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## Seismic Activity around the Epicentral Region of the Mw 7.9 Wenchuan Earthquake

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On 05/12/2008, the Mw7.9 Wenchuan earthquake occurred along the Longmenshan Fault Zone that bound the Tibet Plateau and Sichuan Basin and ruptured ~300 km unilaterally from SW to NE (Xu et al., 2009). A better understanding of spatio-temporal evolutions of seismic activity around the epicentral region of the Wenchuan mainshock, especially right before, could help us to better understand the nucleation process of the large intraplate earthquakes. The Zipingpu Reservoir Seismic Network is in the immediate vicinity of the epicenter of the Wenchuan mainshock (Figure 1), which contains 7 seismic stations with RSFS 1-Hz short-period seismometer and RSDA data acquisition unit (100 sample/s). The existence of this seismic network provides a unique opportunity to examine the seismicity rate changes around the Wenchuan mainshock in details.

To identify potential events that were missing from local earthquake catalog, we apply the waveform-based matched filter technique to continuous recordings from 02/01/2008 to 05/12/2008. The procedure generally follows that of Peng and Zhao (2009) and Meng et al. (2013).

We use 3886 earthquakes listed in a hypoDD-relocated catalog as template events to scan through the continuous data. We first apply a 2-8 Hz bandpass filter of to both template and continuous waveforms and down-sample the data to 20 Hz. The correlation time window is set to be 1s before and 3s after S-wave arrival time and moves forward by one data point. Then, we stack the cross-correlation traces for all channels and get the mean cross-correlation trace. The threshold is set as the sum of the median value and 14 times the median absolute deviation (MAD) of the mean cross-correlation trace. We also estimate the magnitude of the detected events based on the median of all peak amplitude ratios between detected and template events.

In total, we detect 4803 events in ~3 months prior to

the Wenchuan mainshock (Figure 2). In comparison, the Zipingpu Reservoir Seismic Network catalog only has 268 earthquakes during the same period. The magnitudes of detected events range from -0.9 to 3.7. The most significant seismicity rate changes occurred on 02/14/2008, when several earthquake swarms occurred. The largest event during the earthquake swarms was a M3.7 normal faulting event based on the P-wave first motions. Prior to this M3.7 event, there was a 4-day long quiescent period when no event is detected. The swarm activities extended along NW-SE direction, which is normal to the Longmenshan Fault. The seismicity rate decayed back to background level ~4 days later and no significant change of seismicity rate are observed immediately before the mainshock. Our observations are in contrast to recent observations of accelerating/migration foreshock behaviors prior to the 1999 Mw7.6 Izmit earthquake (Bouchon et al., 2011) and the 2011 Mw9.1 Tohoku earthquake (Kato et al., 2012). This is consistent with a lack of accelerating foreshock behavior right before the 2010 Mw6.9 Yushu earthquake (Peng et al., 2013; this meeting), suggesting that the foreshocks or the inferred nucleation processes of large earthquakes are not always been observed for all mainshock sequences. Hence it is challenging to use them as possible warnings for upcoming large events.

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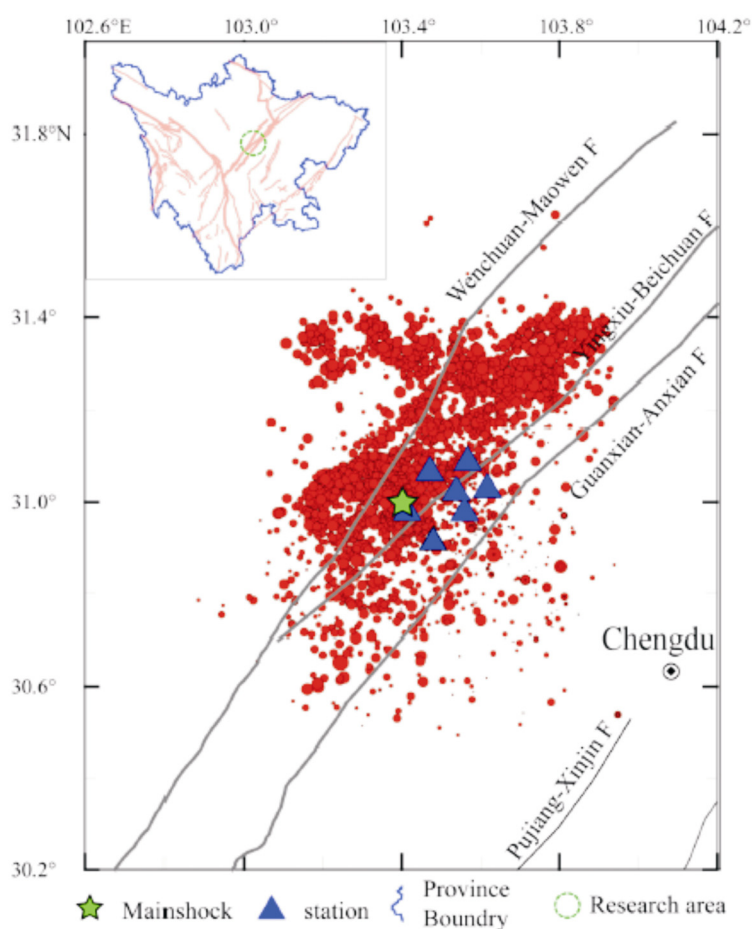


Fig. 1. Distribution of the Zipingpu reservoir seismic network and locations of template earthquakes

The red lines mark the active faults and the green star is the epicenter of the 2008 Mw7.9 Wenchuan earthquake. The inset mark the Sichuan province.

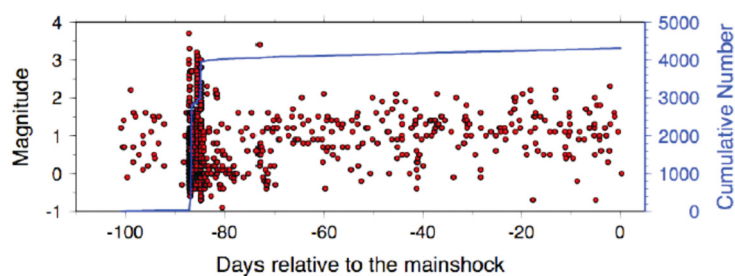


Fig. 2. Temporal evolutions of detected earthquakes about 100 days before the Wenchuan earthquake.

The red circles mark the magnitudes and occurrence times relative to the Wenchuan earthquake. The blue line marks the cumulative numbers.