

Estimation of source process of the 2001 Hyogo-ken Hokubu earthquake from waveform inversion

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1. Introduction

An earthquake swarm activity began in December, 2001 in Hyogo-ken Hokubu area. On January 12, 2001, the largest event with Mw 5.2 occurred, with successive events including ones larger than M4, and then the seismic activity gradually decayed. This study investigates the source process of the Mw 5.2 event on January 12 from the waveform inversion.

2. Data and method

We use NIED K-NET data for the analysis. We use the records of the aftershock (Jan. 13, Mw 4.0) with a mechanism similar to that of the target event as the empirical Green's functions. The number of the stations used for the analysis is 4 (HYG003, HYG004, HYG007, TTR004). Velocity waveforms lowpass-filtered at 5 Hz are used for the inversion. The waveform data with total length of 4 s and starting time 0.5 s before S-wave arrival are used. Freesia mechanism solution of the target event shows an almost pure strike-slip type with NW-SE compression. We examine both of the two fault planes with EW and NS strikes. The assumed fault plane is 5 km x 5 km and it is divided into 10 x 1 meshes. The waveform inversion is done by multiple time window analysis. We put 3 time windows for each mesh. The propagation velocity for the 1st time window is 2.6 km/s ($= 0.75 V_s$, $V_s = 3.5$ km/s). We give spatial smoothing constraint and non-negative constraint to stabilize the inversion.

3. Results

EW-striking fault plane is adopted because smaller residuals are obtained than for the NS-striking fault plane. We find three large slip areas (asperities). The obtained total seismic moment is 6.3×10^{16} N*m. The source duration is about 2 s. The estimated maximum slip is about 90 cm.

Acknowledgments

We thank NIED for providing us with variable strong ground motion data.