Trapped wave observation in fault zone of the Mid-Niigata PrefectureEarthquake in 2004

Takeo Ito[1]; Ryoya Ikuta[2]; Fumihito Yamazaki[3]; Mamoru Yamada[3]; Keiichi Tadokoro[4]; Noa Mitsui[5]; Keisuke Takahashi[6]; Takashi Tonegawa[7]; Kumiko Hori[8]; satoshi kawamoto[9]; Shinya Fujieda[10]

[1] RSVD, Nagoya Univ.; [2] RCSV, Nagoya Univ.; [3] Res. Ctr. Seismol. & Volcanol., Nagoya Univ.; [4] RCSVDM, Nagoya Univ.; [5] Earth and Environmental Stu., Nagoya Univ.; [6] Earth and Planetary Sci., Nagoya Univ; [7] Grad. Sch. Env. Studies, Nagoya Univ.; [8] Earth and Environmental Sci., Nagoya Univ) ; [9] Earth and Planetary Sci., Nagoya Univ.; [10] Earth and Environmental Sci., Env, Nagoya Univ

http://www.seis.nagoya-u.ac.jp/~take/

1. Introduction

The Mid-Niigata Prefecture earthquake in 2004 occurred in northeast Japan at 17:56, October 23 (JST). In this study, knowledge of the fault-zone structure provides the information required to understand the physics of earthquake. In order to understand the fault structure, we must observe the various aftershocks that occur near the active fault by array observation. We use the fault-zone trapped waves and long-period seismic events to delineate the fine structure of the faults rupture of the faults in the Mid-Niigata Prefecture earthquake. We aim to develop an understanding of the fault-zone, and whether there exists any relationship between the slip distribution of the mainshock and the trapped wave of aftershocks.

2. Observation

Two days after the mainshock, we started an aftershock observation along the road, between the southwestern end of the Obiro Fault and the northeastern end of the Western Muikamachi Basin Fault in order to obtain the waveform that propagates thorough the fault plane. The surface raptures of these active faults have been reported by Suzuki et al. (2004). Thus, 21 seismometers are installed along 2 km around the Obiro Fault, and the shortest interval distance of the seismometers is approximately 25 m.

3. Analysis and Results

As the first step toward the identification of the fault-zone trapped waves, we consider them from the following 4 perspectives: (1) propagation along the fault zone; (2) particle motion polarized along the fault-parallel direction; (3) relatively long-period wave trains closely following the S waves; (4) relatively low velocity waves as compared to the direct S waves. We now examine the above four features.

The apparent velocities of the fault-zone trapped waves are about 30 to 40 % lower than those of the S waves, and the peaks of the amplitude spectra of the fault-zone trapped waves have low-frequencies between 4 Hz and 5 Hz. The hypocenters of the fault-zone trapped waves are located in the northern part of the fault plane of the mainshock, which corresponds to the small slip distribution of the mainshock. We observe that the fault-zone in this area is more developed than in other areas. On the other hand, the hypocenter distribution of the characteristic low-frequency (CLF) seismic event corresponds to the region of the large slip distribution of the mainshock. However, few of aftershocks occur in the large slip region of the mainshock. It may be stated that the asperity of the mainshock generates the CLF seismic events and few aftershocks. These results lead us to the conclusion that a large coseismic slip distribution of mainshock can not develop the fault-zone which contain a large number of cracks with respect to the host rocks and imaged as a low-velocity fault-zone.