AOGS 2005

A Synthetic Seismicity Model for the Xianshuihe Fault, Southwestern China: A Simulation with a Rate- and State-Dependent Friction Law

NAOYUKI KATO[1], XINGLIN LEI[2] and XUEZE WEN[3]
[1]*Earthquake Research Institute, University of Tokyo, Tokyo, Japan*
[2]*Geological Survey of Japan, Tsukuba, Japan*
[3]*Earthquake Administration of Sichuan Province, Chengdu, China*

Many M7 class historical earthquakes were recorded for about 300 years along the 350km long Xianshuihe fault, southwestern China, which is located in the eastern margin area of the Tibetan plateau [1]. Left-lateral strike-slip rate of about 10 mm/yr along the fault was estimated from geologic and geodetic data. The historical earthquake data indicate that seismically active periods repeatedly occurred and the locations of the large earthquakes during an active period migrated. To understand the characteristics of historical seismicity and to obtain insight into seismic potential at seismic gaps, we perform a numerical simulation of slip behavior along the fault. The model fault is embedded in a thin elastic plate, and shear stress is imposed so that the long-term slip rates along the fault might be consistent with the geologic and geodetic slip rates. The frictional stress on the fault is assumed to obey a laboratory-derived rate- and state-dependent friction law [2]. To simulate segmented rupture behavior we introduce nonuniformity in friction parameters along the fault. The simulation results indicate that seismic rupture is arrested in the regions where the fault is bent or branched or the regions with velocity-strengthening frictional property. Simulated rupture often triggers another rupture in a neighboring segment with a time delay of several years, resulting in an active period of a duration of a few tens years. Two successive active periods of simulated earthquakes are separated by a quiet period of a duration of a few hundred years. These simulated seismic activity along the fault mimics historical earthquake records. Strictly, neither the time- nor the slip-predictable model can describe the simulated local slip history in each segment. The ratio of the standard deviation to the average value of the recurrence interval of simulated earthquakes is typically a few tens percent and is variable dependent on fault segments. These results are useful for the statistical evaluation of seismic potential along the fault.

References

[1] X. Z. Wen, *Proc First China-Japan Workshop on Earthquake Disaster Mitigation*, 141-154 (2002).
[2] N. Kato, *J. Geophys. Res.* **106**, 4221-4232 (2001).