Seismic forecasting application of Astro-Meteo-Tectonics concept

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Seismic forecasting application of Astro-Meteo-Tectonics concept

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1. Astro-Meteo-Tectonics

Astro-Meteo-Tectonics concept is a further development of empirical scheme of short-term earthquake prediction and seismotectogenesis concept. In Astro-Meteo-Tectonics, interrelations of astronomical, meteorological and geophysical factors at earthquake preparation are considered.

Astronomical factors include
-solar activity ("Earthquakes are born at the Sun");
-interplanetary medium;
-planetary configurations of type Moon-Earth-Planet or Earth-Moon-Planet;
-resonance interactions of planets.

Meteorological factors are
-general atmospheric circulation and cyclogenesis;
-synoptic processes;
-cloud seismotectonic indicators;
-outgoing longwave radiation (OLR);
-atmosphere chemical potential.

Geophysical factors are:
-deformations of geoid;
-anomalies of Earth rotation parameters;
-rotation of lithospheric plates;
-earthquake initiation by geomagnetic disturbances formalized as the seismomagnetic meridians.

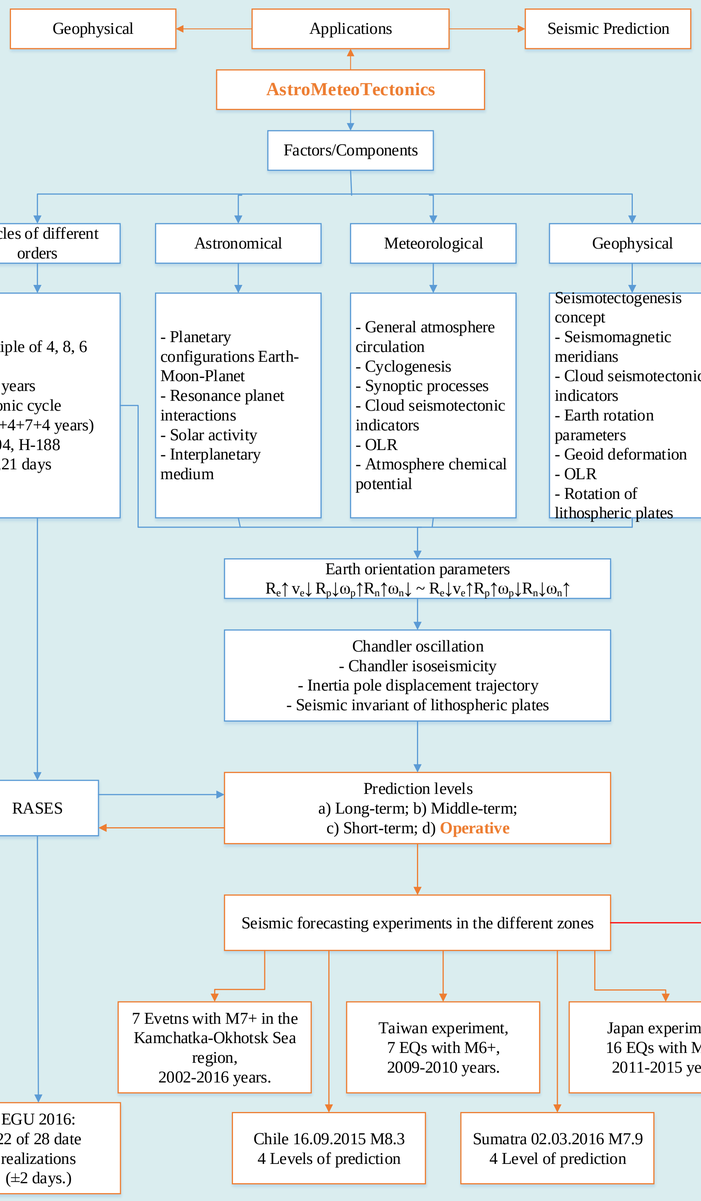


Fig.1. AstroMeteoTectonics and its applications

2. Long-term predictability of seismic activity

Ideas of cycles and rhythms of geophysical processes are used in the data analysis. In particular, we use harmonics multiple of
-4 and 8 years (lunar cycles);
-6 years (recurrence period of Chandler trajectory);
-19 years (Metonic cycle);
-18.6 years (cycle of precession of orbit of monthly Earth revolution around the barycenter of Earth-Moon system);
-one week (7,14 and 21 days) connecting Earth geomagnetic field disturbances and dates of earthquakes;
-104 days (quarter of full lunar cycle) connecting synoptic processes and subsequent earthquakes (A.F. Kubyshen);
-188 days (half-year cycle of solar tide) expressing the periodicity of strongest earthquakes (Shan).

