

Temporal Changes of Seismicity before the 2008 Mw7.9 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. 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 (ZRSN) is in the immediate vicinity of the epicenter of the Wenchuan mainshock (Fig. 1), which provides a unique opportunity to examine the temporal changes of seismicity around the Wenchuan mainshock in details.

We have conducted a systematic study of seismic activity before the Wenchuan mainshock (Ruan et al., 2013). Specifically, we apply a waveform-based matched filter technique (Peng and Zhao, 2009) to detect potential missing earthquakes from 02/01/2008 to 05/12/2008. We use 3886 earthquakes listed in a hypoDD-relocated catalog as template events to scan through the continuous data recorded by the ZRSN. In total, we detect 4803 events in ~3 months prior to the Wenchuan mainshock, while only 268 events were listed in the ZRSN catalog during the same period (Fig. 2). 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

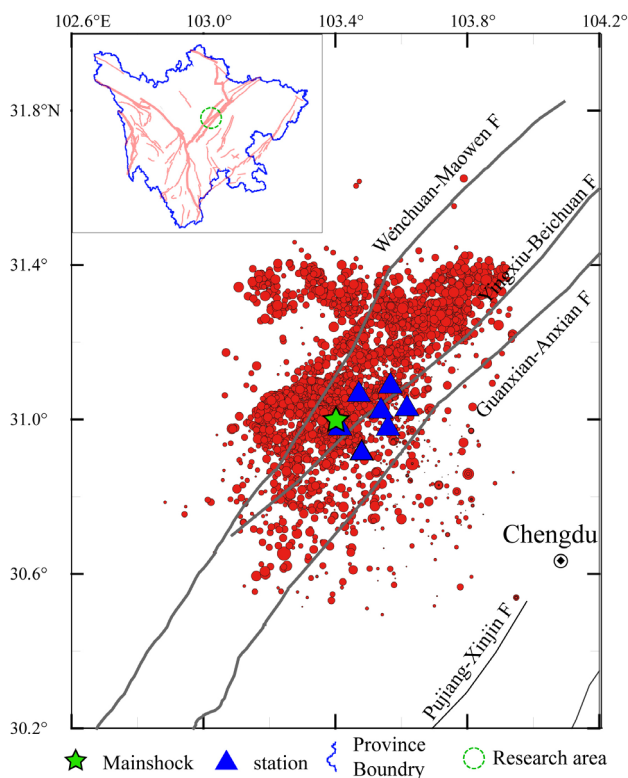


Fig. 1. Distribution of the Zipingpu reservoir seismic network and locations of template earthquakes. The red lines mark the active faults and the green star is the epicenter of the 2008 Mw7.9 Wenchuan earthquake.

The inset mark the Sichuan province to background level ~4 days later and no significant change of seismicity rate are observed immediately

before the mainshock.

10.1038/ngeo697.

References

Peng, Z., and P. Zhao* (2009), Migration of early aftershocks following the 2004 Parkfield earthquake, *Nature Geosci.*, 2, 877–881, doi:

Ruan, X., X. Meng, Z. Peng, and R. Xie (2013), Seismic activity around the epicentral region of the Mw7.9 Wenchuan earthquake, *Geophys. Res. Lett.*, in prep.

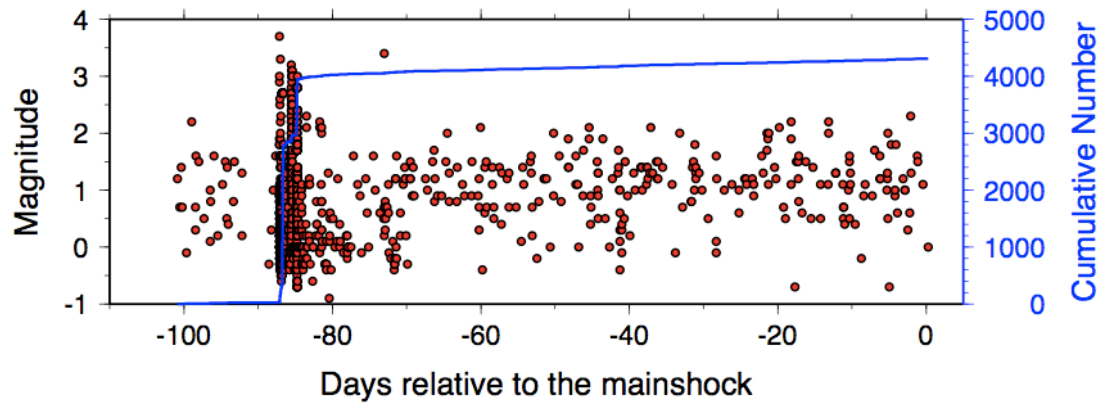


Fig. 2. Temporal evolutions of detected earthquakes about 100 days before the Wenchuan earthquake.

The red circles mark the magnitudes and occurrence times relative to the Wenchuan earthquake.

The blue line marks the cumulative numbers