Precise Data Analyses toward the Update of Earthquake Source Spectral Model

*Takahiko Uchide[1], Kazutoshi Imanishi[1]

1. Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology (AIST)

Earthquake source spectra are useful for simplifying, generalizing and differentiating properties of earthquakes rupture process. The standard model for source spectra is the ω^2-model, in which the spectrum is flat at lower frequencies and decays as inversely proportional to the square of frequencies at high frequencies. The low and high frequency bands are bordered by the corner frequency, which is used for estimating stress drop under an assumption of a circular crack model.

One of the methods to improve the resolution of earthquake source spectra is the multiple spectral ratio analysis method [*Uchide and Imanishi*, BSSA, 2016], in which we employ multiple empirical Green's functions (EGF) to cancel the path and site effects as well as errors due to the differences in source locations and focal mechanisms of a target and EGF events. They applied this method to small earthquakes (M_w 3.2 –4.0) in Fukushima Hamadori and northern Ibaraki prefecture areas and found that the source spectra are well approximated by the ω^2-model with bumps for some earthquakes, whereas for some other earthquakes the ω^2-model fits very well. Then number of questions arise. Is this universal or only in this area? What is the physical meaning of bumps? What is the simple and inclusive model for earthquake source spectra?

In this study, we examined small inland earthquakes in Japan by the same method. The study area includes following areas: Kumamoto, where many of small earthquakes are preceded by the 2016 Kumamoto earthquake (M_w 7.0); Wakayama, where the seismicity is constantly active. The result indicated that the findings of *Uchide and Imanishi* [2016] are also the case in other areas.

The ω^2-model with a bump around the corner frequency can be described as a double-corner-frequency model, while that with a bump at frequencies higher than the corner frequency can be that with a steeper slope at high frequencies. In the case of a double-corner-frequency model, the lower corner frequency will correspond to the source duration. Since the lower corner frequency will be generally smaller than the corner frequency in case of the single-corner-frequency model, such as the ω^2-model, the double-corner-frequency model will give us a longer source duration and then lower stress drop.

Then what will the higher corner frequency represent? To answer this question, we need investigate the scaling relationship of two corner frequencies and the source process in detail, which are left as future work.

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