Estimates of fault tractions in the San Gorgonio Pass region consider fault interaction

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In order to estimate absolute tractions along the southern San Andreas fault, we simulate the regional deformation using three-dimensional quasi-static mechanical models. These models simulate the stressing rates both over multiple earthquake cycles and during interseismic loading of the fault system using deep slip rates determined from the multi-cycle model. Assuming complete shear stress drop during large ground rupturing events, we estimate absolute shear tractions along faults using the time since last event in the paleoseismic record for each fault segment and the distribution of stressing rates from the interseismic model. For the fault normal tractions, normal stressing rates along the San Gorgonio Pass region locally accrue or reduce after multiple earthquake cycles due to the complexity of the fault geometry. The distribution of normal stressing rates from the multi-cycle model can be scaled to provide ripe conditions for earthquake rupture initiation in dynamic rupture models. We compare our interseismic shear stressing rates to shear tractions resolved from a uniform remote stress tensor used in the dynamic rupture models. Shear stressing rates from the interseismic model differ from the resolved shear tractions indicating that fault interaction within the quasi-static impacts the stress distribution. A comparison of the shear tractions estimated using the interseismic shear stressing rates and time since last ground-rupturing event show significant deviation from stresses resolved from a remote stress tensor. This difference may greatly impact dynamic rupture simulations. To further test the effect of recent earthquakes, we simulate the 1992 Landers earthquake to assess the impact of this rupture on the shear stress distribution. Calculated absolute shear stress from the Landers earthquake rupture differs from the absolute shear stress from a model without the impact of the Landers earthquake by +- 0.4 MPa in right-lateral and reverse stresses and +- 0.6 MPa in tensile stresses. Consequently, including nearby earthquake ruptures varies the distribution of stresses and may provide a more accurate stress distribution along the San Andreas fault. We conclude that incorporating fault interaction, time since last earthquake, and nearby earthquake ruptures in the stress distribution along faults influences fault tractions that may improve accuracy in dynamic rupture models earthquake simulations.