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On the algorithm «Barrier» with a single learning class for earthquake–prone areas recognition

Alexey Gvishiani (1,2), Boris Dzeboev (1,4), Ivan Belov (3,1), and Sergey Agayan (1)

(1) Geophysical Center of the Russian Academy of Sciences (GC RAS), Moscow, Russian Federation (b.dzeboev@gcras.ru), (2) Schmidt Institute of Physics of the Earth of the Russian Academy of Sciences (IPE RAS), Moscow, Russian Federation (direction@ifz.ru), (3) Russian State Geological Prospecting University n. a. Sergo Ordzhonikidz (MGRI-RSGPU), Moscow, Russian Federation (foreignmsgpa@mail.ru), (4) Geophysical Institute - the Affiliate of Vladikavkaz Scientific Centre of the Russian Academy of Sciences (GPI VSC RAS), Vladikavkaz, Russian Federation (cgi_ras@mail.ru)

Determination of possible locations of earthquakes is an essential part of seismic zoning, which is, in turn, the most important problem of seismology. However, the epicenters of strong (≥ 0) earthquakes in any studied region are usually concentrated within certain areas. In order to partition the territory into two noncrossing zones, i.e. where epicenters of strong earthquakes are possible and where they are not, the dichotomous algorithms with learning are used, as well as clustering algorithms. As early as 1972, I.M. Gel'fand, V.I. Keilis-Borok, E.Ya. Rantsman et al. had successfully applied the "Kora" (hereinafter, "Crust") recognition algorithm with learning on two classes for highly seismic zones in the regions of the Pamir and Tian Shan. The approach, later called EPA (Earthquake-Prone Area recognition), was used successfully by the authors to identify the locations of possible epicenters of the strongest, strong, and significant earthquakes in various mountainous regions.
Since the development of the EPA method in the 1970s, the problem of reliability of the results, obtained by means of algorithms implying that learning is performed on potentially overlapping learning sets of different qualities, is being debated. In the presented work a new "Barrier" dichotomy algorithm has been designed. Learning in this algorithm is performed on one "pure" high-seismic class. This feature makes the "Barrier" algorithm essentially different from the other algorithms used earlier in the EPA.
In the "Barrier" algorithm learning is performed on the sole highly seismic "pure" learning class, whereas learning of the low seismic class is absent. The algorithm solves the problem of constructing a subset, close to the only learning class in the initial finite set of alternatives on the basis of the set of scalar features (in the present work, we mean that the set of alternatives is the set of intersections of morphostructural lineaments). For this purpose, we construct the measure of difference between arbitrary alternatives, built on each attribute. The idea of constructing a measure implies that we reveal and quantitatively estimate the "barrier" impeding the closeness of alternatives in the given attribute. The measures of the barriers play the role of metrics on the initial set. This allows us to impart an exact meaning for the concept of proximity to the set subset on the basis of a set of attributes.
The "Barrier" algorithm is used for recognition of earthquake-prone areas with ≥ 6.0 in the Caucasus region. Comparative analysis of the "Crust" and "Barrier" algorithms justifies their productive coherence.
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