

Source time function archive of deep earthquake: re-examination of hierarchy source model

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Rupture evolution process to large earthquake from its initiation is still hot topics in seismology. Many analysis and seismograms of major earthquakes show complexity of source process resulting from heterogeneous slip distribution on source fault and its time history. Smaller earthquake generally shows apparent simple rupture process. As one model to explain source evolution and size relation for smaller and large earthquake, hierarchy model was proposed (e.g. Fukao and Furumoto, 1985). In this study, we review last 20 years broadband seismograms excited by world-wide deep earthquakes and re-evaluate evolution model of rupture process.

Moment rate function of large size earthquake generally shows complexity of rupture process. As for shallow earthquake, body wave inversion are required including realistic earth's shallow structure model to get source time function. Meanwhile moment rate function of deep earthquake is obtained relative easily and stably using P-wave form. By global seismic network, world-wide deep earthquakes are recorded in homogenous sensitivity and station coverage.

From earthquake catalogue, recent 20 years deep seismic events are searched and applied grouping in hypocenters' area. From our broadband seismogram data base, we archived P wave waveforms that their magnitude is greater than 4.5. According to attenuation of seismic wave, source duration time of less than 2sec is undetectable. Source time functions of magnitude 5 class events are simple pulse functions. Around magnitude 6 to 6.5 events show also pulse shape function with significant width. Larger quakes than magnitude 6.6 have multiple functions in general and sometimes preceding to initial rupture process. Based on hierarchy model, it seems that an earthquake size locates on step between two hierarchy levels.

Earthquake catalogue shows that each area has apparent magnitude gap in its seismic activity. Now we have searched only last 20 years data, so that final conclusion should be done carefully. However the gap coincides with hierarchy step in some area and the magnitude gap may depend on area in this study. The regionality may be one of parameters that characterize deeply subducting plate, e,g, characteristic scale of heterogeneity in/on plate and occurrence potential of deep earthquake.

Keywords: deep earthquake, source time function, hierarchy model