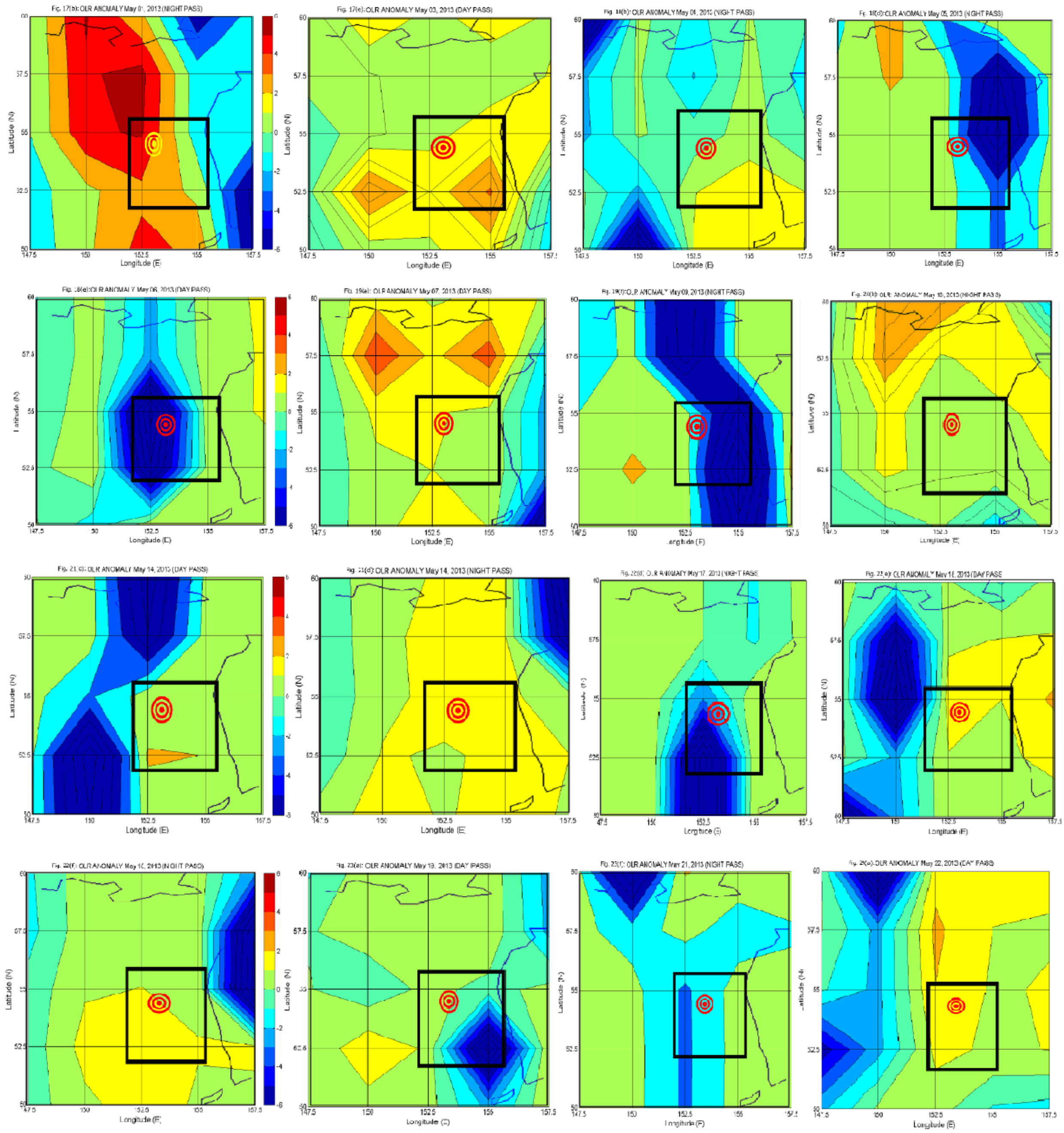


Fig. 6. OLR anomalies in the epicentral zone of deep-focused earthquakes in the sea of Okhotsk on May 24, 2013.

