

Numerical Simulation on Interactions Among Strong Earthquakes in Sichuan-Yunnan Area, China

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Using a relative fine three dimensional finite element model, we have been numerically modeled patterns of coseismic change of Coulomb Failure Stress by strong earthquakes and studied the stress loading/unloading effects of strong earthquakes on potential following events on other major active faults in Sichuan-Yunnan area, China.

1 Stress loading/unloading effects of strong earthquakes on potential following events on other major active faults

In Sichuan-Yunnan area, a strong earthquake not only leads tremendous unloading effects on the rupture segment itself but also results in loading effects on preparations of potential future events on most other active faults. Strong events on the Xianshuihe fault, the Jinshajiang fault, the Xiaojiang fault and the Chuxiong-Jianshui fault induce much stronger loading effects on more than 85% of other major active faults respectively. Even the Lijiang-Xiaojinhe fault which effect is the weakest also leads more than 50% of other major active faults to be loaded. So strong events may play a triggering function on other future events in Sichuan-Yunnan area.

2 Responses of other major active faults to strong earthquakes

More than 60% of strong events produce loading effects on other major active faults but Lijiang-Xiaojinhe fault. Especially the Minjiang fault and the northern segment of Xianshuihe fault turn into increasing zone of Coulomb Failure Stress Change and are loaded by all strong events. The Jinshajiang fault, the southern segment of Xianshuihe fault, the Xiaojiang fault, the Ganzi-Yushu fault and the Anninghe fault are loaded by more than 80% strong events.

The Tengchong-Lancang fault and the Lijiang-Xiaojinhe fault are different from the others. Although these two faults are rather active, simulations indicate that both effects on the others and responses to the others are all rather weak. Locating in the strong deformed region induced by collision between the India plate and the Eurasia plate, the Tengchong-Lancang fault may be mainly controlled by shearing collision of the India plate. The Lijiang-Xiaojinhe fault transversely cuts the Sichuan-Yunnan Rhombic Block as a barrier obstructing material flow towards to SE-direction. It may be governed by the SE-direction tectonic movement of the Northwest Sichuan Subblock.

3 Stress loading/unloading mechanism on strong earthquakes in Sichuan-Yunnan area, China

3.1 Background dynamic conditions in Sichuan-Yunnan area, China

Sichuan-Yunnan area is located in the neighborhood of collision boundary of plates and undergoes material flow of the Tibetan Plateau. Tectonic activities are very strong. Those constitute the background dynamic conditions of strong earthquake activities in Sichuan-Yunnan area.

3.2 Loading/Unloading mechanism based on Coulomb Failure Stress change

The results of simulation show that the geometric and kinematic patterns of major active faults lead the Coulomb Failure Stress Changes to increase on most other active fault planes in Sichuan-Yunnan area. Since the interactions among strong events are mainly loading, an event usually may advance some following events. After a strong earthquake, accompanying the strong unloading effects on the rupture segment itself, the loading effects dominate the preparations of future events on other active faults. So a group of events will occur until the whole accumulated energy has been released and then a new peaceful period comes.

The simulation indicates that seismic activities in Sichuan-Yunnan area may be mainly controlled by the basic dynamic background as well as triggering of Coulomb Failure Stress. It may reveal a mechanism of seismic activities in Sichuan-Yunnan area with some physical meanings. Keywords: 3-D numerical modeling, Coulomb failure stress change, active fault, stress loading/unloading mechanism