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The Active Fault Zones of the Eastern-boundary of the Sichuan-Yunnan Block, Southwestern China: Historical Earthquakes and Seismic Potential

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The eastern boundary of the Sichuan-Yunnan Block in southwestern China is made up of 5 active fault zones, the Xianshuihe, Anninghe, Zemuhe, Daliangshan and Xiaojiang faults, and has a total length of over 1200 kilometers. It is also one of the major active strike-slip fault systems on the southeastern Qinghai-Tibetan plateau. The present work introduces briefly the block-boundary fault zones mainly on the historical earthquake activity and seismic potential. The main points are as follows:

(1) The eastern boundary of the Sichuan-Yunnan Block is a very active fault zone tectonically, mainly shows left-lateral strike-slip faulting. The average left-lateral slip-rates have been estimated to be 10 to 12 mm/yr for the Xianshuihe fault zone, 5 to 7 mm/yr for the Anninghe and the Zemuhe fault zones, 2 to 3 mm/yr for the secondary branch, the Daliangshan fault zone, and 8 to 10mm/yr for the Xiaojiang fault zone.

(2) The block boundary is a highly active fault zone in seismicity too. At least 30 earthquakes of magnitude 6.5 or larger have occurred along the main fault zones in the last 300 to 500 years, and at least 14 of 30 have magnitudes between 7 and 8. It is suggested from the space-time patterns of historical ruptures that most segments of the main fault zone have had 2 or 3 recurrence cycles of characteristic earthquakes in the last 300 to 500 years, with different recurrence intervals varying from decades to hundreds of years.

(3) Along the main fault zone, 4 seismic gaps without rupturing of large earthquakes for long time have been identified from the space-time patterns of historical ruptures. They are located on the central portion of the Xianshuihe fault zone, the Anninghe fault zone between Shimain and Xichang, and the northern and southern portions of the Xiaojiang fault zone, respectively.

(4) An analysis of time-dependent seismic potential suggests that fault segments of the 4 seismic gaps have relatively high conditional probabilities for earthquakes occurring in the next 30 years. Among these 4 gaps, the two on the central Xianshuihe fault zone and on the Anninghe fault zone have shown fault planes being locked from distributions of seismicity parameters and relocated hypocenters of modern small earthquakes.