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Relationships between building damage and characteristics of strong ground motions during the M6.5 Zhaotong Earthquake-2

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On 3 August 2014, an Ms6.5 earthquake occurred at the Longtouchan town located on the northeast side of the Yunnan province of China. As of 8 August 2014, 617 persons were killed by this earthquake, in which almost 85% (526 persons) of the death happened in the Longtoushan town. During this earthquake, the strongest peak acceleration of 949 gal was measured in the Loungtouchan station (LLT station). The observed record at the station also had two impulsive waves (figure (b)). Explication of generation mechanism of the large acceleration is needed to clear the relationship between seismic ground motion and damage. In this study, we construct the strong motion generation area (SMGA) as the short-period source model of this earthquake using the strong-motion records, and elucidate generation mechanism of the large acceleration.

The aftershock distribution of this earthquake is shown in Figure (a). Two possible fault planes from the distribution are considered to be southeast ? northwest (plane A) and southwest ? northeast (plane B).

Most of building damge and landslide disasters were along the plane A. On the other hands, although the slip distribution on each plane was inverted by the teleseismic data, we do not understand which plane is better from the results.

Therefore, we try to estimate the short-period source model using the empirical Green's function method. In the first trial, we did not use the LLT station's data too close to the source fault because the rupture plane is not clear. The earthquake information about the hypocenter of the mainshock and aftershocks is not enough todetermine the rupture planes correctly. Thenre, the seismic moment of the element event used as the empirical Green's function is calculated from magnitude, and the seismic mechanism of the element event is assumed to the same as the mainshock. The scaling parameters N and C are determined for SMGA from the observed source spectral ratio between the mainshock and the element event.

The synthetic ground motions explain well the characteristics of observed ground motions for either plane. The area and stress drop of the SMGA were about 100km2 and about 10 MPa, respectively. However, we do not understandwhich plane is better.

Next, we discussed the arrival direction of seismic waves by the particle motion diagrams of the two pulsive waves using the observed record at LLT station.

The NS and EW particle motion of P-waves in the horizontal plane oscillate in northwest-southeast direction. Namely, the azimuth of the starting point of fault rupture is assumed to be northwest direction (Fig(c) left figure).

Similarly, the particle motion diagrams of the first pulse and second pulse of S-wave oscillate in northwest-southeast and northeast-southwest direction, respectively. If these pulses mainly consist of SH wave, the propagation directions from those two pulses seem to be different. As a result, the first and second pulses are assumed to be generated from plane A and plane B, respectively to satisfy the relation between the aftershock distribution and the location of observation station (LLT).

Hereafter, we try to estimate the strong-motion generation areas using LLT station's record.

Keywords: Zhaotong Earthquake, large acceleration, strong-motion generation area

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