Determination on the Dynamic Source Parameters of an Earthquake from Kinematic Parameters

Wenbo Zhang[1]

[1] Disas. Prev. Res. Inst., Kyoto Univ.

In this paper, we use an effective method suggested by Chen, X.F. and K. Aki (1996) to determine the dynamic source parameters of an earthquake (i.e., stress drop and strength distribution) from the known kinematic source parameters obtained by the previous source inversion studies. This method is simple, straightforward and accurate, and needs much less calculations. We apply this approach to the 2000 Tottori-Ken Seibu Earthquake, and try to get the dynamic source parameters of this event.

Seismic source parameters play an important role in studying the seismic source process, strong motion simulation and earthquake prediction, etc. particularly the reconstruction of dynamic source parameters (e.g. dynamic stress strop and strength) is very useful in understanding the complex faulting process. Until now, most of studies on seismic source modeling are based on kinematic fault models and do not involve dynamic faulting mechanisms. In kinematic models, forces or stresses are not considered fundamental quantities; the solutions depend on predetermined source functions. These functions usually are assumed to be uniform over the fault plane. These assumptions maybe do not satisfy the stress-strain condition on the fault plane. So, the results obtained from kinematic models may violate the stress-strain conditions and may even be physically unreasonable. In order to understand the physical processes actually occurring in the source region, we must study the stress-dependent material properties. That is, we should examine the way in which material failure nucleates and spreads (e.g., over a fault plane), rapidly relieving stresses that had slowly risen to exceed the strength of material in the source region. This is a dynamic problem, and a very difficult one (Aki and Richards, 1980). In this paper, we use an effect method to determine the seismic dynamic source parameters (i.e., stress drop and strength distribution) from the previous kinematic source inversion. Using the seismic source representation theorem to calculate the dynamic stress field on a fault plane from the known kinematic parameters (i.e., slip distribution and rupture time distribution on the faults plane). Then determine the strength of the fault defined as the peak stress just before the rupture. This method is simple, straightforward and accurate, and needs much less calculation. It can be used for a comparative study of large data sets in exploring the dynamic source process. We apply this approach to the 2000 Tottori-Ken Seibu Earthquake, and investigate the dynamic source parameters of this event.