S045-008 Room: Convention B Time: May 28 11:00-11:15

Static Stress Changes and Aftershock Distribution in the 1999 Chi-Chi, Taiwan, Earthquake, Sequence

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The 1999 Chi-Chi, Taiwan, Earthquake (Mw7.6) occurred on September 20, 1999 (UT) with a 100-km-long surface rupture along the Chelungpu fault. The coseismic horizontal and vertical slips on the hanging wall were from 1.5 m to 8.5 m and from 2.2 m to 4.5 m, respectively [Yu et al., 2001]. A large number of aftershocks, including 6 large aftershocks with a magnitude of 6 or greater, followed the mainshock and covered an area as broad as 150 km long and 100 km wide, which is almost half of the Taiwan Island and much larger than the ruptured area [e.g. Nagai et al., 2003]. Especially, seismicity in the eastern part of Taiwan, that is 40-km far from the rupture area, increased about an hour after the mainshock. The pattern of aftershock distribution was a little different from that of past seismicity [Shin and Teng, 2001]. The change of seismicity might be induced by the mainshock, and some large aftershocks. In the present study, we focused on the effect of static stress changes induced by the mainshock. Some papers [e.g. Wang et al., 2000] discussed a relationship between the effect and aftershock occurrence, but they did not consider the characteristics of aftershocks exactly, for example, focal mechanism and distribution. We calculated the static stress changes due to the mainshock on various fault planes with some rake directions, which are based on the distribution and the focal mechanisms of the aftershocks, reported by Kao and Angelier (2001) and Nagai et al. (2003). We adopted a slip model of the mainshock rupture process of Ma et al. (2001). Mainly, each result of static stress change, which was consistent with the aftershock occurrence, showed that seismicity increased on the various faults where the Coulomb failure stress increased. The results showed that some of the Chi-Chi aftershock sequence could be consistent with the static-stress triggering model in the present study. The triggering model like this can also explain the aftershock sequence in the eastern part of Taiwan, where the static stress change was calculated on the left-lateral strike-slip vertical fault plane with a 20-degree strike, although it had not been explained. These results dependent on the focal mechanisms and distribution of aftershocks suggested that the aftershock sequence had the effects of the crustal structure, which is constrained by the convergence between the Eurasian Plate and the Philippine Sea Plate in Taiwan. But this distribution of the static stress change on the specific plane with the rake direction based on the aftershock occurrence was not always consistent with the aftershock distribution and cannot explain all of the features of aftershock occurrence. For example, aftershocks did not occur under the Central Range that is between the rupture area and the eastern part of Taiwan. We will discuss the relationship between the occurrence of the Chi-Chi aftershock sequence and static stress changes.