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CRUSTAL STRESS-FIELD FROM THE INVERSION OF FOCAL MECHANISMS IN THE GREEK REGION: NEW INSIGHTS FOR REGIONAL DEFORMATION

Kapetanidis Vasilis* (1), Kassaras Ioannis (1)

(1)National And Kapodistrian University Of Athens

* vkapetan@geol.uoa.gr

Greece is one of the most rapidly deforming parts of the continents globally, with significantly large strain-rates along the Hellenic Arc, owing to the active subduction of the eastern Mediterranean lithosphere beneath the Aegean, but also in the North Aegean Trench, caused by the westwards propagation of the North Anatolian Fault. In the present study we employ a massive dataset of over 2000 focal mechanisms (Kassaras et al., 2016) of Mw>=3.5 earthquakes that occurred at crustal depths to resolve the stress field in a grid of nodes with 0.25Â° spacing and 30km search radius that covers the entire region of Greece, using a damped least-squares inversion (Hardebeck & Michael, 2006). We explore the properties of the stress field, including the orientations of the principal stress axes and the stress-shape, R, to determine key characteristics of its variation across the Greek territory.
We compare our results with the expected focal mechanisms and maximum compression principal strain-rate axes of the Global Strain Rate Model (GSRM; Kreemer et al., 2003). The two models are generally in good agreement with the exception of regions where the strain-rate magnitude is low, such as NW Greece, near Corfu, where the stress-field suggests compression more transverse to the Apulian collision front than the strain-rate field does, and SW Aegean, where the strain-rate tensor is overwhelmed by the contraction along the Hellenic Arc, whereas the stress-field is related to strike-slip faulting near Crete and N-S normal faulting in southern Peloponnese and near Rhodes Island.
Regions with dual stress-state were identified by employing the Multiple Inverse Method (Yamaji, 2000) on areas delineated by joining several neighboring Area Sources of the European Seismic Hazard Model 2013 (ESHM13; Woessner et al., 2015). NW Greece and Corfu Island are mainly affected by NE-SW contraction causing NW-SE reverse faulting and, in addition, strike-slip faulting, mainly in Epirus. Northern/central Greece and the Corinth Rift are primarily characterized by E-W normal faulting, with secondary stress-states favoring oblique-normal to dextral SW-NE or sinistral NW-SE strike-slip faulting. Central Aegean, including Lesvos, Chios and Samos islands, is mainly governed by SW-NE dextral faulting but also N-S extension, with a very stable minimum principal stress axis (S3) in Northe Aegean, also causing E-W normal faulting which becomes dominant near Dodecanese. The southern part of the Hellenic Arc around Crete is dominated by SW-NE sinistral faulting with additional E-W reverse faulting, in the vicinity of the subduction zone.
The stress-tensor was also applied on the Fault Sources (FS) of the ESHM13 to evaluate its relation with their geometry and kinematics. In most regions, our results were found to be compatible with the ESHM13 FS, in terms of orientation and expected faulting type, which was examined by imposing the direction of maximum shear on the fault plane as the direction of slip. Some differences were observed in regions of low strain-rate, such as the southern Aegean, where left-lateral strike-slip E-W faulting is expected, in contrast to the registered E-W normal FS. Discrepancies were also found in areas with complex tectonics, such as pull-apart basins in Western Greece, where the resolution of the regional stress-field is insufficient to explain local stress heterogeneities. However, such areas were also highlighted by anomalies in the stress-shape, R, which are strongly dependent on the

variation of one principal stress axis while another remains relatively stable. A high R, E-W oriented anomaly marks a significant rotation of the stress field by 90Â° that occurs along the latitude of 37Â°N, turning E-W (in the north) to N-S (in the south) normal faulting in Southern Peloponnese and Dodecanese Islands, as well as dextral to sinistral SW-NE strike-slip faulting in Northern and Southern Aegean, respectively.

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