Slip velocity funtion for strong motion evaluation based on the hybrid method

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1. Introduction

Broad-band strong motion in general has been estimated by the hybrid method, long-period motions by a numerical method and short-period motions by a semi-empirical method. Ground motions from the long-period calculation and those from the short-period calculation are combined using matching filter about 1Hz. The synthesized waveforms by the hybrid method fit the observed records well in the previous researches (e.g. Kamae et al., 1998).

Slip velocity functions used above are different in the target frequency ranges. For example, smoothed ramp function, Nakamura and Miyatake's function (2000) and so on are used for the long period calculation. On the other hand, in case of the short-period calculation the slip time function is not directly defined but given as a convolution of the slip time function of small event with a correction function defined by Irikura (1986).

Therefore, the slip velocity function in intermediate period range from 0.5 to 1.0 s is expressed as the summation of the theoretical slip time function given in the long-period range and the empirical one in the short-period range.

However, there is a possibility that the combined spectra have some sag in the intermediate period range,

In this study, we discuss ground motion characteristics between the long-period waveform and short-period waveform in the intermediate period range during 2008 Iwate Miyagi Nairiku earthquake. First, strong motions generation area (SMGA) during this earthquake was estimated by the empirical Green's function method (Irikura, 1986). Second, theoretical long-period waveform was calculated by discrete wavenumber method (Bouchon, 1981) based on High Rate Area (HRA) characterized source model. We examine whether the both spectra of the synthesized waveforms are smoothly connected.

2. Estimation of Strong Motion Generation Area (SMGA)

SMGA source model during 2008 Iwate Miyagi Nairiku earthquake was already estimated by Kurahashi and Irikura (2013, 2014). We re-estimated the SMGA source model, because Yoshida et al. (2015) re-estimated the characterized source model which was constructed from slip distribution by the waveform inversion. Yoshida et al. (2015) proposed HRA characterized source model from peak moment rate distribution. Yoshida et al. (2015) thought that short-period strong motion is generated from HRA because short-period strong motion relates slip velocity function. Therefore, we re-estimated the SMGA source model by the empirical Green's function method (Irikura, 1986) referring to the HRA characterize source model. As a result, the synthesized waveform based on the HRA characterized source model agrees with the observed one.

Next, the long-period waveform was calculated by the discrete wavenumber method (Bouchon, 1981). Parameters of the slip time function were determined to comparison between the observed and synthesized waveform. We discuss how to select the slip velocity time function to smoothly connect between the long-period and short-period calculations.

Keywords: slip velocity function, the hybrid method, 2008 Iwate Miyagi nairiku earthquake

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