

**Ground Motion Characteristics in Sendai during the 2011 off the Pacific Coast of Tohoku Earthquake
-Comparison of 1978 Miyagi-ken Oki earthquake at the same observation point-**

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It is important to discuss the ground motion characteristics at the same observation point for different scale of earthquakes. As a quick report, we inform the characteristics of the observation records at B2F of Sumitomo Building near Sendai Station, one of DCRC, Tohoku University observation points. At the observation site, the valuable observation record was obtained during the 1978 Miyagi-ken Oki earthquake (M7.4) and also during 2005 Miyagi-ken Oki earthquake (M7.2). It is noted that the Sumitomo Building is on the relatively stiff soil (delivium terrace) and the record at B2F can be referred as engineering bedrock motion. The observation record during the 1978 earthquake has been used in seismic design of building structures as Sendai 038. Ground motion distribution characteristics in Sendai is necessary to be investigated by collecting and analyzing observation data at many observation points. The records at Sumitomo building can be reference point for discussing ground motion characteristics of alluvium sites like Orosimachi and hill zone like Aobayama campus of Tohoku University, where structural damage is recognized.

Fig. 1 shows the acceleration and velocity waveforms of 3 components and Fourier spectra and response spectra (Tripartite)

Table 1 shows PGA values of the 2011 off the Pacific Coast of Tohoku earthquake (M9.0), the 1978 Miyagi-ken Oki earthquake (M7.4) and the 2005 Miyagi-ken Oki earthquake (M7.2).

Fig. 2 shows comparison of waveforms of the three earthquakes in the NS direction (S25E) and the response spectra of the three earthquakes are comparatively shown in Fig.3 for the three components.

From these figures, the following findings are obtained.

Regarding ground motion characteristics of the 2011 earthquake, findings are;

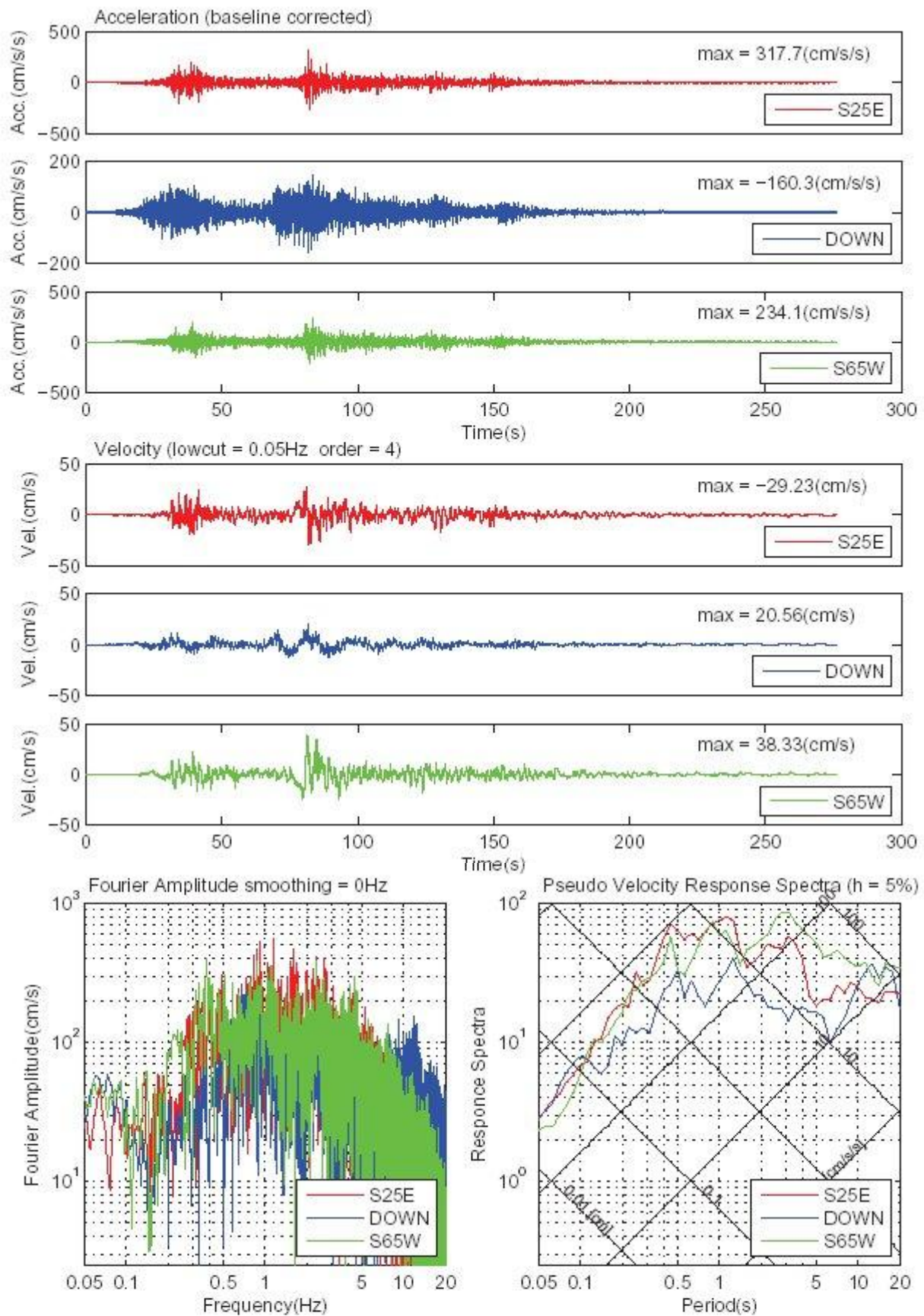
- 1) Duration of the records of the 2011 earthquake is very long about 180 seconds due to large magnitude (M9.0). From the envelope, two large phases are recognized and the other two smaller phases are followed.
- 2) Regarding spectral characteristics, dominant periods of about 1s and about 3s are recognized in the 2011 earthquake.
- 3) Regarding the spectral values in the period range shorter than 1.5s, NS component is larger than EW direction.
- 4) But in the period range around 3s, EW component is larger than NS component

