Source Parameters of Historical Earthquakes in North China Retrieved From Macroseimic Intensity Data

Li Yingchun[1,2] * and Wu Zhongliang[1]

[1]*Institute of Geophysics, China Earthquake Administration, Beijing 10081,China*
[2]*Earthquake Administration of Jiangsu Province, Nanjing 210014, China*

China is a country with high seismicity and has accumulated vast collections of historical documents about destructive earthquakes. These historical records are of unique value for studies on historical earthquakes, because there were no instrumental recordings when these earthquakes occurred. We collected and digitized macroseismic intensity data from several published literatures, for determining the source parameters of earthquakes in north China since five centuries ago. The isoseismals of most of these earthquakes have the form of Shebalin-Chen ellipse, providing information for constraining some of the parameters of earthquakes. We developed a trial-and-error Matlab-based interactive program to determine earthquake depth, fault plane strike, dip, fault length and fault width by comparing the calculated isoseismals and recorded ones. We also compared the Shebalin-Chen method and the Pettenati-Sirovich method, with reference to some modern earthquakes such as the 2008 Wenchuan earthquake, and the new results of strong ground motion studies, arguing that lack of data samples may not be the principal reason for the isoseismals to be apparently elliptic. Using this method, we determined the source parameters of 27 earthquakes using the Shebalin-Chen method, and of 36 earthquakes using the Pettenati-Sirovich method. For earthquakes after 1965, earthquake source parameters such determined agree with the results from instrumental seismology, providing the inversion approach with calibrating information. From the results for all the earthquakes with M≥6½ since the recent half millennium, Shanxi graben and North China plain show apparently different features. To make our results repeatable, a set of electronic products is provided online (http://www.bjsn-igp.cn/), with a database, an interactive program with source code available, and a dataset of preliminary results.

Keywords: Historical earthquake; North China; Earthquake intensity; Isoseismal; Earthquake source parameter.

*Contact Info：li_ying_chun@yahoo.com