Estimation of SMGA source model during the 2018 Hokkaido Eastern Iburi (Mw6.6) earthquake

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1. Introduction

The 2018 Hokkaido Eastern Iburi earthquake (Mw6.6, depth: 37km) occurred in the western Iburi region of Hokkaido, Japan, on September 6, 2018. The maximum seismic intensity with 7 was observed at Atsuma-cho. PGA of 1796 gal is observed at the HKD127(Oiwake) staion. Strong motions during this earthquake were widely observed, because the source depth was deep. We estimated the SMGA source model by comparing the synthetic and observed ground motions from the 2018 Hokkaido Eastern Iburi earthquake.
The observed records of this earthquake have some specific features. The observed ground motion at HKD126 station located in south of hypocenter has pulse-wave with maximum velocity of 158 cm/s. The observed record at HKD127 station located in north of hypocenter has three wave-packets. Observed ground motions at other stations also show three-wacepackets. Then, we estimated the SMGA source model considering these features seen in the observed records.

2. Estimation of the SMGA source model using empirical Green’ s function method

We constructed a characterized source model with SMGAs based on the slip distribution model inverted by Japan Meteorological Agency (2018). The source model of JMA. (2018) consists of one segment fault plane.
The EGF events whose records are used as the EGFs are selected to have hypocenters close to the SMGAs with almost the same radiation characteristics as the target events. We selected the records of an aftershock (Mw 4.3) as the empirical Green’ s functions based on the above conditions.
We calculated the spectral ratios between the mainshock and the EGF events to estimate the corner frequency of the EGF events. The source area and stress parameter of the event were estimated as 3.3km2 and 1.5MPa, respectively, from the seismic moment and the corner frequency using Brune’ s (1970, 1971) formula.
A SMGA area is divided into N x N subfaults, the area of which is taken to be equal to the fault area of each EGF event. Target frequency range is 0.5 - 10Hz. The best-fit characterized source model to simulate ground motions from the mainshock using the EGF method was determined, choosing the starting point, rupture velocity, and slip duration by comparing the observed and synthetic waveforms. The criterion of the best-fit model is to minimize the residuals between the observed and synthetic waveforms. The residual is defined as the sum of the squared residuals of displacement waveforms and acceleration envelopes at KiK-net stations. On the other hands, at K-NET stations, the residual is defined as the sum of the squared residuals of displacement and velocity waveforms to avoid non-lenear site effects on acceleration motions.
The best fitting SMGA source model has three SMGAs. The locations of the SMGAs are the northerm part, southern part and shallow part of the hypocenter. The areas and stress parameters of the SMGAs were estimated to be 136 km^2 and 20-25MPa, respectively. The area of combined SMGAs is agreement in comparison with the scaling relationship of combined asperity area versus seismic moment from Irikura and Miyake (2001).

We are analyzing the detailed SMGA source model assuming with multi-segments with defferent strike and dip for each SMGA.

Keywords: the 2018 Hokkaido Eastern Iburi earthquake, strong motion generation area