We use three methods: H-104 method, extrapolation method and astronomical method.

Harmonic H-104, revealed by A.F. Kubyshen, correlates the date of specific variations of meteorological parameters at the Chelyabinsk weather station with the following strong earthquakes occruing in average after 104 days. Period of 104 days is close to the quarter of Chandler period (~438/4=109.5 days). This fact looks paradoxical, but the works of A. Sytinskiy and V. Bokov on the correlation of global atmospheric circulation and seismic events give a physical basis for this empirical fact. Also, 104 days is a quarter of a Chandler period so this fact gives insight on the correlation between the anomalies of Earth orientation parameters and seismic events.

Extrapolation method is used to investigate the seismic activity in the special coordinate system associated with astronomical cycles and rhythms. Special sequence diagrams of seismic activity are constructed. Sequence diagrams are used to identify the time-frames of low and high seismic activity. **By the extrapolation of sequence diagrams we can predict the time-frame of future earthquake with a very long forestalling of up to several years**.

Determination of days of possible earthquakes with M5.5+ is also performed using astronomical data. Determination of days of potential earthquakes with M5.5+ is performed using astronomical data. Earthquakes occur on days of oppositions of Solar System planets (arranged in a single line). At that, the strongest earthquakes occur under the location of vector "Sun-Solar System barycenter" in the ecliptic plane. Also there is time coherence between earthquake date and oppositions of three and more planets.

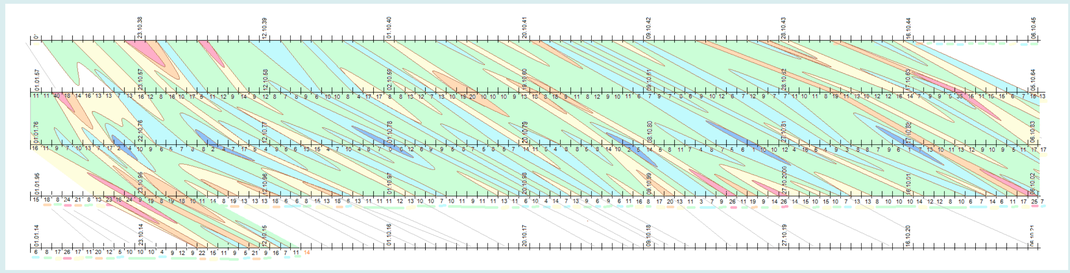


Fig.2. Monthly sequence diagram of global seismic activity

M6+ earthquakes total count

1960-2015

1936-1949

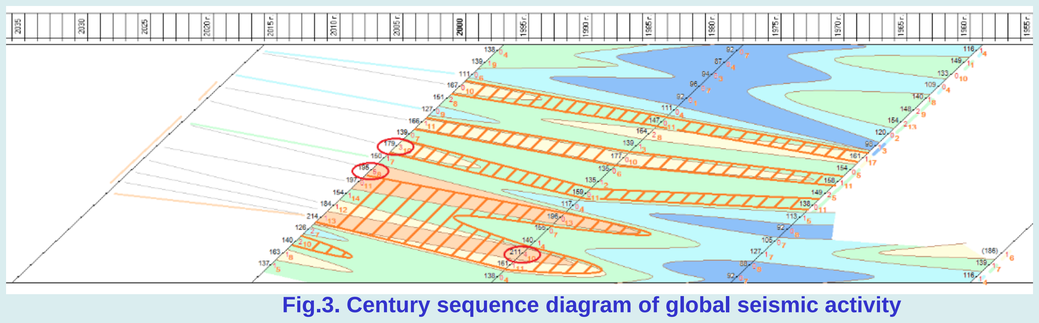


Fig.3. Century sequence diagram of global seismic activity

M6+ earthquakes total count

M7+ EQ count

M8+ EQ count

3. Seismic invariants

The idea of seismic invariant is strongly depending on the so-called Chandler trajectory iso-seismicity is considered. It is the periodic repeatability of Earth's pole Chandler trajectory segments, along which strong earthquakes occur in the same regions at time intervals multiple of 6 years.

Seismic invariant is a sequence of cyclically repeated earthquakes at the margin of two lithospheric plates conjugated by seismomagnetic meridians. Seismic invariants are defined by the coherent anomalies of Earth rotation parameters, long-term time series of gravity measurements, proton migration, radon and other geophysical parameters.

