Development of Regional Earthquake Early Warning System with Structural Health Monitoring Function and Real-time Ground Motion Prediction Using Front-Site Waveform Data

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Introduction

Background
- General Operation of EEW System by JMA
- The approach to Miyagi-ken Oki earthquake
- Limitation of National (JMA/NIED) EEW System
- Applicability to Near-source earthquake
- Accuracy of the predicted ground motion parameters

Objective
- To enhance the accuracy and the immediacy by combining the ‘On-site’ and ‘Regional’ EEW System with the National EEW System
- To add Structural Health Monitoring as daily Function
- To investigate the Forward use of the Front-Site Waveform Data

Regional Earthquake Early Warning System with Structural Health Monitoring Function

Developed Regional EEW/SHM System

Real-time Ground Motion Prediction based on Artificial Neural Network

Outline of the Methodology

Artificial Neural Networks
- Basic units & Neuron cells (unit)
- Matrix representation of Neural Network

Forecasting Peak Ground Motion parameters: PGA and PGV

Information for ANN construction in the peak ground motion forecasting

Comparison of the average and standard deviation of the predicted and observed peak ground motion

Concluding Remarks

The Regional EEW/SHM System combined with the real-time earthquake information from JMA has been developed.
- The developed EEW/SHM system makes it possible to enhance the accuracy and the immediacy of the real-time ground motion prediction.
- The standard specification of online data transmission for the regional EEW/SHM would be used regarding packet length, connection way, TCP/IP connection and/or UDP connection.
- The advanced method of the real-time ground motion prediction using the front site waveform data based on ANN and its verification and the validity were described.
- The ANN based ground motion forecasting method made it possible the accurate spectral ground motion before arrival S-wave for the approaching Miyagi-ken Oki earthquake.
- The accurate ground motion forecasting would be applied to the making the hand-pass filtered information for various period range of interest and advanced engineering applications, e.g., food-forward structural control.

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References