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Real-time fault area location of a massive scale earthquake-Wenchuan Earthquake-

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1. Introduction It's difficult to estimate accurate tsunami heights at a time of a massive earthquake occurrence, since obtained magnitude by Japan meteorological agency are always less than the moment magnitude due to the problem of so-called Magnitude saturation. The Earthquake early warning uses a model of a point source to calculate seismic intensity, causing estimated intensities less than actual ones. Using data of real-time seismic intensity of every one seconds, Horiuchi et al. (2011) developed a method to determine time-and space distribution of fault area of the 2011 Off the Pacific coast of Tohoku Earthquake, and pointed out that these issues can be solved.

In 2008, a massive earthquake of M7.9 with a 280km fault length jolted Wenchuan County of Southwest China's Sichuan province. An estimated number of 80,000 people were found dead or missing in this catastrophic disaster. The length of the fault was so long that beyond the faulting, the destructive shake started 10 seconds after the initiation of the faulting. The development of the real-time location of fault area distribution will help people to effectively escape from the disaster in time, and it would also lighten the predicted damage. The report applied the Horiuchi etc. method to the Sichuan Wenchuan earthquake. An improvement to this method was made to make sure that it would be applicable in China.

2. Real-time location of fault area distribution Shi and Midorikawa(1999), Matsuzaki et al.(2006), showed that the seismic intensity is represented by the function of shortest distance from the seismic fault and determined empirical formulas. Shaking intensity by the empirical attenuation relation is put as,

$$S = S(M,D,H,C) \quad (1)$$

where, D, H, and C are magnitude, fault distance, depth and site amplification. Assuming S of eq. (1) to be measured seismic intensity of every one seconds, time function of fault distance is

$$D(t) = D(S(t),M,H,C) \quad (2)$$

Present study, similar with that of Horiuchi et al., determines real-time distribution of fault area by using equation (2) and projecting them onto the line connecting the epicenter and the observation point. We projected them only when calculated seismic intensities by the empirical attention are larger than the observed intensity.

3. Result Obtained direction of the fault is consistent with the result of the aftershock distribution or the results of waveform inversion when using the Shi and Midorikawa (1999)'s empirical equation, but the length of the fault was approximately doubled. The reason is caused by the data of large seismic intensities in a region 200km-500km northeast from the northeastern edge of the fault. There, empirical attenuation relation was changed for Chinese Mainland and was re-calculated. The source region of the results obtained the present study is in good agreement with the results estimated by data of aftershock distribution.

Since the present method is simple and can estimate nearly correct real-time distribution of fault, it can be used for an EEW system in China, which can provide information to eventually mitigate earthquake disaster at a time of a massive scale earthquake.

Keywords: Massive earthquake, Fault area, Real-time estimation, Fault, Seismic intensity, Empirical attenuation relation