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# Change in site amplification factors before and after the 2011 Off Tohoku earthquake

TAKEMOTO, Teito[1*], FURUMURA, Takashi[2], MAEDA, Takuto[2]

[1]Earthquake Research Institute, the University of Tokyo, [2]Center for Integrated Disaster Information Research, Interfaculty Initiative in Information Studies

## Introduction

We have compared between estimated broad band site amplification factor before and after the 2011 Off Tohoku earthquake at each site of the K-NET, KiK-net and F-net strong motion network in Japan. The amplification factors are estimated by coda normalization method (e.g. Phillips and Aki, 1986).

Estimated amplifications are applied for shaking intensity to show the validity of our estimates on the site amplification factors at each site and in frequencies (Takemoto et al., 2012 in press). In this paper, we also found even KiK-net borehole stations have strong site effect.

In this study, we confirmed that site amplification over 4 Hz significantly drops after 2011 Off Tohoku earthquake.

## Data and Method

We used KiK-net surface and borehole stations and F-net nation-wide strong motion network developed across Japanese Islands. Using waveform data of acceleration record from 48 moderate 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 an F-net broadband seismic observation station installed in the basement rock site as unity (0 dB) site amplification. We also estimate site amplification after 2011 Off Tohoku earthquake using 4 events in northeastern Japan.

## Results

In the high-frequency band (f = 0.5-1 Hz), we cannot confirm change of site amplification after the Tohoku earthquake. In the high frequency band (4-8 Hz), site amplification factors in most stations drop around half value.

Site amplification from coda normalization method is value relative to one F-net station. If absolute site amplification in F-net increase, site amplification factor of all stations will drop. For check the change of site amplification without certain reference, we compared two acceleration waveform at FKS006, where site amplification largely drop after Tohoku quake, and FKSH09, where site amplification drop small, in two quakes that location and mechanism are similar each other. Hypocentral distance from two events to stations are almost same. In 2010 event, amplitude at FKS006 is larger than FKSH09 by over seventh. This indicate site amplification in FKS006 is much larger than FKSH09. On the other hand, in 2011 event, amplitude at FKS006 is about twice to FKSH09. Therefore, we can confirm change of the site amplification from waveform. We will estimate the change of site amplification more quantitative in future study.

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Keywords: 2011 Off Tohoku earthquake, site amplification

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