SPATIAL VARIATIONS OF ACTIVE STRESS PATTERNS AND FREQUENCY-MAGNITUDE DISTRIBUTION OF EARTHQUAKES IN WESTERN ANATOLIA, TURKEY

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ABSTRACT

Western Anatolia is one of the most important tectonic elements of Turkey, and constitutes the eastern margin of Aegean Extensional Province. The area is one of the most seismically active continental margins around the globe experiencing N−S extension. Earthquake data in this study is used to analyze the active stress patterns and to estimate the earthquake return periods for different sub-regions in western Anatolia. Focal mechanism solution data is used for determining the orientations and ratios of principal stress components in the area. Minimum principal stress (σ_3) is horizontal in the region trending in almost N−S (S16°W) direction and the region is characterized mainly by normal fault regime. The area is sub-divided into 10 sub-regions based on the variations in focal mechanism solutions and tectonic setting. The results for sub-regions showed that apart from the predominant extensional regime; Bakırçay and Gulf of Sığacık sub-regions are dominated by strike-slip, while Manisa and Soma sub-regions are dominated by extensional strike-slip regimes. These sub-regions roughly coincide with the İzmir Balıkesir Transfer Zone (IBTZ), which is characterized by mixture of normal and strike-slip faults. Computed principle stress directions shows that the area is mostly characterized by N−S extension except Gökova region marked by NW−SE extension and Dinar-Burdur and Fethiye regions displaying more variable stress tensor solutions with more dominant NE-SW extension. The earthquake return periods computed using Gutenberg-Richter relation and Gumbel extreme value method shows that the whole region has a return period of 4 and 7 years for a magnitude 6 earthquake. According to our results, Simav and Gulf of Gökova sub-regions have shortest and Manisa has longest earthquake return periods. According to G-R method; sub-regions 1, 7 and 9 (Simav, Bakırçay and Gulf of Gökova) and based on Gumbel method; sub-regions 1, 8 and 9 (Simav Gulf of Sığacık and Gulf of Gökova) have the largest maximum expected magnitude (Mmax) earthquake in 100 years. The correlation of parameters computed for sub-regions showed that a- and b- values are correlated positively with stress ratio (R) when the whole magnitude range is considered but the relation changes to a weak negative correlation when the catalogue is restricted to magnitude 4.0. Similar weak negative correlation exists between Stress variance and stress ratio (R).

Keywords: *Western Anatolia, stress tensor inversion, earthquake return periods, b- value, Stress ratio (R)*