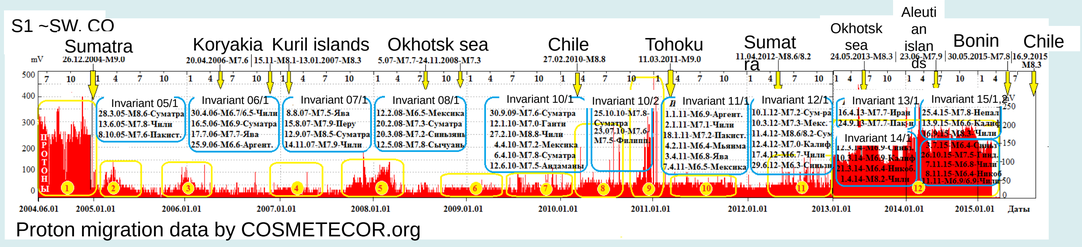
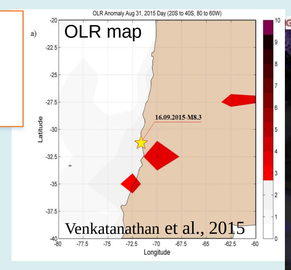
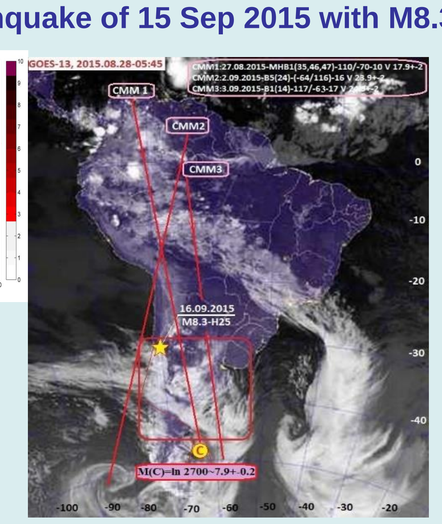


Fig.4. Seismic invariants of Indian and Pacific plates

4. Chile earthquake of 15 Sep 2015 with M8.3





Potential dates by SMMs:
27.08.2015 – 10.09 or 17.09±2 days
02.09.2015 – **16.09** or 23.09±2 days
03.09.2015 – 17.09 or 24.09±2 days

L-type CSTI. CSTI length is 2700 km
Potential magnitude estimate is
M=ln 2700 ~ 7.9 ±0.2

Fig.5. OLR,Seismomagnetic meridians and CSTI for Chile EQ

5. Japan earthquake of 12 May 2015 with M6.8

Prediction statement:
Date: before 10 May 2015
Magnitude: 6.5-7.0
Zone: Japan, offshore Southern Honshu

Actual event:
Date: 12 May 2015 (inaccuracy!)
Magnitude: 6.8
Region: 38.91N; 142.03E, offshore Honshu

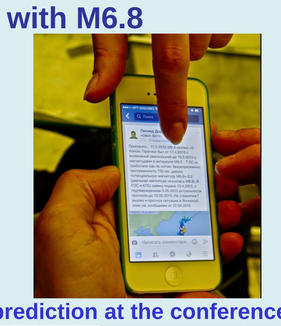
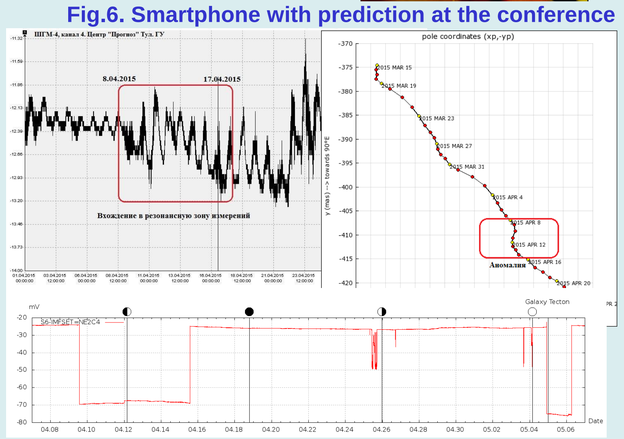


Fig.6. Smartphone with prediction at the conference

Prediction was submitted to Russian Expert Council on Earthquake prediction and seismic hazard assessment on **17.04.2015** with reaffirmation on **03.05.2015.** Presented at the 39th Meeting of the Working Group on Information Systems & Services (Tsukuba, Japan)



Coherence time-frames: 08.04.2015 –17.04.2015, 03.05–07.05.2015

Fig.7. Ground-data with EQ preparation indicators

6. Kamchatka earthquake of 30 Jan 2016 with M7.2

Earthquake was not operatively tracked.
Middle-term warning was developed in November 2015 with alarm period **till the May of 2016**.
Presented at session of Russian Expert Council on Earthquake Prediction and Seismic Hazard assessment on 12 Nov 2015.

