Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SSS025-P01 Room: Convention Hall Time: May 25 17:15-18:45

Attenuation Model and Its Application in Estimating the Earthquake Location and Magnitude

Baoping Shi[1*], Gan Ma[1], Yang Zhang[1]

[1]Graduate University of CAS

With an adopted technique proposed by Bakun and Wentworth in 1997 for bounding historical earthquake epicentral and magnitude from historical intensity data, we have developed earthquake intensity model used to estimate historical earthquake location and magnitude. This technique is quantitative and particularly appropriate for historical earthquakes which have few intensity data or occurred near offshore. In this study, we focused our study region in Southwestern-China (Sichuan and Yunnan Provinces) in which there have been a lot of moderate or large historical and modern earthquakes occurred since last a few centuries. First, 14 earthquakes, including the 2008 great Wenchuan earthquake, with modern instrumental records ranging from the magnitudes of Ms 5.8 to 8.0 in this region were used to develop intensity magnitude epicentral distance attenuation relationship and the intensity magnitude MI is calibrated to Ms, the surface wave's magnitude. The intensity attenuation relation is In = -5.38 + 1.91M ? 0.0173*D_{median}or In = -4.29 + 2.06M ? 2.1933*$\log_{10}D_{median}$and predicts that, with the same earthquake magnitude, the intensity decrease rate with distance in this region is about 70 percent of predicted from California intensity attenuation model which was developed by Bakun and Wentworth. Based on the intensity attenuation model, we have proposed the Grid Searching of Trial Source Location (GSTSL) method for estimating earthquake magnitude and bounding epicentral region from the calculation of confidence value of rms[MI]=rms(MI-Mi)-rms0(MI-Mi) and the contours of MI=mean(Mi), where rms is the root means square, rms0(MI-Mi) is the minimum rms over a grid of assumed epicenter, and Mi (i=1, 2, 3, ...) are the discrete values derived from the intensity attenuation model. Furthermore, we have discussed the size effect of b-value, a parameter used in Wi of weight function in order to precisely compute rms[MI], on the closure of rms[MI] contours. Finally, in order to demonstrate the technical strategy we have developed in estimating historical earthquake magnitude and bounding its epicentral region, four typical earthquakes are used in our analysis, which include 1786 KangDing event, 1850 XiChang event, 1913 EShan event and 1970 TongHai event. The results show that, by minimizing earthquake magnitude within the 90 percent confidence region of rms[MI], the corresponding intensity magnitudes of MI are 8.1, 7.6, 7.0 and 7.6, respectively. It needs to point out that the technique we have developed here also can be used for bounding the epicentral region and earthquake magnitude in other regions with abundant historical earthquake documents in China.

Keywords: seismic intensity, magintude, epicenter, attenuation