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Crustal stress field in the Greek region inferred from inversion of moment tensor solutions

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The Hellenic region is the seismically most active area in Europe, having experienced numerous large magnitude catastrophic earthquakes and associated devastating tsunamis. A means of mitigating these potential hazards is by better understanding the patterns of spatial and temporal deformation of the crust across the Hellenic orogenic system, over timescales that range from individual earthquakes to several tens of years. In this study for the first time we make collective use of the Global CMT (GCMT), Regional CMT (RCMT) and National Observatory of Athens (NOA) moment tensor databases in order to extract focal mechanism solutions that will be used to infer crustal stresses in the Greek region at an unprecedented resolution. We focus on the shallow seismicity within the upper plate (down to 42 km) and select solutions with good waveform fits and well-resolved hypocentral depths. In this way we obtained 1,614 focal mechanism solutions covering western Greece up to southern Albania, central and southern Greece, northern Aegean as well as the subduction trench west and east of Crete. These solutions are used as input to a regional-scale damped stress inversion over a grid whose node spacing is 0.35 degrees for the purpose of recovering the three principal stress axes and the stress ratio R for each node. Several sensitivity tests are performed where parameters such as damping, hypocentral depth, magnitude range are varied, in order to ascertain the robustness of our results. The final stress field model is then compared to the GPS-derived strain field revealing an excellent agreement between the two datasets. Additionally, maximum and minimum stress axes orientations are correlated with the strike and dip of known faults in order to improve our understanding of future fault rupture and corresponding seismic hazard.