Regarding comparison of the 1978 Miyagi-ken Oki earthquake and the 2005 earthquake, findings are;

- 5) The envelope shape of the 1978 earthquake is almost same as the first phase of the 2011 earthquake.
- 6) Period contents shorter than 1.5s of the 2011 earthquake is larger than those of 1978 earthquake, about 20% larger at 1s, and twice as large at 0.5s
- 7) The period contents around 3s of the 2011 earthquake is twice as large compared to those of 1978 earthquake.

Table 1 Comparison of PGA value at the Same Observation Point in Sendai
(Sumitomo Building B2F) Unit: cm/s/s

Earthquake		NS direction S25E	EW direction S65W	UD direction	Type of Seismometer
yr/m/d	Magnitude				
2011/3/11	9.0	317.7	234.1	160.3	SSA-1
1978/6/12	7.4	250.9	240.9	90.8	SMAC-Q
2005/8/16	7.2	120.8	78.0	56.4	SSA-1



Record Time : 2011/3/11 14:47:53.58, Code :SU2B(20110317-05), Intensity :5.3

Fig.1 Acceleration and Velocity Waveforms of 3 Components and Fourier Spectra and Response Spectra

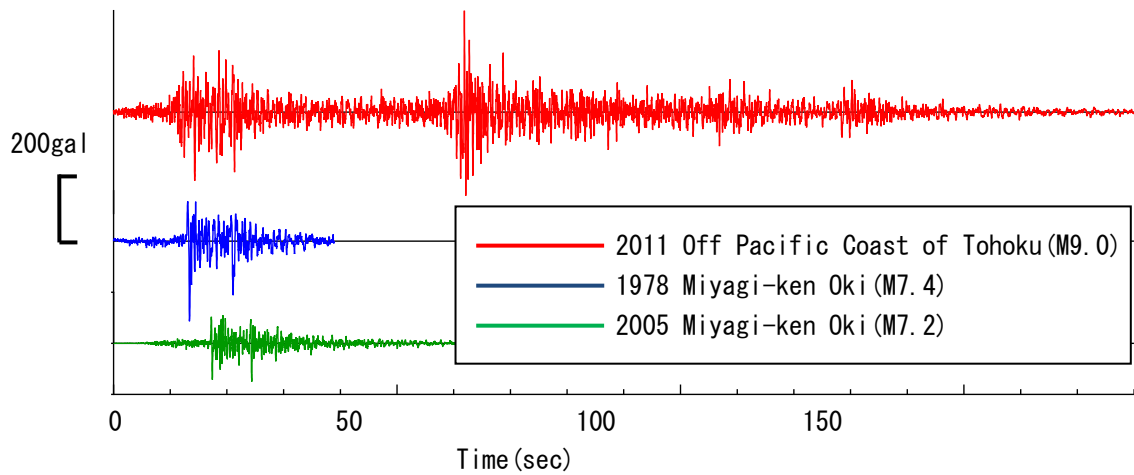


Fig.2 Comparison of Observed Acceleration Waveforms (NS Direction) at Sumitomo Building near Sendai Station for 3 earthquakes

