

The Absolute Strength of the San Andreas Fault Inferred From 3D Loading Simulation at and Around the Big Bend Segment

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In order to estimate the absolute strength of the San Andreas fault (SAF), we numerically computed the absolute stress fields around SAF on the basis of elastic dislocation theory.

Around a simple strike-slip fault in northern-central California, the absolute deviatoric stress fields are determined by only the strength of SAF. The axis of maximum compressive horizontal stress generally makes a 45-degree angle with the strike of SAF, regardless of the absolute strength level. Our simulation results suggest that the observed stress rotation in central California is caused by the spatial variation in absolute strength along SAF.

On the other hand, around the big bend segment in southern California, the absolute deviatoric stress fields are determined by not only the strength of SAF but also the strength of thrust faults in the surroundings. Because the strike of SAF is oblique to the plate motion, the stress rotation must occur more or less, depending on the relative magnitude of shear stress related to the strength of SAF to normal stress related to the strength of the surrounding thrust faults. The stress rotation occurs in a broader region as SAF is stronger and the surrounding thrust faults are weaker.

Therefore, to estimate the absolute strength of SAF, it is crucial to examine the change in stress orientation with distance in the vicinity of the big bend segment. If stress rotation occurs within 20 km from SAF, the friction coefficient of SAF is about 0.1, assuming that the thrust faults have the standard strength expected from laboratory experiments of rock friction. If stress rotation extends to 40 km from SAF, we may conclude that SAF has the standard friction coefficient.