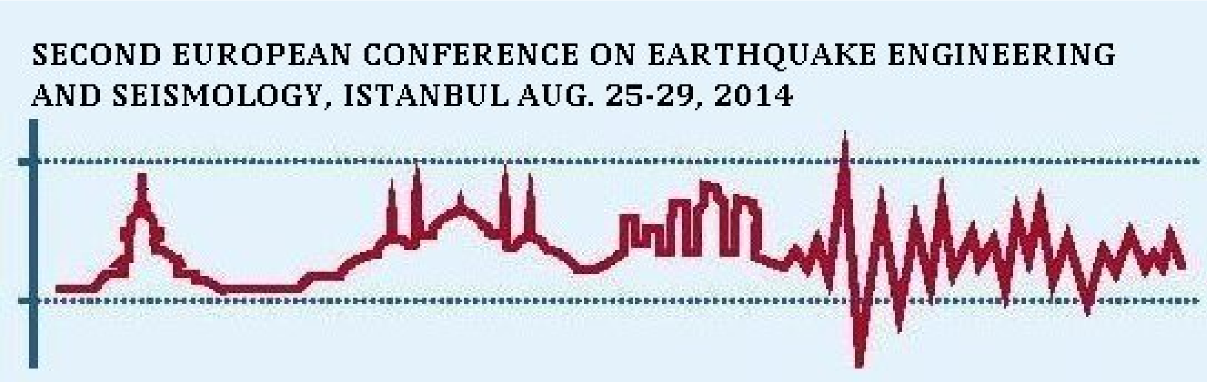

ANOMALIES IN TEMPORAL STRUCTURE OF SEISMICITY AND THEIR CORRELATIONS WITH TECTONIC STRUCTURE IN KAMCHATKA

Victor I. GERMAN[1]

Traditionally two main characteristics are used to describe seismicity: the activity and b-value of the Gutenberg-Richter plot. This description is usually implicitly assumed stationarity of seismic process. This means that the accumulation of earthquakes in time is described by the simple stream (Bogdanoff and Kozin, 1985) and therefore the time intervals between successive seismic events ΔT in any fixed energy-space-time interval I should have an exponential distribution.

Obviously, the assumption of seismic process stationarity in fact is rarely performed. At the same time, in recent years, it was found that the distribution of time intervals ΔT between the seismic events (for the representative data) is well described by the same law of distribution (distribution function) accurate within a scale parameter (Bak et al., 2002; German, 2002; Corral, 2004). This statement is proved by the analysis of seismic events catalogs of various regions (German, 2006b; Corral, 2004). This regularity indicates that there is a similarity in the time structure of seismicity, which is determined by the constant value of the shape parameter for distributions of ΔT. In this case scale parameter of the distribution just takes into account the change in the level of seismic activity in the interval I with changing its parameters.

Regional seismicity catalog of Kamchatka from 1963 to 2009 (http://data.emsd.iks.ru/dbquaketxt_min/index_r.htm) was taken for analysis of seismicity temporal structure. Earthquake with energy class $K \geq 10$ (magnitude $M \geq 2.8$) were considered to ensure the representativeness of the data.

It was shown (German, 2006 a) that the distribution function of time intervals ΔT poorly described by an exponential distribution even after the removal of aftershock sequences, but sufficiently well approximated by the Weibull distribution function $F(\Delta t) = 1 - \exp(-\lambda\, \Delta t^k)$, where λ is the scale parameter, and k is the shape parameter. Weibull distribution is a generalization of the exponential one, which is obtained from it in case of $k = 1$. Thus, to delineate the anomalies in temporal structure of seismicity in space it is enough to study the variation of the shape parameter k for different spatial interval.

In this work the distribution of time intervals ΔT was constructed for data from spatial cells 100x100 km. A set of cells shifted by 20 km from each other was considered. Those cells which include less than 50 earthquakes were not considered.

Value of the shape parameter k determines the probability density of the next earthquake occurrence in moment Δt after the occurrence of the last registered earthquake (in considered interval I). This probability density is equal to the function of the intensity $r(\Delta t)$ for the Weibull distribution $r(\Delta t) = \lambda k\, \Delta t^{k-1}$ (Bogdanoff and Kozin, 1985). Thus, if the shape parameter k is equal to 1 then $r(\Delta t) = \lambda$ and the occurrence of one earthquake does not affect to the occurrence of the other earthquake. Distribution with k less than 1 indicates the grouping of earthquakes in time (the probability of a new earthquake after the last one decreases over time). At the same time k value,

[1] PhD, Krasnoyarsk Research Institute of Geology and Minerals, Krasnoyarsk, Russia, german3v@yandex.ru

which is greater than 1, indicates the presence of "repulsion" of earthquakes. In general, the Kamchatka region is characterized by parameter *k* equal 0.65 (German, 2006a; German, 2006b).

