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Relationship between the rupture directivity of main shock and aftershock activity

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After the 1992 Landers, 1999 Hector Mine and 2001 Denali earthquakes, some researchers observed increases in seismicity rates in many areas far from epicenters. Many researches indicate that static stress changes due to large earthquakes influence following seismicity rate changes in the near filed. However, in the far field, static stress changes have little effect on seismicity because their amplitudes are too small to trigger earthquakes in the far field. Alternatively, dynamic stress changes accompanied by seismic waves, which attenuate less than static stress changes, must trigger earthquakes in the far field. If dynamic stress changes trigger earthquakes in the far field, they should affect aftershock activity in the near field, and some researchers evaluated effects of dynamic stress changes by comparing a distribution of maximum values of dynamic stress changes with aftershock activity. However, most of them studied on strike slip events whose rupture propagates mainly along the strike direction, such as the 1992 Landers earthquake. On the other hand, events on normal and reverse faults are rarely studied. Kimura and Miyatake (2006) investigated the relationship between characteristics of spatial and temporal distribution of dynamic stress changes and the rupture process of pure dip slip in which the rupture propagates mainly along the fault strike. They indicated the distribution of maximum values of dynamic delta CFF has two lobes with large delta CFF values that extend from the fault edge because of stopping phases with large amplitudes of dynamic delta CFF. This characteristic is not seen in the distribution of static stress changes.

In this study, to examine whether aftershock activities in the near field reflect the characteristic of dynamic delta CFF mentioned above, we investigate relationship between aftershock areas and rupture processes of main shocks on dipping faults, especially the rupture directivity and the edge of the fault.

The 1987 Kameoka, Japan, earthquake (M 4.9) occurred in the midst of the seismic network of the Regional Center for Earthquake Prediction of the Faculty of Science, Kyoto University. Maeda (1991) obtained the detailed aftershock distribution by means of the master event technique. The aftershock distribution has a gap around the hypocenter of the main shock corresponding to the rupture area during the main shock. And activity in an area extending in the strike direction from the gap is seen. The 1980 El Asnam, Algeria, earthquake occurred on a thrust fault. Aftershocks concentrated around the endpoint of rupture point (Miyatake, 1985). These characteristics of aftershock activities agree with the dynamic delta CFF distribution in Kimura and Miyatake (2006).

On the other hand, in the case of the 1999 Chi-Chi, Taiwan, earthquake, we can not see the characteristic corresponding to the dynamic stress change distribution in Kimura and Miyatake (2006) in the aftershock activity during the first 3 months after the main shock.

We will analyze detailed aftershock activity of these events and other thrust and normal events.