

# The Coupling Evolution of Seismic Faults in the Eastern Margin of the Bayan Har Block Before and After Three $\geq$ M7.0 Earthquakes

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**Key words:** GNSS/GPS; 2008 M8.0 Wenchuan earthquake; 2013 M7.0 Lushan earthquake; 2017 M7.0 Jiuzhaigou earthquake; Fault coupling; Block movement

## SUMMARY

Since the 21st century, three  $\geq$ M7.0 earthquakes occurred in the eastern margin of the Bayan Har block, which are the 2008 M8.0 Wenchuan earthquake, the 2013 M7.0 Lushan earthquake in the Longmenshan fault (LMSF) and the 2017 M7.0 Jiuzhaigou earthquake in the Huya fault (HYF). It's very important to clarify the effects of these three earthquakes on the seismic faults' activities and the movement characteristics of the Longmenshan block for assessing the earthquake risk of this region. Nowadays, satellite geodesy technology for crustal deformation monitoring, like Global Navigation Satellite Systems (GNSS), provides effective data constraints for inter-seismic deformation study. Based on four periods GNSS observations, which are before and after the three earthquakes (1999-2007, 2011-2013, 2013-2017 and 2017-2021), we establish a 3-D block model of multi-faults system to invert the coupling evolution of the seismic faults, LMSF and HYF. The results indicate that: (1) Before the 2008 Wenchuan earthquake, the movement of the Longmenshan block was hindered. (2) After the 2008 Wenchuan earthquake, the movement of the Longmenshan block was significantly enhanced, which is represented that the dextral strike-slip rate of the LMSF increased from 1.5 mm/a to 10.0 mm/a and the sinistral strike-slip rate of the HYF increased from 0.5 mm/a to 5.9 mm/a. The ruptured segments of this earthquake (A2, A3) were decoupled completely and the fault coupling in unruptured segments (A1, A5, A6 and B4) increased. (3) After the 2013 Lushan earthquake, the ruptured segment of this earthquake (A5) was decoupled partly, while the ruptured segments of the 2008 Wenchuan earthquake (A2, A3) began to relock. Besides, the movement of the Longmenshan block was restricted with the velocity decreased from 16.3 mm/a to 13.0 mm/a, due to the fault coupling of these boundary faults. (4) After the 2017 Jiuzhaigou earthquake, the ruptured segment of this earthquake (B2) was decoupled. Meanwhile, the fault coupling in the ruptured segments of the first two earthquakes increased significantly, which lead to the gradually decreasing of the movement of the Longmenshan block. Finally, we inferred the segments of the LMSF (A1, A2, A4, A5 and A6) and the southern HYF (B4) have high seismic risks.

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