

## **Deformation of conjugate compliant fault zones induced by the 2013 Mw7.7 Baluchistan (Pakistan) earthquake**

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Strain localizations in compliant fault zones (with elastic moduli lower than the surrounding rocks) induced by nearby earthquakes have been detected using geodetic observations in a few cases in the past. Here we observe small-scale changes in interferometric Synthetic Aperture Radar (InSAR) measurements along multiple conjugate faults near the rupture of the 2013 Mw7.7 Baluchistan (Pakistan) earthquake. After removing the main coseismic deformation signal in the interferograms and correcting them for topography-related phase, we observe 2-3 cm signal along several conjugate faults that are 15-30 km from the mainshock fault rupture. These conjugate compliant faults have strikes of N30°E and N45°W. The sense of motion indicates left-lateral deformation across the N30°E faults and right-lateral deformation across the N45°W faults, which suggests the conjugate faults were subjected to extensional coseismic stresses along the WSW-ENE direction. The spacing between the different sets of faults is around 5 to 8 km. We explain the observed strain localizations as an elastic response of the compliant conjugate faults induced by the Baluchistan earthquake. Using 3D Finite Element models (FEM), we impose coseismic static displacements due to the earthquake along the boundaries of the FEM domain to reproduce the coseismic stress changes acting across the compliant faults. The InSAR measurements are used to constrain the geometry and rigidity variations of the compliant faults with respect to the surrounding rocks. The best fitting models show the compliant fault zones to have a width of 0.5 km to 2 km and a reduction of the shear modulus by a factor of 3 to 4. Our study yields similar values as were found for compliant fault zones near the 1992 Landers and the 1999 Hector Mine earthquakes in California, although here the strain localization is occurring on more complex conjugate sets of faults.