



Spatial Distribution of Seismicity Parameters in the Seismogenic Area before the 1988 Lancang-Gengma Earthquake in Yunnan Province, Southwestern China

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On Nov. 6, 1988, $M7.6$ and $M7.2$ earthquakes occurred in Lancang and Gengma counties, respectively, in Yunnan Province, southwestern China. The two quakes were separated only 0.4 units in magnitude, about 63 km in space and less than 13 minutes in time, and their aftershock areas were connected in space. All of these above features indicate that the 1988 Lancang-Gengma earthquake is a double-mainshock event. Using the seismic data for the period from Jan. 1, 1973 to Nov. 5, 1988, recorded by the Yunnan Regional Seismic Network, we calculated several seismicity parameters, including a and b values in the Gutenberg-Richard frequency-magnitude relationship, and the local recurrence intervals T_L in the seismogenic area and its surroundings. The primary goal is to reveal the stress state in the seismogenic area before the 1988 earthquake and further analyze why the two mainshocks occurred successively within very short time interval. Our main findings are as follows: (1) Before the 1988 Lancang-Gengma earthquake, the spatial distribution of each seismicity parameter was significantly heterogeneous in the Lancang-Gengma area. (2) In the seismogenic area of the Lancang $M7.6$ earthquake, there was anomalously low b -value much lower than the regional average about 0.81, relatively low a -value, and the shortest recurrence interval T_L , which implied that the Lancang area might be locked under high stress and more likely to generate major earthquakes. (3) From b -value distribution, the accumulated stress level in the Gengma seismogenic area was much lower than that in the Lancang area prior to the 1988 Lancang-Gengma earthquake, however, both the loaded dynamic and static stress from the Lancang $M7.6$ earthquake on the Gengma area were much higher than the triggered thresholds. Therefore, we infer that the Gengma $M7.2$ earthquake would be quickly triggered by the Lancang $M7.6$ earthquake. (4) The significant difference of stress level in the seismogenic area is the major factor for the first occurrence of the Lancang earthquake.