CORRELATION OF STATIC AND PEAK DYNAMIC COULOMB FAILURE STRESS WITH MAINSHOCKS, AFTERSHOCKS, SEISMICITY RATE CHANGE, AND TRIGGERED SLIP IN THE SALTON TROUGH

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Numerous studies have found good correlation of static Coulomb failure stress (ΔCFS) from large earthquakes with the occurrence of aftershocks and other earthquakes later in time. However, reasons for a less than perfect correlation includes the observation that aftershocks often occur in the ΔCFS shadow zones, and remote triggering of earthquakes is difficult to explain from relatively small ΔCFS values. Recently, complete or dynamic Coulomb failure stress, parameterized by its largest positive value (peak ΔCFS(t)), has been proposed as an alternative triggering mechanism (Kilb, 2002). In order to quantify the ability of the ΔCFS and peak ΔCFS(t) distributions for large earthquakes to trigger other large earthquakes, aftershocks, and aseismic slip, we have modeled ΔCFS and peak ΔCFS(t) for four recent historical earthquakes in the Salton Trough area of the Imperial Valley, California (1968 M6.7 Borrego Mountain, 1979 M6.6 Imperial Valley, 1987 M6.6 Elmore Ranch, and M6.5 Superstition Hills), using a finite-difference method. A cross-correlation is calculated between the modeled stresses and seismicity rate change in terms of the Z-value (Habermann, 1983). Modeling results show that peak ΔCFS(t) provides significantly better correlation with later mainshocks, aftershocks, seismicity rate change, and triggered slip than ΔCFS for all four events. On average, peak ΔCFS(t) fits the seismicity rate change 26% better than ΔCFS for time periods up to a month after the mainshocks, and peak ΔCFS(t) correlates with aftershocks significantly better than ΔCFS up to two years after the mainshock events. Our results for the Salton Trough suggest that peak ΔCFS(t) may be a more robust and sensitive parameter for earthquake triggering estimation, as compared to ΔCFS calculations.