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Focal mechanism and stress analyses for main tectonic zones in Albania

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In this study, a number of 33 moderate earthquakes for the period 2013-2015, ranging in magnitude within 2.2 $\leq M_W \leq$ 4.9 and located within the Albanian territory, have been analyzed. As an earthquake prone country, situated at the frontal collision boundary between Adria microplate and Eurasian tectonic plate, Albania is characterized frequently by micro earthquakes, many moderate and seldom by strong ones. It is evidenced that the whole territory is divided in two different tectonic domains, correspondingly the outer and the inner domain, showing different stress regime as clearly evidenced based on earthquake focal mechanism and geodetic studies. Although strong earthquakes are clearly related to faults in tectonically active areas, moderate events are more frequent revealing valuable information on this purpose. All the studied events are selected to be well-recorded by a maximum possible number of the local broadband (BB) seismological stations of Albanian Seismological Network (ASN), although regional stations have been used as well to constrain the solution. Earthquakes are grouped according to their location, within three well-defined tectonic zones, namely: Adriatic-Ionian (AI), Lushnja-Elbasani-Dibra (LED) and Ohrid-Korça (OK). For each event, the seismic moment $M_0$is determined, through spectral analyses. Moment values vary ranging 10^{12} – 10^{15} Nm, for the Adriatic-Ionian (AI) outer zone; 10^{13} – 10^{16} Nm, for the Lushnja-Elbasani-Dibra (LED) transversal zone, which cuts through both the outer and the inner domains and 10^{12} – 10^{14} Nm, for the Ohrid-Korça (OK), north-south trending inner zone. Focal mechanism solutions (FMS) have been determined for each earthquake, based on the robust first motion polarities method, as applied in the FOCMEC (Seisan 10.1) routine. Using the Michael's linear bootstrap invertion on FMS, a stress analysis is applied. Results show the minimum compressional stress directions variation: σ_1 $37^0/27^0$, $\sigma_2 303^0/8^0$ and $\sigma_3 198^0/62^0$ (μ = 0.4) for AI zone; $\sigma_1 83^0/9^0$, $\sigma_2 204^0/73^0$and $\sigma_3 350^0/14^0$ (μ = 0.4) for LED zone and $\sigma_1 306^0/43^0$, $\sigma_2 186^0/28^0$ and $\sigma_3 75^0/34^0$ (μ = 0.65) for OK zone. Based on final results, according to Zoback (1992), the Adriatic-Ionian (AI) zone is characterized mainly by thrust (TF) faulting, although normal and oblique ones take place as well. This outer zone is under a compressive stress regime, where the maximum horizontal stress lies in the direction of P axes. Meanwhile, the Lushnja-Elbasani-Dibra (LED) transversal zone, is characterized by normal-oblique faulting (NF-NS), undergoing an oblique transform to extensional stress regime, where the maximum horizontal stress extends at the (T + 90^0) direction. The Ohrid–Korça (OK) zone is characterized by oblique-normal faults, undergoing and extensional stress regime, where the maximum horizontal stress lies in the of T axes direction.

Keywords: moderate earthquakes, focal mechanism, stress