

MIS036-P72

Room:Convention Hall

Time:May 26 14:15-16:15

## Strong-motion characteristics in Sendai during the 2011 off the Pacific coast of Tohoku Earthquake and its aftershocks

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### 1. Introduction

Since 2004 we have been operated the strong-motion observation network in Sendai (Ohno et al., Annual Meeting of AIJ, 2004). Based on the observation records by this network, we report summary of the strong-motion characteristics in Sendai during the 3/11/2011 off the Pacific coast of Tohoku Earthquake as well as in its aftershocks.

### 2. Strong-motion observation

Before 2004, there were two major strong-motion networks in Sendai: Sendai Strong-motion Array by BRI/Tohoku Univ. and 'Small-Titan' network by Tohoku Institute of Technology. Our network, composed of ETNA and QDR seismometers, were installed in order to spatially supplement these two networks. Also, SSA-1 was installed at the Sumitomo-Seimei building, central Sendai, where the strong-motion record was obtained during the 6/12/1978 Miyagi-oki earthquake (M7.4). A total of 19 stations were operated but only 13 records were obtained at the 2011 mainshock. The major reason of losing records is probably due to QDR memory initialization by the long-term blackout after the mainshock. Still, the Higashi-Rokugou station was located in the inundated area but the mainshock record remained in the ETNA's memory.

### 3.Strong-Motion Characteristics in Sendai

The major strong-motion characteristics in Sendai estimated from the observation records are summarized as follows.

1) At the Sumitomo-Seimei building, central Sendai, the strong-motion duration of the 2011 mainshock (M9.0) is about 3 minutes, which is quite longer than 30 seconds of the 1978 Miyagi-oki earthquake (M7.4). In response spectrum at periods of 0.02-10sec, the 2011 mainshock amplitude is averagely 1.3 times larger than the 1978 earthquake's amplitude and more than twice of the amplitudes of the 2005 Miyagi-oki and the 2008 Iwate-Miyagi Nairiku earthquakes.

2) During the M9.0 mainshock of 3/11, PGA ranged about 300-800Gal in Sendai. Maximum PGA was 840 Gal at the Shogen-Chuou elemental school. PGV ranged about 30-80cm/s; maximum PGV was 86cm/s at the Matsumori elemental school. Also, during the M7.1 aftershock of 4/7, PGA ranged about 170-750Gal; maximum PGA was 767 Gal at the Matsumori elemental school. PGV ranged about 15-75cm/s; maximum PGV was 76cm/s also at the Matsumori elemental school.

3) These maximum values were obtained at the northern part of Sendai. Compared with the central part of Sendai, spectral amplitudes at periods shorter than 1-sec were larger at the northern part. On the other hand, spectral amplitudes at periods not only shorter than 1-sec but also about 3-sec were larger at the southern part of Sendai. Also, long-period later phases can be seen on the velocity traces at the southern part of Sendai. Such regional differences in Sendai have been commonly observed over the 2011 fore, main, and aftershocks as well as in the past disastrous earthquakes in the Tohoku region.

4) At the southern part of Sendai, 3-sec spectral peaks commonly appear in almost all earthquakes, while the spectral peaks at periods shorter than 1-sec have clear amplitude dependencies, probably due to the effect of non-linear response of surface soil.

We will investigate the strong motion characteristics in Sendai in more detail by adding records from the other networks, and will also investigate the relationships between strong-motion characteristics and building damages.

Keywords: The 2011 off the Pacific coast of Tohoku Earthquake, Strong-motion record, Sendai