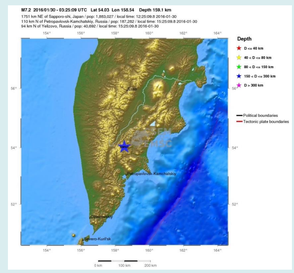


Fig.8. Epicenter location

Prediction was developed using so-called seismic invariants, which are coherent anomalies of long time series of gravity, proton migration, radon data analyzed together with Chandler trajectory and Earth inertial parameters.

SMM1: 07.01.2016 – 14.01 ─ 21.01 ─ 28.01
SMM2: 08.01.2016 – 15.01 ─ 22.01 ─ 29.01
SMM3: 09.01.2016 – 16.01 ─ 23.01 ─ 30.01

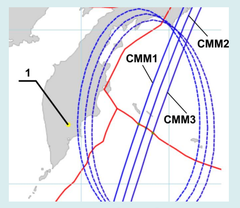


Fig.9. SMM map and epicnter

7. Offshore Kamchatka earthquake of 20 Mar 2016 with M6.4

Middle-term warning for EQ2 was developed on 30 Jan 2016 right after earthquake of 30 Jan 2016 took place.

Short-term prediction was officially submitted to REC on **01 March 2016** with confirmation on 07.03.2016.

Prediction statement:
Dates: 07.03, 17.03, 20.03, 23.03
Magnitude: M7+ (inaccuracy)
Region: Kamchatka

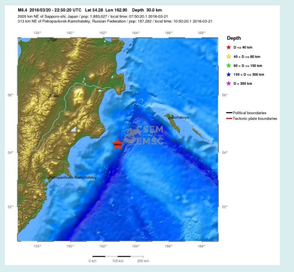


Fig.10. Epicenter location

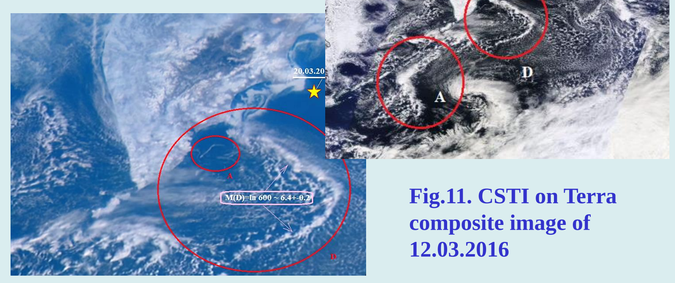


Fig.11. CSTI on Terra composite image of 12.03.2016

Fig.12. CSTI on image of Himawari-8

SMM1: 26.02.2016 – 04.03 ─ 11.03 ─ 18.03
SMM2: 24.02.2016 – 02.03 ─ 09.03 ─ 16.03.

Fig.13. SMM map and epicenter location

Conclusions

1. For the first time it was realized the fourth level system of earthquake prediction: from long-term and middle-term (forestalling of up to 3-6 months) to short-term (up to 2-3 weeks) and operative.
2. Scheme was successfully tested in the prediction of Chile earthquake with M8.3 occurred on 16.09.2015.
3. **For the first time, it was realized principally new system for tracking operative predictions for all specified dates for potential Kamchatka earthquake. Four subscribers received operative prediction on 20.03.2016**.
4. Analysis of sequence diagrams of seismic activity give the Analysis of sequence diagrams gives the following long-term prediction: the strongest earthquake with M8+ and a series of earthquakes with M7 are expected in the period of 29.11.2016-26.01.2017, the most probable dates are 8,16,17,23 of January 2017

References

1. **Doda L.N., Natyaganov V.L., StepanovI.V..** An Empirical Scheme of Short - Term Earthquake Prediction//Doklady Earth Science, 2013. Vol. 453. Part 2, pp 1257-1263.
2. **Doda L.N., Dushin V.R., Natyaganov V.L., Smirnov N.N, Stepanov I.V.** Earthquakes forecasts following space and ground-based monitoring//ActaAstronautica, 2011. V. 69, № 1-2. P. 18-23.
3. **Kubyshen A.F.** O vremennoy korreljacii zemletrjasenij I atmosfernyh processov [On time correlation between earthquakes and atmospheric processes] / Sistema "Planeta Zemlja" : XX let Seminary "Sistema planeta Zelya" [Planet Earth Systemm. 20 years for seminar System Planet Earth].– Moscow.: Lenand 2014.– 608pp– pp.473–477
4. **Doda L.N., Natyganov V.L., Shopin S.A.** Results of a Seismic Forecasting Experiment for the Kamchatka Region // Doklady Earth Sciences 469(2):882-886