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Quantitative Evaluation of Seismic Activity Around Active Faults and a General Seismicity Cycle of the Fault

KUNIHIKO WATANABE[1], SATOSHI ITABA[2], JAMES MORI[1], RYOHEI NISHIDA[3]

[1] *D. P. R. I., Kyoto-University*

[2] *Inst. Geology and Geoinformation, AIST*

[3] *Fac. Engineering, Tottori University*

Seismic activity is generally high along active faults. However, there is no successful method to evaluate seismic activity along the fault objectively and quantitatively. In this paper, we propose a simple method to achieve this purpose. The steps of procedure are as follows. For each surface fault trace, narrow encircled zones, Zi, are made on the surface by dividing the distance from the fault trace in fixed intervals (1km). For each Zi, the number of epicenters, Ni, is counted. Then, the density of earthquake number, DNi, can be expressed as DNi = Ni / (Si*p), where Si is the area of zone Zi, and p is the time interval of analysis. DNi generally decreases with distance from the fault. So, the distance at which DNi reaches the background level is defined as the fault influenced distance, FID. By dividing the total number of events inside FID by the area within FID and p, we can define the seismic activity of the fault, SAj, where j means the fault number. By evaluating SAj, the seismic activity of any fault in anywhere can be compared. We examined this method on the 98 major active faults in Japan and also on San Andreas Fault System. For both regions, FIDs are about 3 to 6 km. The seismic activities around strike slip faults are generally higher than those around dip slip ones. By synthesizing many SAj, we can suppose the whole figure of the fault by the following procedure. For each active fault, we know LT which is the time interval from the latest major earthquake occurred on the fault, and also RT which is the mean recurrence interval of big events for the fault. Then, the lapsed rate, LR, which is equal to LT/RT can be defined. LRj means the normalized lapsed time of j-th fault, and present seismic activity of the fault, SAj, can be expressed by a function of LRj. By plotting those SAj vs LRj for many faults, a whole figure of seismic cycle of the generalized active fault is drawn. From this figure, it can be seen that Omori's formula for aftershock activity holds good through whole cycle of the fault for some thousands of years. To know the whole figure of the generalized active fault may be useful for long-term earthquake prediction.