Three-dimensional attenuation structure in the source region of the 2004 Mid-Niigata prefecture earthquake

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Introduction

The Mid Niigata Prefecture earthquake occurred on October 23, 2004 in Niigata prefecture in Japan. The temporary aftershock observation was done by a lot of organizations in the hypocenter region. The distribution of aftershocks indicate that at least of three or more fault planes exist in the source region[e.g. Sakai et al.(2005)] and some fault planes are located at deeper part of the mainshock fault plane. Since many rays pass the mainshock fault plane, physical properties of the mainshock fault plane might be able to estimated by using such rays. We use inversion technique[Tsumura et al.(2000)] for microearthquake spectra of earthquake wave to estimate a three dimensional Q structure near the hypocenters.

Data and analysis

We use P-wave spectra of 105 events which occurred from 2 March to 21 April, 2005.Twenty stations were set by Central Research Institute of Electric Power Industry and Tokyo Metropolitan University. Thee component seismometers with natural frequency of 2Hz were installed at each station. Waveform data were recorded witch sampling rate of 200Hz or 250Hz. We calculate amplitude spectra for a time window of 0.64s beginning from the P arrival. The range of the frequency is 0.97˜31.24Hz or 1.56˜31.24Hz, and we use 32 frequency bands. The total number of the wave spectra is 1326.

Result

We can find in the result of surface to 2km depth, that low Q(50˜200) have NNE-SSW direction tendency. This trend coincides with that of geologic structures such as strikes of Muikamati-fault, Obiro-fault and anticline axes.

In the depths deeper than 2km, low Q(50˜100) area distributes having a NNE-SSW trend and it inclines toward the west. The easter part of the study area deeper than 2km shows high Q(400 or more) overall. The mainshock fault is located in the part where Q value abruptly changes from low Q(50˜200) to high Q(400 or more). Kato et al.(2006) reported a strong Vp contrast on the mainshock fault plane and the high-velocity body depicted in the footwall is considered to be the basement.

Both of the fault planes which exist at 5km under the mainshock fault plane or has a east dip are located in the area of high Q(400 or more). Some part of those fault plane show low Q(200˜400). It indicate a possibility that this low Q show physical properties in the fault plane.