Let us note that as May 10, 2013 it was not only the new moon, but in the North of Australia there observed annular solar Eclipse, and two days before that, in Tula (Russia) gravity anomalies were registered [7, Fig. 3], but not as strong as at the end of April. To say that this Eclipse in the southern hemisphere could significantly impact on seismicity in the area of Kamchatka is impossible, but a similar case was described in [1, table 1, № 18].Then geomagnetic disturbances from the full solar Eclipse on July 22, 2009 in the Eastern hemisphere 12 days became the trigger for a series of three strong earthquakes on August 03, 2009 with max M=6.9 in the Gulf of California, and in 4 days, perhaps, there happened thirty three weak earthquakes on July 26, 2009 on the Andaman Islands with 4.5=<M=<5.2. At the period from May 16 to 19, 2013 in area of

Kamchatka there occurred thirty weak earthquakes with 4≤M<6 that could be one of the signs of stronger seism activities.

During ground and space monitoring of LAI signs in the period of initial forecast for Kamchatka there were registered new SMM from geomagnetic perturbations on May 1, 3 and 18-21, 2013, which covered the forecast area and new dates was given by the formula (1) of possible earthquakes: May 22-26, 2013 and June 02-06 or 09-13, 2013.Over the sea of Okhotsk and Kamchatka weak and shortly living linear STCI continued in a flickering mode, although some of them reached more than 1200 km, which according to the formula (1) gave the potential magnitude of M=7.2±0.2.Therefore, May 20, 2013 in REC was shifted to June 16, 2013 as a new forecast for the Kuril-Kamchatka seismic zone with max M=7.4. On the same day, May 20, 2013 the giant angular-shaped STCI was found on pictures from satellite (Fig. 3 nadisa.org, the message on May 31, 2013)with a total length of more than 2500 km, which increased the magnitude up to M=7.8±02 in accordance with formula (1).

It is interesting to note significant correlations of dates of various anomalies: geomagnetic perturbations on May 18-19, 2013 (Fig.7); contrasting (plus and minus) OLR anomalies in the same dates (Fig. 6); complex dynamics of negative anomalies of the parameter TEC in the ionosphere for May 22-23, 2013 (Fig. 4)that were between two positive anomalies; sharp changes in registration of protons on May 19 and 22, 2013 at the station “Kosmometeotektonika”, Petropavlovsk-Kamchatskiy (Russia); the appearance of the angular-shaped giant STCI on May 20, 2013, and rapid changes of trajectory of Chandler movement of geopoles on May 19 and 22, 2013, which became a global cause of synchronization of all these anomalies.

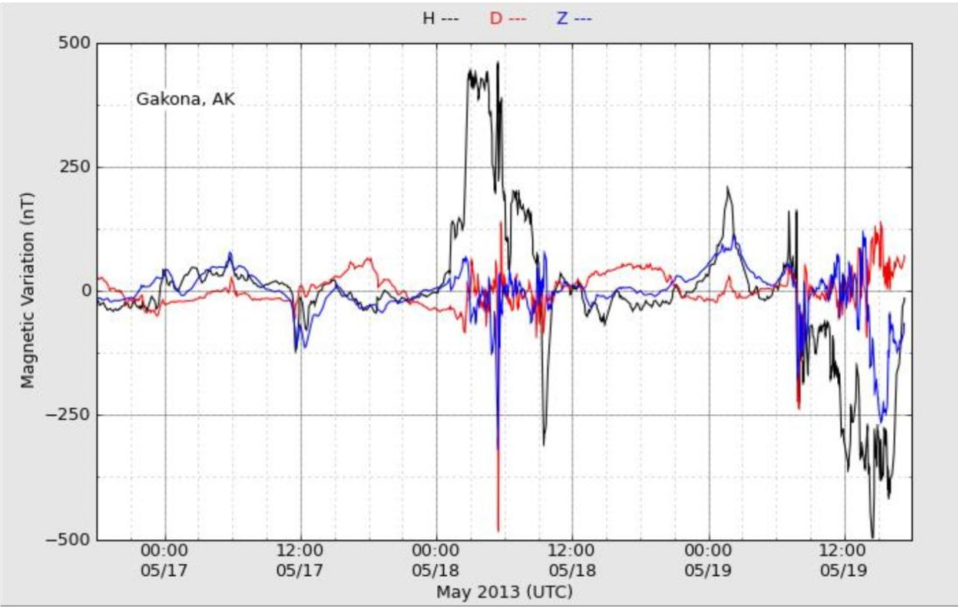


Fig. 7. Geomagnetic anomalies on May 18-19, 2013.

