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The TR method: A new graphical method that uses the slip preference of the faults to separate heterogeneous fault-slip data in extensional and compressional stress regimes

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The new graphical TR method uses the slip preference (SP) of the faults to separate heterogeneous fault-slip data. This SP is described in detail and several examples of the application of the TR method are presented. For this purpose, synthetic fault-slip data driven by various extensional and compressional stress regimes whose greatest principal stress axis ($\sigma 1$) or least principal stress axis ($\sigma 3$) always remains in vertical or horizontal position respectively as in Andersonian stress states have been considered. Their SP is given through a simple graphical manner and the aid of the Win-Tensor stress inversion software. The extensional stress regimes that have been examined are the radial extension (RE), radial-pure extension (RE-PE), pure extension (PE), pure extension-transtension (PE-TRN) and transtension (TRN), whereas the compressional stress regimes are the radial compression (RC), radial-pure compression (RC–PC), pure compression (PC), pure compression-transpression (PC–TRP) and transpression (TRP). A necessary condition for the TR method that is the faults dipping towards the certain horizontal principal stress axis of the driving stress regime are dip-slip faults, either normal or reverse ones, is satisfied for all extensional and compressional stress regimes respectively. The trend of the horizontal least or greatest principal stress axis of the driving extensional or compressional stress regime respectively can be directly defined by the trend of the T-axes of the normal faults or the P-axes of the reverse faults respectively. Taking into account a coefficient of friction no smaller than 0.6, the reactivated extensional faults in the crust dip at angles higher than about 40°, and the increase of the stress ratio and/or the fault dip angle results in the increase of the slip deviation from the normal activation. In turn, in the compressional stress regimes, the dip angle and SP of the activated faults suggest the distinction of the compressional stress regimes into “real” and “hybrid” ones. The “real” compressional regimes are the RC, RC–PC and PC, where the activated faults dip at angles up to 50° and their slip deviation from the reverse activation is no more than 30°. The “hybrid” compressional stress regimes are PC–TRP and TRP, where the activated faults can dip with even higher angles than 50° and their slip deviation from the reverse activation increases with the dip angle and the decrease of the stress ratio. In these stress regimes, the steeply dipping faults behave as contractional oblique strike-slip and strike-slip faults when their dip direction shifts at high angles away from the $\sigma 1$ trend. Examples of the application of the TR method indicate that the method not only succeeds in separating heterogeneous fault-slip data into homogeneous groups, but it can (a) distinguish stress regimes whose horizontal principal stress axes trend close to each other, (b) distinguish faults driven by either tectonic or magmatic stresses, e.g., along the South Aegean Volcanic Arc, and (c) partition the contemporary stress regime related with the plate convergence between the Philippines Sea and Eurasia due to the different orientation of the activated structures, e.g., the inherited N-S striking Chelungpu Thrust and NE-SW striking Shihkang-Shangchi fault zone that have been activated during the 1999 Chi Chi earthquake, Taiwan.