SOURCE AND GROUND MOTION STUDIES OF THE JANUARY 23, 1993 HUALIEN EARTHQUAKE

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ABSTRACT

One of the purposes of ground motion studies is to learn to predict strong ground motion generated by a large earthquake. Using the CWB strong motion database,we shall be able to systematically test ways of ground motion prediction using various methods. In this paper we study the records of a moderate earthquake which has a relatively simple time function and a small source dimension. We shall try to simulate the ground motions at various distances using the source determined by other methods and layered half-space synthetics.

The earthquake in question occurred near Hualien on January 23,1993 at UT, with ML of 5.6, mb 5.3 (USGS) and Ms 5.3 (USGS). This event was well recorded by the CWB strong motion stations in Taipei, Hualien and Ilan,by the CWB telemetered network, and it is also recorded by many Global Seismic Network and other digital stations in Asia. In this study we first determine the moment tensor of the earthquake using global data. By using a technique developed recently by Salzberg and Wu (1994), we were able to derive the moment tensor for the source. It is interesting that this moment tensor agrees quite well with a near field inversion result of Huang (1993, personal communication) and the double couple mechanism derived from this moment tensor is consistent with a mechanism by Cheng(1993, personal communication) using CWB telemetered network data.

The peak horizontal accelerations within the Taipei basin vary by a factor of 4, with the lowest value about 3.5 gal and highest about 15gal. The source being more than 100 km away, it is interesting to see how we can approach the problem of ground motion prediction with relatively simple theoretical calculations for this relatively small earthquake. One wishes to see what role do crustal structures and properties affect strong ground motion.

We use the frequency-wave number integration technique (Barker, 1983) to compute synthetics for this distance range. The initial structure has a simple 2-layer crust, with Qp and Qs on the order of 1000 and 500, respectively. With

the moment of the source fixed by results of source inversion, we successively decrease the Q's to render the acceleration to be in the general range of the observed values. We found that a Qp and a Qs in the range of 150 and 60, respectively satisfy that criterium. We then add layers on top of the structure in order to account for the local amplification. We hope to gradually unravel all the factors that affect the ground motion using records of moderate earthquakes and thus will be able to predict better ground motion from large earthquakes.