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BIAS CORRECTION OF SHAKEMAPS FOR ACCELERATION BASED ON LIMITED RECORDS

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Introduction

In shakemap work quickly after earthquake, errors of the earthquake magnitude for quick report and not considering types of causative fault in Ground motion prediction equation (GMPE) may produce systematic bias in estimation of Ground motion parameter in China. We want to using limited station data obtained and GMPE to correct the systematic bias of estimates in the region without stations.

Method

Firstly, the actual observations of stations are converted to the value on bedrock with considering local site effect. We think that value on bedrock for observations outside ±3-times standard deviation of local ground motion attenuation relations is abnormal. Then the deviation factor between normal observed data and calculated values on bedrock can be acquired by logarithmic linear least squares fitting. Finally, we use this deviation factor to correct estimates in the region without stations. By analyzing residuals between the observed data and calculated values, we proposed a method of logarithmic deviation correction for theoretical estimates in regions lacking seismic observation.

Application

Strong motion data during April 10, 2011, Luhuo, Sichuan province, China MS5.3 earthquake (100.9°E，31.3°N) is shown in the following table 1（China Strong Motion Networks Centre，2011）. Ground motion prediction equation in this paper is that of Wang SY in 2000 for peak ground acceleration, Hereinafter referred to as Wang2000. According to the moment tensor solution of Institute of Geophysics, China Earthquake Administration, and distribution of active faults, orientation for long axis of elliptical attenuation model in Luhuo earthquake were determinate as 330 ° and 290 °.

Table 1. Strong motion data during April 10, 2011, Luhuo earthquake (MS5.3)

Name	Long/° E	Lat/° N	EW PGA/10^{-2}m.s^{-2}	NS PGA/10^{-2}m.s^{-2}
DFBM	101.5	30.49	-9.329	-10.385
LHDB	100.7	31.39	-359.863	261.657
LHZY	100.8	31.3	246.168	-249.002
LHYD	100.6	31.47	143.152	130.375
LHDD	100.4	31.55	21.623	28.530
LHZW	100.3	31.64	13.847	-10.148
GZDB	99.99	31.63	-8.787	-5.845
DFZY	101.1	30.99	42.092	-11.171

As shown in Figure 1, the system deviation really exists between the calculated values from Wang2000 and observations. Results of Wang2000 are systematically less than the observation value.

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And residuals between the calculated values from Wang2000 and observed values on bedrock are greater than that of the logarithmic deviation correction. Residuals of the logarithmic deviation correction are evenly distributed in the vicinity of the 0 axis.

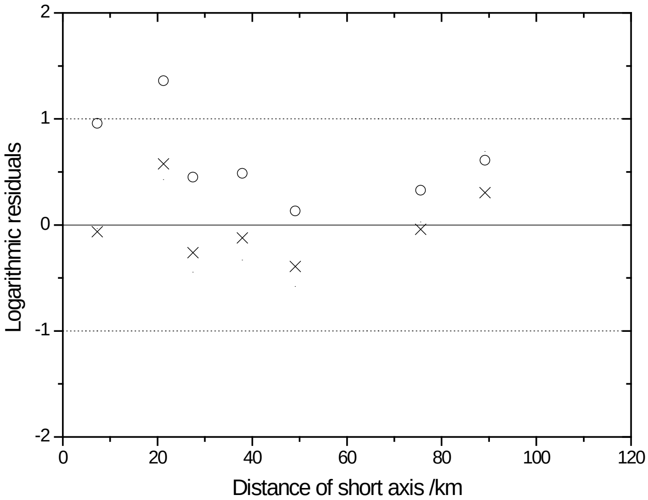

Figure 1. Logarithmic residuals between observed values and estimated values on bedrock for Luhuo earthquake， distance of short axis is distance between station and epicentre rotated toward short axis direction on the same ellipse

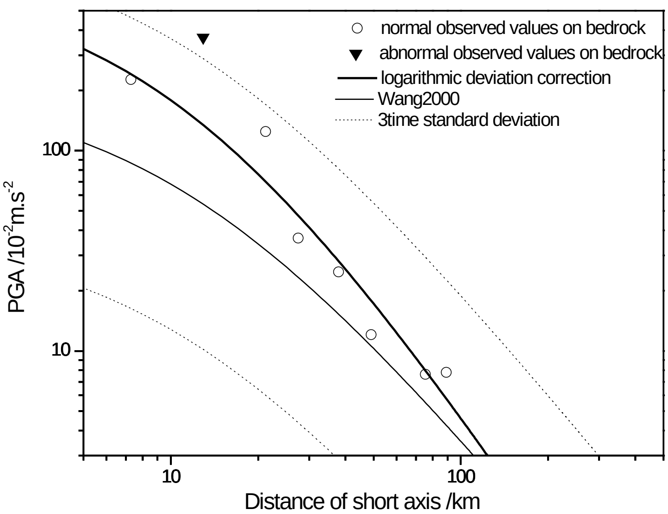

Figure 2. Comparison of the results from different methods for Luhuo earthquakes, distance of short axis is same as Figure 1.

Figure 2 shows that results of the logarithmic deviation correction are closer to actual observed values than that of Wang2000.

İn conclusion, the method of logarithmic deviation correction is suitable for systematic error correction of theoretical estimates of ground motion parameters during rapid report of ground motion intensity..

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