As the result (May 21, 2013) in the declared area of the first forecast a series of earthquakes happened: 01:55 - M6, 03:05 - M5.8, 03:08 - M5.8, 05:43 - M6.1, and in fact the record deep-focused earthquake occurred with M=8.3at the full moon of May 24, 2013.

Let us get to abnormal ring structure (Fig.5) for May 02, 2013, which according to the Russian authors of this work has the signs of artificial initiation using magneto-cumulative or other technologies of active influence on geophysical environment. Retrospective analysis has revealed earlier analogues of such a structure in the form of so-called “camomile” on the North-West and “dandelion” over the South-East of Australia at the date January 22, 2010; doughnut February 26, 2010 over Chile [8] and a system of concentric circles of the type of “dandelion” against the background of strong clouds in the area of future mega-earthquakes Tohoku March 11, 2011.

As the conclusion of the discussion we will touch upon the issue of effectiveness of active influences on geophysical environment for the preliminary discharging of tectonic stresses and reducing the magnitude values. Similar impacts were carried out in different countries using powerful seism vibrator and MHD-generators. The results of geophysical experiments in the USSR (1976-78, Tajikistan) on electromagnetic sounding of the layers of the Earth highlighted the influence of powerful impulses of MHD-generators on regional seismic activity [9]. Local maxima subsequent seismic tremors were noted in 6-7, 15-17 and 20 days after the excitation pulse, which actually coincides with formula (2).

But the long-term consequences of such geophysical experiments for active impact on the natural environment cannot be predicted. In Japan there is a program ACROSS (Accurate Control Routine Operated System) for use in the country of powerful seism vibrators that in the opinion of the authors of [10] could lead to the release of strong earthquakes from land to the ocean and increase the probability of the formation of powerful tsunami. In the United States they realize program HAARP (High-frequency Active Auroral Research Program) on electromagnetic pumping of ionosphere and geomagnetic perturbations from the work of the system HAARP can be a trigger of earthquakes [8] and lead to the restructuring of the entire global electric circuit of the planet. Artificial phenomenon Theta Aurora in radio wave range can be indirect confirmation of this [11] when the natural Theta Aurora seen from space in ultraviolet range [12] (it usually connects zones of Canadian and East Siberian geomagnetic anomalies) turns at 60 - 70 degrees to the West and often connects the North of Norway (district of Tromso), Spitsbergen and Alaska where the system HAARP is situated.

However, the additional energy pumping of any Geosphere shell of the planet may in unexpected way result in catastrophic phenomena of nature in other shells, for example, a powerful hurricane and serial tornado or awakening super-volcanoes Yellowstone and Long Valley in the US. Moreover, the last super-volcano already shows signs of activity and almost falls into the area of SMM with Gakona, Alaska, where the most powerful system HAARP is installed.

CONCLUSIONS

At the beginning of the last century V.I. Vernadsky commented: “...the growth of scientific knowledge of the XX century quickly blurs the lines between different Sciences. We increasingly **focus not on science, but on the problems**. This allows, on the one hand, extremely delve into the investigated phenomenon, and on the other, to extend the coverage of it from all points of view”. This trend in the mid-twentieth century was followed by a return to narrow specialization, which proved its efficiency in solving engineering problems and clarifying the mechanisms of functioning of relatively simple natural systems. However, in studying and solving complex interdisciplinary problems of nature such specialization is often ineffective. For the successful decision of interdisciplinary problems of short-term earthquake prediction it is necessary to combine efforts of scientists from different countries for collecting, systematizing and complex analysis of different geophysical data, as well as the creation of the international system of rapid exchange of such data.

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