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Contemporary stress and strain field data in the Mediterranean from surface to depth: Resolution, correlations and contradictions

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Mapping the contemporary stress field orientation in the Mediterranean region can provide fundamental insights on the complexity of plate tectonic forces in this region at different depths. Despite increased data availability and methodological improvements, most recent stress field characterization across the entire Mediterranean dates back to 1995. We consistently map stress field orientations and related parameters for the Mediterranean utilizing all focal mechanisms from the World Stress Map database release 2016. Our main goals are (1) to resolve the stress field orientation for this region at unprecedented finer scale, (2) to evaluate the performance of our stress inversion methodology in one of the most tectonically complex regions on Earth, (3) to compare different types of stress and strain observations covering the entire depth range from surface (e.g. GPS data) to mantle (e.g. shear wave splitting in the mantle). The obtained stress field orientations generally capture correctly the main seismotectonic features of each area, including tectonically complex settings such as the Alpine Orogeny or the Ionian Sea. SHMax orientations and stress regimes tend to be uniform with depth within uncertainties, but larger stress heterogeneity is resolved for the upper 1-10 km. Both coseismic elastic strain field from potency tensors and strain field from GPS data are highly consistent with the stress field orientation, indicating that stress and strain maintain a linear relationship in this area and that inelastic strain release is consistent with the elastic stress or strain accumulation. The Italian Peninsula displays the largest discrepancies between these parameters, potentially indicating stress/strain changes with depth, a prominent role of aseismic deformation, and/or a non-linear relation between stress and strain. Increasing discrepancy between stress field orientation and fast shear wave propagation is found from eastern (sub-parallel) to western (sub-perpendicular) Mediterranean, eventually indicating different causes of anisotropy. Implications of these results with respect to seismic hazard will be discussed.