

## Long-term predictability of regions and dates of strong earthquakes

Alexander Kubysheva (1), Leonid Doda (2), and Sergey Shopin (2)

(1) Private Researcher, Chelyabinsk, Russia, (2) Tula State University, Tula, Russian Federation (sshopin@mail.ru)

Results on the long-term predictability of strong earthquakes are discussed. It is shown that dates of earthquakes with  $M > 5.5$  could be determined in advance of several months before the event. The magnitude and the region of approaching earthquake could be specified in the time-frame of a month before the event.

Determination of number of  $M6+$  earthquakes, which are expected to occur during the analyzed year, is performed using the special sequence diagram of seismic activity for the century time frame. Date analysis could be performed with advance of 15-20 years. Data is verified by a monthly sequence diagram of seismic activity.

The number of strong earthquakes expected to occur in the analyzed month is determined by several methods having a different prediction horizon.

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. Details of this astronomical multivariate indicator still require further research, but its practical significant is confirmed by practice.

Another one empirical indicator of approaching earthquake  $M6+$  is a synchronous variation of meteorological parameters: abrupt decreasing of minimal daily temperature, increasing of relative humidity, abrupt change of atmospheric pressure (RAMES method). Time difference of predicted and actual date is no more than one day. This indicator is registered 104 days before the earthquake, so it was called as Harmonic 104 or H-104. 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. Further development of the H-104 method is the plotting of H-104 trajectories in two-dimensional time coordinates. The method provides the dates of future earthquakes for several (3-4) sequential time intervals multiple of 104 days.

The H-104 method could be used together with the empirical scheme for short-term earthquake prediction reducing the date uncertainty.

Using the H-104 method, it is developed the following long-term forecast of seismic activity.

1. The total number of  $M6+$  earthquakes expected in the time frames:

- 10.01-07.02: 14;
- 08.02-08.03: 17;
- 09.03-06.04: 9.

3. The potential days of  $6+$  earthquakes expected in the period of 10.01.2016-06.04.2016 are the following:

- in January: 17, 18, 23, 24, 26, 28, 31;
- in February: 01, 02, 05, 12, 15, 18, 20, 23;
- in March: 02, 04, 05, 07 ( $M7+$  is possible), 09, 10, 17 ( $M7+$  is possible), 19, 20 ( $M7+$  is possible), 23 ( $M7+$  is possible), 30;
- in April: 02, 06.

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