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A STATISTICAL ESTIMATION OF SEISMICITY LEVEL: THE METHOD AND RESULTS OF APPLICATION TO ALASKA AND ALEUTIAN ISLANDS

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Information on the current seismicity of a region is rather widely required. The persons who are interested include not only members of the seismological community, but also organizations that are professionally involved in the monitoring of the natural environment (in particular, the Ministry of Emergencies and administrative units). A separate problem apart is that of providing earthquake information to residents of seismic regions.

In view of the wide range of potential users, the characteristics used must be, on the one hand, intuitively understandable and, on the other, their definition must be based on quantitative seismicity parameters. Traditionally the solution is to make scales that convert numerical values to qualitative characteristics.

A formalized scale of the seismicity level makes for greater terminological definiteness in descriptions of the state of the seismicity in a region and avoids several ambiguities in assessment and comparisons between seismicities in different space–time volumes. In particular, the concept of "seismic background" is formalized thereby.

There is description of the scale for seismicity level that relies on the statistical distribution function of seismic moment M_0 as a parameter that characterizes the seismicity level in a specified space object during a specified time interval. Considering that the basic parameter is statistical in character, the procedure proposed was called *Statistical Estimate of Seismicity Level*, or *SESL*.

The technique has been introduced into the practice of the Kamchatka Branch of the Geophysical Survey RAS [*Saltykov*, 2011]. Estimates of the current seismicity level on Kamchatka are reported on a weekly note to the Kamchatka Branch of the Russian Expert Council for Earthquake Prediction, Assessment of Volcanic Hazards, and Risk and can be found in the Council's conclusions about the seismic situation in the region.

A scale of seismicity levels.

The concept of "background" is associated with the notions of "usual, widely prevalent, and of the most frequent occurrence," in contrast to the notion of an "anomaly," which is observed rather rarely. Bearing this in mind, we propose to define the threshold values of the distribution function F as follows: $F = 0.005, 0.025, 0.15, 0.85, 0.975$, and 0.995. The intervals between these values make a scale that contains five seismicity levels:

extremely high,	$0.995 \le F$,
high,	$0.975 \le F < 0.995$,
background,	$0.025 < F < 0.975$,
low,	$0.005 < F \le 0.025$,
extremely low,	$F \le 0.005$.

According to this scale, seismicity is 95% of the time at the background level, with 2% occurring at high and low levels and 0.5% at extremely high/low levels, which may be defined as seismicity anomalies. To make the division more detailed, the background level can be subdivided into three further sublevels:

lower background,	$0.025 < F \le 0.15$,
intermediate background,	$0.15 < F < 0.85$,
higher background,	$0.85 \le F < 0.975$.

With this refinement, the intermediate background level will occur 70% of the monitoring time, while 12.5% are for the higher/lower background levels.

Conclusions

The *SESL* technique in order to estimate the seismicity level in a specified space–time region in qualitative terms based on a quantitative parameter, viz., the distribution function of seismic moment M_0 was developed.

Suggested scale for estimating seismicity levels contains five basic grades and three additional ones.

The main features of this technique and demonstrated certain restrictions on its uses were outlined.

An example of using the technique for one of the most seismically active regions of the world – Alaska and Aleutian Isl. was demonstrated.

References

Saltykov V.A. A statistical estimate of seismicity level: the method and results of application to Kamchatka // Journal of Volcanology and Seismology, 2011, Vol. 5, No. 2, pp. 123–128. (*Original Russian Text: V.A. Saltykov, 2011, published in Vulkanologiya i Seismologiya, 2011, No. 2, pp. 53–59*). DOI: 10.1134/S0742046311020060