Oral | Symbol M (Multidisciplinary and Interdisciplinary) | M-AG Applied Geosciences

[M-AG39_1AM1]Special Project for Reducing Vulnerability for Urban Mega Earthquake Disasters

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Thu. May 1, 2014 9:00 AM - 10:45 AM 502 (5F)

Human beings have experienced devastating earthquakes in this century (e.g. 2004 Sumatra, 2008 Wenchuan, 2010 Maule, 2011 Tohoku earthquake). These earthquakes have caused strong ground motions and/or large tsunamis. The 2011 Tohoku, Japan, earthquake, for instance, produced widespread complex disasters product of nation-wide ground shaking and large tsunami waves. In the Tokyo metropolitan area, many problems specific to urban regions have been exposed: liquefaction damage, stranded commuters, paralyzed traffic, suspensions of business activities, power blackout, lost of lifelines, etc. Metropolitan areas in Japan concentrate sophisticated social functions and are the political and economic nerve centers of the country. As such, they are particularly vulnerable to natural hazards like earthquakes. When large earthquakes occur, unforeseen consequences are exposed and considerable damages may happen. We have started the Special Project for Reducing Vulnerability in Urban Mega Earthquake Disasters (2012?2016) from two years ago, which is sponsored by the Japanese Ministry of Education, Culture, Sports, Science and Technology. This project is composed of three academic disciplines: Earth and physical sciences, engineering, and human social sciences. It seeks to (1) clarify the earthquake mechanism of southern Kanto region and develop evaluation technology for seismic damages in urban areas; (2) develop technology for rapid damage assessment of high-rise office buildings which may be damaged during earthquakes, and (3) develop strategies to increase earthquake social resilience. These three disciplines are usually studied independently. However, we have one common mission, to reduce the impact of seismic events. Multidisciplinary collaboration has an important role in our project. This session will be the important activity to foster collaborations through academic discussions between participating researchers.

10:30 AM - 10:45 AM

[MAG39-P05_PG]Sparse Modeling to Estimate Spatial Distribution of Ground Motion Required for Rapid Prediction of Structural Damages

3-min talk in an oral session

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Keywords:Sparse modeling, lasso, urban disaater, MeSO-net

A rapid prediction of structural damages due to a large earthquake is important to prevent secondary disasters. The first step of the prediction is to estimate ground motion at a targeted construction from observed seismic data, and the second step is to predict structural damage using the estimated ground

motion. An accurate damage prediction requires ground motions with spatially-high resolution although the spatial density of constructions is much higher than that of seismometers in urban area. We have been developing a statistical method to model such ground motions using seismograms obtained by a seismometer array. Our target is Tokyo metropolitan area in which seismogram of MeSO-net (Metropolitan Seismic Observation network) is available.Mizusako[2013, graduation thesis] proposed a method based on the Taylor expansion, and applied it to MeSO-net data when the Great East Japan Earthquake occurred. This method was found never to account for ground motions higher than 0.15 Hz, which was insufficient when considering that the eigenfrequency of constructions is usually between 1-10 Hz. Mizusako[2013] determined the partial differential coefficients, which appear in the Taylor expansion, from five nearest observatories with a truncation of the first order, but a better selection of a truncation of order and a group of observatories, which is hereinafter called " cluster", could more accurately explain ground motions higher than 0.15 Hz.We propose an algorithm based on sparse modeling that automatically and objectively determine the truncation of order and the size of the cluster. Our algorithm adopts the lasso, which is able to select dominant partial differential coefficients owing to the L1-norm regularization term. Moreover, the group lasso is implemented on our algorithm in order to select the coefficients of the same order associated with different components. We will report initial results obtained by the proposed method, comparing with the results of Mizusako[2013].