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System-analytical method of strong earthquake-prone areas recognition

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Proper seismic hazard assessment is the most important scientific problem of seismology, and geophysics in general. With the development of the world economy, the importance of the problem grows and acquires global significance.

Strong earthquakes ($M \geq M_0$, M_0 is the magnitude threshold starting from which earthquakes in the studied region are considered strong), as a rule, do not occur over the entire territory of the seismic region. Accordingly, the recognition of areas prone to future strong earthquakes is an urgent fundamental direction in research on the assessment of seismic hazard. Identification of potentially high seismicity zones in seismically active regions is important from both theoretical, and practical points of view. The currently available methods for recognition of high seismicity zones do not allow repeatedly correcting their results over time due to the invariability of the used set of recognition objects. In this work, a new system-analytical approach FCAZ (Formalized Clustering And Zoning) to the problem has been created. It uses the epicenters of rather weak earthquakes ($M \geq M_R$, M_R is a certain magnitude threshold of weak earthquakes) as objects of recognition. This makes it possible to develop the recognition result of zones with increased seismic hazard after the appearance of new earthquake epicenters. The latter makes FCAZ a method of systems analysis.

The system-analytical method for analyzing geophysical data developed by the authors has led to the successful recognition of areas prone to the strongest, strong, and most significant earthquakes on the continents of North, and South America, Eurasia, and in the subduction zones of the Pacific Rim. At the same time, in particular, for the classical approach of strong earthquake-prone areas recognition EPA (Earthquake-Prone Areas), a new paradigm for recognition of high seismicity disjunctive nodes, and lineament intersections with training by one "reliable" class was created in the work.

In the regions studied in this work, FCAZ zones occupy a relatively small area compared to the field of general seismicity – 30% – 40% of the area of all seismicity, and 50% – 65% of the area where earthquakes with $M \geq M_R$ occur. This illustrates the spatial nontriviality of the FCAZ results obtained in this work. The results of the work also show that weak seismicity can actually

“manifest” the properties of geophysical fields, which in the classical EPA approach are used directly as characteristics of recognition objects (disjunctive nodes or intersections of the axes of morphostructural lineaments).

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