Mapping of the shape parameter *k* in space (Fig. 1) shows the presence of strong extensive anomalies with values *k* smaller then 0.5. The anomalies come along the border of the Kuril-Kamchatka Deep-Sea Trench. This Trench separates the Okhotsk Plate from the Pacific Plate, which moves over it. The clustering of earthquakes in this area can be associated with "engagements" of the edge of the Pacific Plate with Okhotsk Plate. The absence of the strongest earthquakes in this area can be explained by the fact that in that place pressing force between plates cannot achieve high value. A similar but less pronounced anomaly also passes along the Aleutian Trench (Fig. 1) which is the line of contact of the Pacific Plate and the North American Plate.

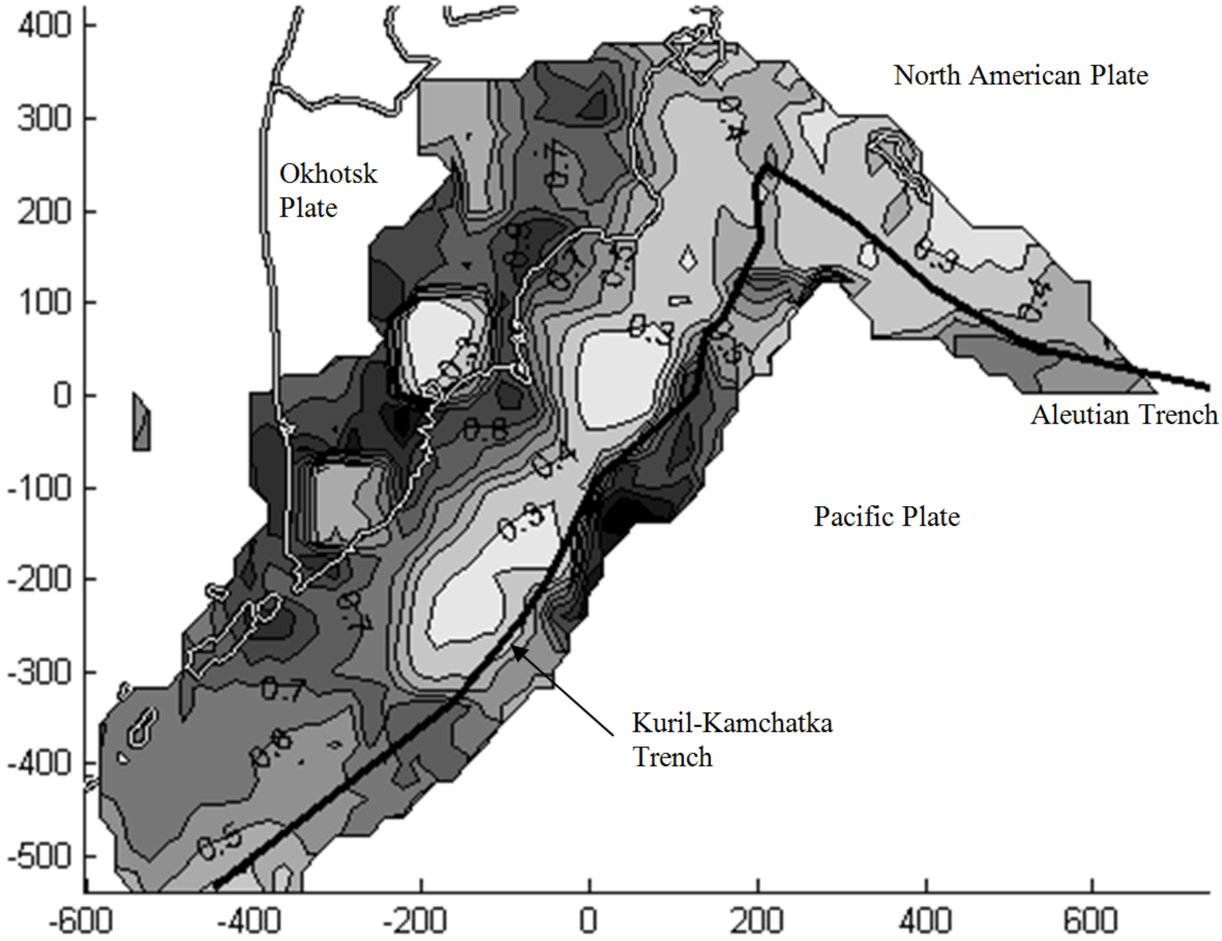

Figure 1. Changing in the shape parameter *k* of the Weibull distribution, which approximate the distribution of time intervals ΔT between successive earthquakes in 100x100 km cells

Another anomaly is located directly on the Kamchatka Peninsula near Avachinsky Gulf. It is suggested that it can be related with the activity Avachinskaya volcanic group. Removal of aftershock sequences does not lead to the disappearance of the anomalies found.

Thus, the analysis of the temporal structure of seismicity of the Kamchatka region showed its anomalies. Correlation between these anomalies and the tectonic structure of the area was demonstrated.

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