

Implications for the magnitude of background stress field from GPS measurements and focal mechanisms

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We use GPS data and earthquake focal mechanisms before and after the Chi-Chi earthquake to estimate stress changes. Compared to pre-seismic velocities, postseismic geodetic velocities over a 15-month period on the hanging wall of coseismic rupture have changed azimuth, with a counter-clockwise rotation of about 20° , and increased by a factor of 8 due to the Chi-Chi coseismic stress change. The observed deformation is assumed to be governed by creep along a sub-horizontal shear zone forming a décollement beneath the Central and Hsueshan Ranges. The rotation of the geodetic displacements suggests a background stress of the order of the coseismic stress change. Assuming the direction of shear stress is parallel to slip on the décollement; our observations imply a very low basal shear stress of the order of 2-4 MPa, and a low friction of about 0.02. Such a low friction is consistent with the lack of internal deformation and the low taper angle of the orogenic wedge. We use our estimates of strain rates and stress to place constraint on the rheology governing crustal deformation considering either velocity-strengthening friction or power law creep. The rheology with frictional sliding provides more reasonable parameters.