# Source Parameter Scaling of Recent M7-class Inland Earthquake Sequences in Japan (2)

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1. Introduction

Recently, several M7-class inland crustal earthquakes have occurred in Japan. In this study, we determine source parameters from strong motion records to distinguish source spectral characteristics of those sequences, and investigate their source scaling relationships for the seismic moment. Based on these scaling relationships we study differences between the scaling relationships for those sequences.

2. Method

The source spectral ratio fitting method (e.g. Miyake *et al*.,1999) gives estimation of the corner frequency objectively. This method can remove propagation path and site effects from the observed spectrum using the spectral ratio of two events which have the similar mechanisms and have the hypocenter locations close to each other. The corner frequency is estimated by fitting the theoretical source spectral ratio function (SSRF) that obeys the omega-squared source spectral model of Brune (1970) to the observed spectral ratio. In this study, we fix the moment ratio that is derived from the seismic moments estimated by F-net. Somei *et al*. (2008) has applied this method using the mainshock as the reference event. While it is reasonable to select the mainshock as the reference event because its waveforms observed widely, it should be considered with the difference of the path effects and the sizes of rupture areas between the mainshock and aftershocks. In this study, we use the larger aftershocks as the reference events for the spectral ratio estimation. Based on the determined corner frequency ($f_c$) from this method and seismic moment ($M_0$) that is derived from F-net, we study the scaling relationship between those parameters. Following to Eshelby(1957) and Brune (1970,1971), we estimate the stress drop of each event, and study these spatial characteristics in the sequence.

3. Results

Here, we focus on the 2008 Iwate-Miyagi Nairiku Earthquake sequence. We use the acceleration waveform data recorded at the KiK-net (downhole) stations. We window the 20s records beginning from 1s before the S-wave arrival, and calculate the vector sum of three component amplitude spectra. The spectral ratio for each station is given by the amplitude spectra from two events, and the observed spectral ratio is log averaged from the results of 6 stations. The observed spectral ratios using the larger aftershocks ($M_w$ 4.9-5.5) as the reference events have smaller standard deviations than those using the mainshock ($M_w$ 6.9). They explain to the omega-square source spectral model well. Corner frequencies for 47 aftershocks ($M_w$ 3.5-5.5) including the reference events are determined. The obtained $f_c$ tends to be in inverse correlation to $M_0$, and the $M_0$-$f_c$ relationship shows the significant variation in the locations of aftershocks. Aftershocks occurring in the northern part of the source region have higher corner frequency relative to those in the other part for the similar seismic moment. The obtained stress drop values of aftershocks occurring in the northern part of the mainshock fault are 0.68-8.7 MPa, while those values for the others are 0.04-1.2 MPa. This variation is significantly larger than the perturbation of the S-wave velocity and rupture velocity those are used to estimate the stress drops. In the northern part of the mainshock fault, the slip amount of the mainshock is small (e.g. Asano and Iwata, 2008). Thus, we could suppose that aftershocks which occur in the smaller slip area or in the no slip area of the mainshock have larger stress drops.

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