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Site amplification from coda waves in Japan (3)

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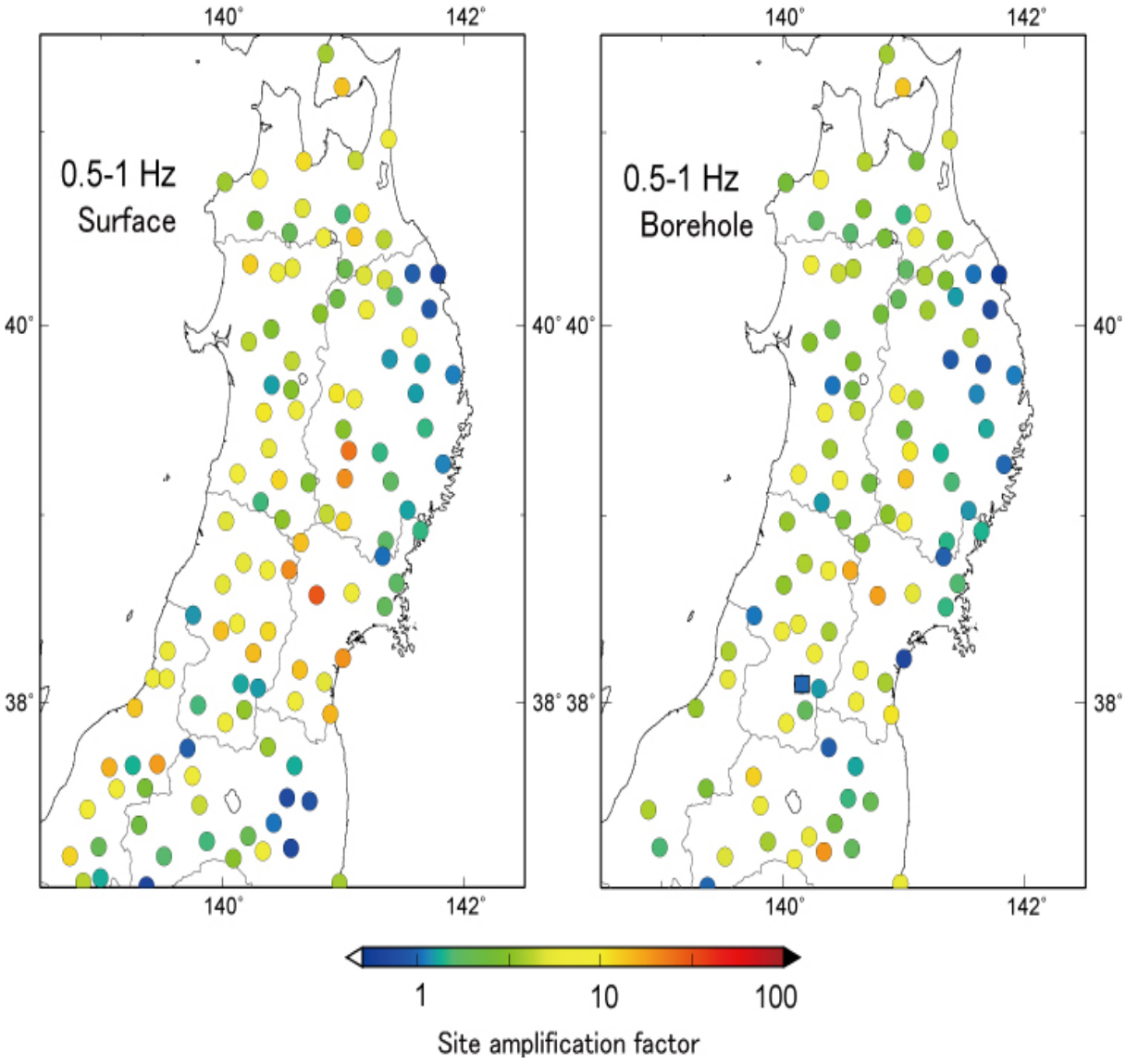

Introduction

We estimated site amplification factors in whole Japan quantitatively using the technique called the "coda normalization method" (e.g. Phillips and Aki, 1986) that uses the coda wave following S-wave. Distribution of the estimated site amplification factors differs greatly in the low frequency band (0.5-1 Hz) as compare with that of the high frequency band (4-8 Hz) (Takemoto et al. JpGU Meeting 2009). In order to check the reliability of the site amplification factors and to examine how the site amplification characteristic affects seismic intensity during recent large earthquakes

(the 2004 Niigata Chuetsu earthquake, the 2005 Western Fukuoka earthquake and the 2008 Coast of Iwate earthquake), we removed the site amplification characteristic from acceleration record at the earthquakes, and then investigated the change in the seismic intensity pattern (Takemoto et al. SSJ Fall Meeting 2009). We compared between site amplification factors from KiK-net surface record and borehole record to estimate how depth site amplification is affected. We calculated site amplification using model about 10 m from surface. We discovered the depth which affected site amplification factor is differing with frequency.

Data and Method

We used K-NET and KiK-net nation-wide strong motion network of about 1,800 stations developed across Japanese Islands and a dense SK-net strong motion and intensity-meter network deployed in Tokyo metropolitan area. Using a large number of waveform data of 3,004 acceleration record from 48 earthquakes, we estimated the site amplification characteristic at each station in four frequency bands (f=0.5-1 Hz, 1-2 Hz, 2-4 Hz, and 4-8 Hz).
The distribution of the site amplification characteristic in each frequency bands has been estimated by inversion. We assumed the F-net Tashiro broadband seismic observation station installed in the basement rock site as unity site amplification.

Site amplification factors from surface and borehole data

To estimate how depth site amplification is affected, we estimated site amplification factor in each frequency bands from KiK-net borehole data in northeastern Japan.
In the low-frequency band (0.5-1 Hz), large site amplification factor at Onoda (MYGH05) and Mogami (YMTH11). Small site amplification factors are estimated at Kitakami Mountains and Asahi (YMTH 13). In the high-frequency band (4-8 Hz), large site amplification factor at Kitakami Basin and southern part of Fukushima. In low frequency, the pattern of the amplification factors from borehole data is in good corresponding to the amplification factors in surface except Sendai (MYGH01) with a depth of 1,206 m. In high frequency, the pattern of the amplification factors from borehole data is in poor corresponding to the amplification factors. Site amplification in high frequency is seemed to affect by structure below borehole station. We modeled S-wave velocity structure from surface to 10 m depth and calculate site amplification factor of SH wave using multiple reflection theory. Large peak of amplification around 4-8 Hz is shown at stations which has large site amplification factor from coda waves. No peak of amplification around 4-8 Hz is shown at stations which has small site amplification factor from coda waves. Site amplification is occurs till 10 m depth from surface in high frequency. We will use more large scale S-wave velocity model to estimate the depth which affected site amplification factor in low frequency.

Acknowledgement

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Keywords: coda normalization, site amplification, multiple reflection theory