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DISCUSSION ON PROBLEM OF EARTHQUAKE REDUCTION*

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In 1968 Cornell and in 1977 Kiureghian developed a method of earthquake hazard analyses. But they had not considered mutual interactions between faults. In 1984, some seismologists of China developed a theory of reducing earthquake between faults. But the calculation formula of reduced distance is very complex. This paper proposed a simple formula for calculating the reduced distance and studied some influences of beginning point of fracture on determining the maximal magnitude by segmentation of seismogenic fault.

1.Simple formula for calculating the reduced distance

In the paper[3] reduced distance R between parallel faults is given by the following formula:

$$R=\frac{H}{1.17}\operatorname{ctg}\left(\frac{\pi}{2}\ \frac{100}{D}\right), \qquad (1)$$

$$D=10^{0.52M-1.25}。 \qquad (2)$$

where R is reduced distance, D is dislocation offset, M is magnitude, H is depth of earthquake source fault plane.

Substituding(2) into(1), the formula is given by the following:

$$R=\frac{H}{1.17}\operatorname{ctg}\left(\frac{\pi}{2}10^{3.25-0.52M}\right)。 \qquad (3)$$

If H=20km, the reduced distances which correspond to various magnitude are shown in table 1:

Table 1

M	8.5	8	7.5	7.0
R(km)	160	90	50	25

However, the formula (3) is not convenient for calculation. We proposed a simple formula for calculating the reduced distance R stead of formula(3):

$$\log R=0.48M-1.87。 \qquad (4)$$

From the formula(4), we obtained the reduced distance R given

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in table 2.

Table 2

M	8.5	8	7.5	7
R(km)	162	93	54	31

Comparing the above table 1 with the table 2, we found them are almost the same. According to our statistics, earthquakes with magnitude of 6—6.5 may occur within the reduced distance for 100 years, but to occur bigger earthquakes is impossible.

2. Relation between the beginning point of fracture and the segmentation of seismogenic fault

In 1965, the Northwestern Earthquake Expedition of Academy of China began to use segmentation of seismogenic fault to predict magnitude of future earthquake and proposed a formula between magnitude M and segmented length L as follows:

$$M=3.3+2.1\log L \qquad (5)$$

where L is in unit of km.

In the recent years, it is emphasized touse segmentation to estimate the future earthquake magitude. We consider the segmentation may be classified into two kinds, one is relative, other is absolute. The relative segmentation has such a stopping point of fracture which only resist tensile transmission, but do not resist pressure transmission (Fig. 1).

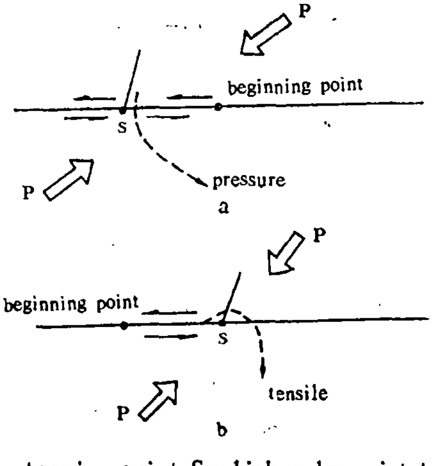

Fig. 1　Relative stopping point S which only resist tensile transmission(b) and do not resist pressure transmission(a)

We called this stopping point relative one. The absolute segmentation has such a absolute stopping points which not only resiste tensile transmission, but also resist pressure transmission (Fig.2).

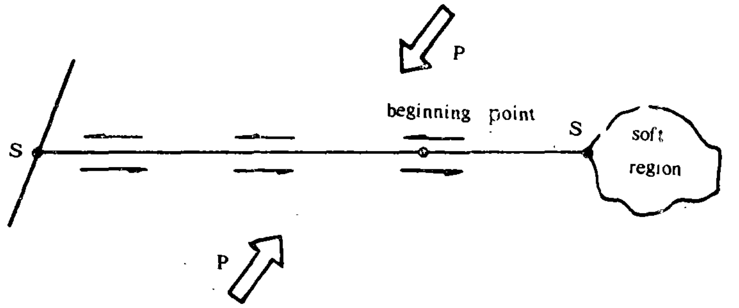

Fig. 2 Absolute stopping point S which can resist both pressure and tensile

In Fig.3, A, B are absolute stopping points, C, D are relative stopping points, P is direction of regional principal pressure stress. If the beginning point of fracture is located in the segment AC, point 1, C may be regards as a relative stopping point. In this case the segment AC corresponds an earthquake with magnitude as follows:

$$M = 3.3 + 2.1\log(AC) \qquad (6)$$

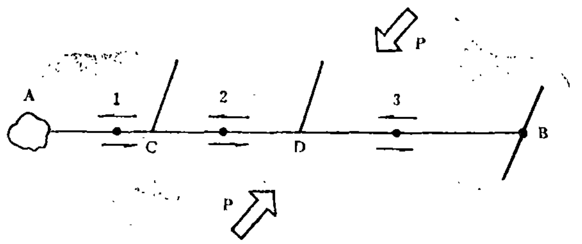

Fig. 3 Relative and absolute stopping point

If beginning points of fracture are located on point 2 or point 3, respectively, we obtained the following magnitudes:

$$M = 3.3 + 2.1\log(AD); \qquad (7)$$

$$M = 3.3 + 2.1\log(AB)。 \qquad (8)$$

Supposing that in the total segment AB (Fig.3), the probability of appearing beginning point of fracture is the same, and supposing in the segment AB there must be a beginning point to appear, we got the probability corrsponding to those magnitudes which are determined by the formula (6), (7) and (8) respectively as follows:

$$P_1 = \frac{AC}{AB}, \qquad (9)$$

$$P_2 = \frac{CD}{AB}, \qquad (10)$$

$$P_3 = \frac{DB}{AB}。 \qquad (11)$$

If we want to know the seismic intensity on a point inside of A, B in Fig. 3, we should take into account of the above-mentioned magnitudes and their probabilities. Our discussion means, it is should to be careful to use segmentation for estimating maximal magnitude and must consider location of the beginning point of fracture and direction of the regional principal pressure stress.

Reference

〔1〕C. A. Cornell, Engineering seismic risk analysis, BSSA, Vol.58, PP.1583—1606, 1968.

〔2〕A. Der. Kiureghian and A. H—S. Ang, A fault rupture model for seismic risk analysis, BSSA., Vol.76, No. 4, 1977.

〔3〕Guo Zengjian and Qin Baoyan, Repeatition of strong earthquake and reduction of seismic risk, Northwestern Seismological Journal, Vol. 6, No. 4, 1984.

〔4〕Guo Zengjian, Qin Baoyan and Yao Lanyu, Discussion on earthquake prediction and some anti—seismic problems from Songpan strong earthquake in 1976, Proceedings of the Euro—China Joint Seminar on Earthquake Engineering, PP. 5—58, 1986.