THE MECHANICAL INTERACTION AMONG LARGE EARTHQUAKES IN NW IRAN

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Briefly, we ask under what conditions does one earthquake trigger another. It has long been recognized that while each event produces a net reduction of regional stress, events also result in stress increases. With further tectonic loading it seems logical that such sites of stress rise should be the foci of future events and therefore such events should be readily predictable from preceding ones. Earthquake slip causes stresses to change. The stress increases result in further earthquakes. Aftershocks are the most readily studied such events because of their large number.

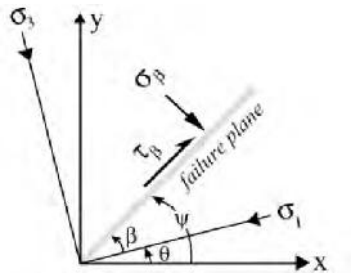

Figure 1. Coordinate system to Coulomb stress change calculation

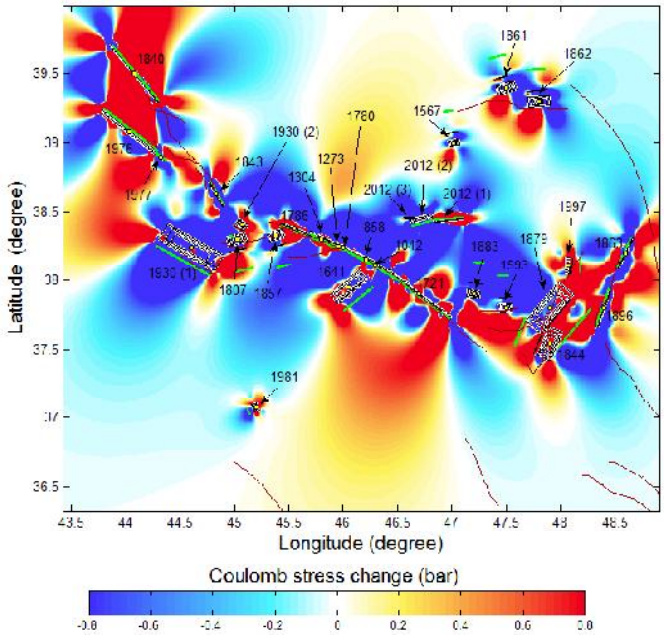

Figure 2. Coseismic Coulomb stress change among large earthquakes in NW Iran

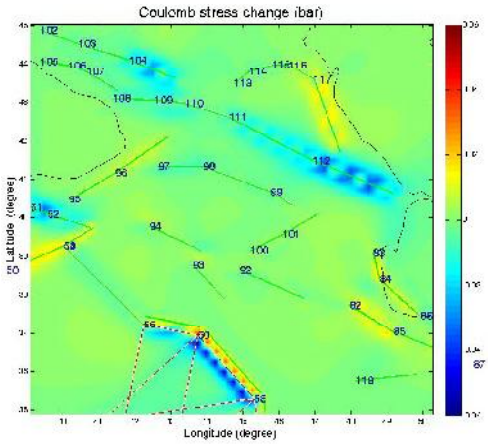

Figure 3. Interseismic coulomb stress change rate in the study region based on modeled slip rates for known active faults

Obtained results show the some earthquake occurrence in Coulomb stress change increase. It proves that we can use Coulomb stress change to predict the probable next large earthquake or aftershocks. The exact locations of off-fault stress changes are modestly sensitive to assumptions about regional stress direction and, to a lesser extent, the effective friction coefficient. Since a range of plausible values can reproduce observed aftershock distributions, neither the effective friction coefficient nor the regional stress field are constrained by our results. Conversely, the predictive power of the method that we use does not depend on having a detailed knowledge of these parameters.

Stress increases of less than one-half bar appear sufficient to trigger earthquakes and stress decreases of a similar amount are sufficient to suppress them. The former, in agreement with current ideas of self organised criticality, suggests that some parts of the brittle crust are always on the threshold of failure. This indicates that over periods of aftershock sequences other processes do not change stresses by even modest amounts. Over long time periods Coulomb stress changes in the upper crust will increase as a result of stress relaxation processes in the lower crust. Thus our calculations may understate the amplitude of the triggering stress for delayed events.

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