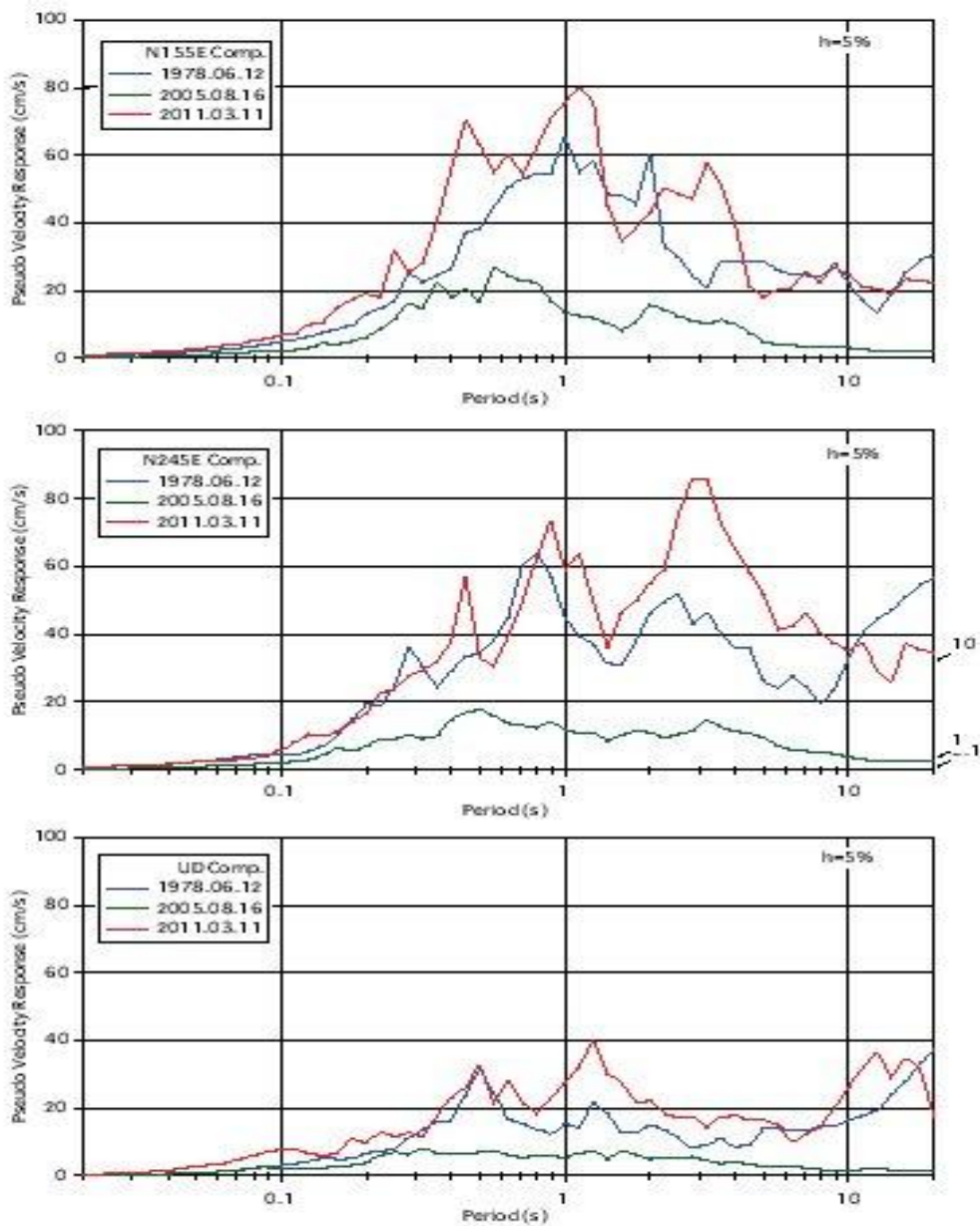


Fig.3 Comparison of Pseudo Velocity Spectra for 3 Earthquakes at B2F of Sumitomo Building