Source modeling and strong ground motion simulation in the Tokyo metropolitan area of the 1923 Kanto earthquake based on seismic intensity inversion analysis

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1. Introduction

The 1923 Kanto earthquake had serious damage to the Tokyo metropolitan area. It is concerned that similar large earthquake will occur repeatedly in the future. So, it is important to evaluate characteristics of the source and strong ground motions of this event. The short-period strong ground motions were not recorded during this event. Therefore, the seismic intensity data are effective for the source modeling used to the short-period strong motion simulation. Kanda and Kato (2018) evaluated the short-period spectral level of the acceleration source spectrum A, and number of strong motion generation area (SMGA) by the inversion analysis using seismic intensity data investigated by Moroi and Takemura (2002). In this study, the short-period spectral level A_i of six SMGA by Kanda and Kato (2018) are evaluated, and the strong ground motions of two sites in the Tokyo metropolitan area are simulated using the stochastic Green's function method.

2. Seismic source modeling

A_i's are evaluated referring to A, seismic moment of each SMGA M_{0ai}, and area S_{ai} by Kanda and Kato (2018). Assuming that omega-square model, Brune's model (Brune, 1970, 1971) and circular crack model (Eshelby, 1957) are applicable to modeling of each SMGA, A_i is proportional to M_{0ai}/S_{ai}.

The whole fault A is 4.66×10^{19}Nm/s^2 by Kanda and Kato (2018), and each SMGA A_i is 1.4 to 2.2 $\times10^{19}$ Nm/s^2. The whole fault A by Kato et al. (2013) is 2.46×10^{19}Nm/s^2, and maximum A_i has the almost same level as this. Kato et al. (2013) constructed the source model based on the slip distribution evaluated by Sato et al. (2005) using seismic waveform and geodetic data of The 1923 Kanto earthquake. Therefore this model reflects relatively long period ground motion. This study’s model based on seismic intensity reflects relatively short period ground motion. Note that the difference.

Each SMGA is converted into a rectangular model holding the area. Strike and dip angle are set along the subducting the Philippine Sea plate. Background area is not considered. Other parameters (density, S wave velocity, rupture velocity (Vr), fmax and radiation pattern coefficient) are the same as those of Kato et al. (2013). Rise time of each SMGA is set from the relationship of $\tau_i=0.5S_i^{1/2}/Vr$. Rupture starting point of the whole fault is set on the SMGA located in the western Kanagawa, and rupture type of each SMGA is multi-hypocenter. The Q value is $100f^{0.7}$ (f is frequency) with reference to Central Disaster Management Council (2004).

3. Strong ground motion simulation

In order to the effect of the source model based on seismic intensity inversion to strong motions in the Tokyo metropolitan area, the strong motions at Asakawa and Etchujima evaluated by the stochastic

Green's function method. Soil structural models follow Kato et al. (2013).
The results of the strong motions evaluation are investigated about differences of 2 sites, contributions of each SMGA and differences from strong motions using the source model of Kato et al. (2013).

Keywords: the 1923 Kanto earthquake, seismic intensity, short-period spectral level, strong motion generation area, strong ground motion simulation

