A NUMERICAL STUDY OF THE ATTENUATION OF HIGH FREQUENCY LG WAVES IN THE NEW MADRID SEISMIC REGION

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Any study of seismic risk in regions of seismic activity must take into account the rate of attenuation of seismic energy with distance. Since frequencies of damaging ground motion usually lie between 1 and 10 Hz, a study of the attenuation of seismic waves in this frequency range is important. This study uses a numerical least squares method to determine a value for the coefficient of anelastic attenuation for Lg waves, using both broadband and narrow-bandpass filtered time domain data.

In order to measure the attenuation rate of 1-Hz Lg waves, amplitude data were taken from stations of the World Wide Standard Seismograph Network and the Seismological Service of Canada. For 1-Hz Lg waves, our method yields a Q-value of 816 ($690 < Q < 997$) using 14 events from the southeastern United States, and a Q value of 1248 ($997 < Q < 1795$) using 6 events from the central United States. For measuring the attenuation of 10-Hz Lg waves, we used 10-Hz Lg amplitude data from 69 events in the New Madrid seismic region, recorded by stations of the Southeast Missouri Regional Seismic Network. For these data we obtain a Q-value of 3095 ($2307 < Q < 4724$), larger than that of the 1-Hz waves.

In order to try to determine Q-values for a range of frequencies between 1 and 10 Hz we again used data from the New Madrid region, this time narrow-bandpass filtered at various frequencies. The results using these data also indicate a

frequency dependence for Q. The numerical values obtained from these narrow-bandpass filtered data, however, are subject to much uncertainty, as they were obtained over a range of relatively small epicentral distances for which the effects of anelastic attenuation are not pronounced. Thus small errors in data at these distances can cause large errors in calculated Q-values. We therefore made a study of the distance range and number of events necessary for a credible Q-value. This study indicates that our results for the high frequency filtered data are more reliable than those for the low frequency filtered data.

Besides determining the attenuation rate at a given frequency, our method also yields source amplitude values for each of the events used. We can use the source amplitudes measured at each of the different frequencies to construct a source spectrum for an event, from which seismic moment may be obtained. Reasonable values of seismic moment versus m_b magnitude have been obtained in this study using this method.