Systematic Studies of Dynamic Triggering in Continental China

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Large distant earthquakes can dynamically trigger microearthquakes and deep tectonic tremor/slow-slip events along major plate boundary faults (Hill and Prejean, 2007). Recent studies also show that teleseismic earthquakes could trigger seismic activity in relatively stable continents. Here we summarize our recent efforts in studying dynamic triggering in continental China. In the first study (Jiang et al., 2010), we systematically examined remote triggering following the 2008 Mw7.9 Wenchuan earthquake, using continuous waveforms recorded by hundreds of seismic stations in the China digital seismic network. We found that dynamic triggering following the Wenchuan mainshock tends to occur near active faults that have ruptured in historical times, and are in the rupture direction of the Wenchuan mainshock.

One of the best examples of remotely triggered seismicity occurred around the Fangshan pluton near Beijing, China. This region has been repeatedly triggered by many large distant earthquakes, including the 2001 Mw7.8 Kunlun, 2003 Mw8.3 Tokachi-Oki, 2004 Mw9.2 Sumatra, 2008 Mw7.9 Wenchuan, 2010 Mw8.8 Chile, 2011 Mw9.0 Tohoku-Oki, and the 2012 Mw8.6 Sumatra earthquakes (Peng et al., 2010; Wu et al., 2011, 2012; Gong et al., 2013). These events generally produced dynamic stresses of at least 7 KPa, and both Love and Rayleigh waves are responsible of triggering microearthquakes. These triggered events occurred around the Fangshan pluton, which was formed during a dioritic intrusion more than 100 Ma ago.

To further understand the relationship between background and triggered earthquakes in this region, we have deployed an 11-station temporary seismic network between 12/2010 and 09/2011 (Figure 1). This deployment was fortunate because we recorded clear triggered microearthquakes during the 2011 Mw9.0 Tohoku-Oki earthquake. Preliminary analyses suggest that thousands of microearthquakes have occurred in this region, and their locations are close to those triggered earthquakes (Wang et al., 2012). However, we did not find any clear changes of seismic activity long before and after the Tohoku mainshock. We suggest that triggered earthquakes occurred at the weak boundary regions between the host rocks and the dioritic intrusion.

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