Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)
©2009. Japan Geoscience Union. All Rights Reserved.

SSS025-11 会場: 301A 時間: 5月25日14:45-15:00

2008年Wenchuan地震における強震動シミュレーションのための震源モデルの構築

Source model for simulating strong ground motions during the 2008 Wenchuan earthquake

倉橋 奨[1*], 入倉 孝次郎[1]

Susumu Kurahashi[1*], Kojiro Irikura[1]

[1]愛知工業大学

[1]Aichi Institute of Technology

The Wenchuan earthquake (Mw7.9) struck the western part of Sichuan Province on 14 May 2008, China, resulting in about 70,000 fatalities as well as huge damage to infrastructures and buildings. Causes of serious damage of structures should be attributed to the characteristics of strong ground motions and vulnerability of structures.

The strong motion records during the Wenchuan earthquake will be very useful not only in making source modeling for estimating strong ground motion but also in clarifying the relation between structural damage and strong ground motions through reproduction of ground motions at damage sites. We estimate the characterized source model for simulating ground motions using the empirical Green's function method (EGFM) and the hybrid method for the Wenchuan earthquake.

Several authors published the slip distributions from the waveform inversion of teleseismic and strong motion data and those from the inversion of GPS and SAR data. The source models used for the inversion have fault length ranging from 250 to 300 km with strike of about 230 deg. and dip of about 35 deg.

The results by the teleseismic data have common features. First, the rupture started at the south-west end of the fault and propagated mainly unilaterally toward the northeast with a main rupture length of about 250km. Second, there are at least two significant asperities with large slip. Third, a small asperity is seen near the hypocenter and the largest one is located at about 50 km northeast of the hypocenter.

The strong motion records near the source fault have some distinctive pulses. Each pulse possibly corresponds to ground motions from each asperity. We picked out totally 4 distinctive pulses in the near-field records. Those four pulses are back-projected on the fault plane using the travel times of the pulses obtained at more than 3 stations. Then, the pulses can be connected to 4 asperities with large slips in the source inversion results. We found large asperities generate motions with long duration, while small asperities do those with short duration. The waveforms of the strong motion records are formed by superposing ground motions from the asperities.

We try to simulate strong ground motions including a short-period range from 0.1 to 2 seconds using the EGFM. The information about underground structures is very limited in the target area. It is a reason why we use the EGFM for simulating ground motions. However, the seismic records of small events including aftershocks of the Wenchuan earthquakes have not been open yet. Therefore, we use the observed records from an aftershock of the Iwate-Miyagi Nairiku earthquake occurring in the shallow inland crust in Japan instead of the empirical Green's

functions (EGFs). The earthquake is a reverse fault event, whose source fault has a strike to the southwest and a dip to the northwest similar to the Wenchuan earthquake. We call them substitute EGFs. We choose the substitute EGFs for the stations, considering the distances and radiation patterns from each asperity to the stations and ground conditions there. The synthetic motions by the EGFM agree well with the observed waveforms in the period range less than 2 seconds, as long as the asperity area and asperity stress drop are appropriately estimated. The stress drop is taken about 13 MPa on each asperity for the best-fit source model.
Broad-band strong-motions are simulated by the hybrid method combining the numerical method for period longer than 1 s and the EGFM for period shorter than 1 s. We find that the simulated long-period ground motions at stations in the forward rupture direction agree well with the observed motions. On the other hand, the simulated ground motions in the backward rupture direction are underestimated in comparison with the observed ones. In the conference presentation, we will show the influence of the rupture velocity fluctuation on the synthesized waveforms in the backward rupture direction area.

キーワード:四川地震,強震動シミュレーション,震源モデル

Keywords: Wenchuan earthquake, Strong ground motion simulation, source model