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Earthquake hazard study in Azerbaijan on the basis of stress and strain state distribution using CASMO model and topography-induced elements

Gulam Babayev (1), Elnara Akhmedova (2), and Fakhraddin Kadirov (Gadirov) (1)

(1) Geology and Geophysics Institute, Azerbaijan National Academy of Sciences, Baku, Azerbaijan (babayev74@gmail.com), (2) Baku State University, Ministry of Education, Baku, Azerbaijan (elnare.isayeva.88@mail.ru)

Seismicity is the severest stress-induced geohazard in the Caucasian area. The risk resulting from this geohazard is substantial. Earthquakes result from stress concentrations at zones of weakness. Besides, the influence of topography anomaly on the stress-strain state of the lithosphere is essential. One approach to advance the level of hazard assessment is to perform geodynamic models to compute stress concentrations within the crust. In line with studying the stress and strain state using CASMO model, this study also concentrates on a specific aspect of the contemporary tectonic stressof the Caucasus lithosphere (Azerbaijan), the component that is caused by topography, which itself is an expression of density distribution and processes at depth as well as on the surface. In the paper, stress-strain state was studied by the finite element method with the application of software packages HypermeshTM and AbaqusTM. Based on the plotted models of stress-strain state of lithosphere, the orientations and localization of the horizontal stress axes at the various lithosphere depths were determined. The correlation of those stress axes was done with the stress map plotted on the basis of focal mechanism solutions of the earthquake occurred in Azerbaijan within the period of 1990-2016 years with the application of CASMO ("World Stress Map") technique. Mainly western and central parts of Greater Caucasus ridge are characterized by northeastern-southwestern tension. In the eastern part, the tension reverses into intensive compression. In the studied region, earthquakes are predominantly thrust-faulting with a number of normal-faulting and some strike-slip faulting. The consideration of the topographic anomalies at analysis of stress-strain state at the various lithosphere depth levels will allow obtaining more reliable data for the plotting of geodynamic model of the region, which consequently will give an insight in understanding the stress state of the region and finding the region that was probable to future shocks. Such researches are necessary to be conducted at the construction of the strategic facilities, especially underground constructions (mines, tunnels, underground pipelines, terminals).
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