

Distribution of seismic motion in the Niigata-ken Chuetsu area of the 2011 off the Pacific coast of Tohoku Earthquake

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It is well known that the seismic bedrock in Niigata-ken Chuetsu area is deep and it is pointed out that long-period seismic motion is outstanding in this area. In this area, the seismic observation network consisting of 40 stations is operated for the study of seismicity around the fault zone of western margin of Nagaoka plain [Sekine et al.(2010)]. The servo-type accelerometers are installed at ground surface and 100 m in depth. The observation record of this network will be useful for the study of seismic ground motion for wide period range. We report the characteristics of the 2011 off the Pacific coast of Tohoku Earthquake observed in this network and the relation between spatial distribution of seismic motion and topography or underground structure.

The envelope shape of the acceleration waveform is like a spindle shape and shows peak acceleration at around 100 seconds from the onset of shaking. The PGA shows 10-20cm/s/s in a hill part and 30-40cm/s/s in the plain part. In the Fourier spectrum of the EW component, the common peak is recognized at 0.08Hz. The common peak at 0.05Hz is seen in the Fourier spectrum of the UD component, too. The spectrum amplitude of 0.1-1 Hz in plain part shows approximately five times in comparison with the hill part. Two clear pulses with period of approximately 20 seconds are recognized at the interval of 40 s in the velocity waveforms of EW and UD components at the observation site of the hill part. The velocity waveforms at the observation point in the plain are overlapped with successive waves of frequency 0.1-1 Hz and the amplitude is bigger than waveforms at the hill part. In addition, two pulses propagate from the epicenter direction of N80E with approximately 3.3 km/s evaluated from semblance analysis using the UD component of velocity waveforms.

Spatial distributions of PGA, PGV and acceleration responses at period of 1, 5, 10 seconds with 5 % damping are evaluated and compared with the topography and the seismic bedrock depth [AIST (2010)]. In perspective, the shape of the amplitude distribution shows relation with the topography. The amplitude is big on plains and small in the hill part. The amplitude is small in particular at the observation point located foot of Kakuda-Yahiko Mountain. The contrast between plain part and hills part in case of acceleration response of 1 s show more clear than in case of PGA. It is because the PGA affected relatively low frequency waves. In the hill area of the south side, PGV and the acceleration responses of 5, 10 s are relatively large and distribution characteristics correspond to the depth of seismic bedrock not to the topography. It is thought that the amplification of long-period seismic motions is affected from deep ground structure.

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Keywords: Spatial variation of seismic motion, Depth of seismic bedrock, Niigata-ken Chuetsu area, the 2011 off the Pacific coast of Tohoku Earthquake, Long-period seismic motion