

*Highlights* → TEM-NIED workshop  
SHA issues in the island arc of  
Taiwan and Japan

Coordinator: Ken XS Hao (郝 憲生)

Representative: Hiroyuki Fujiwara (藤原広行)



12/06/13

What lessons we have learnt from the Tohoku M9 earthquake.

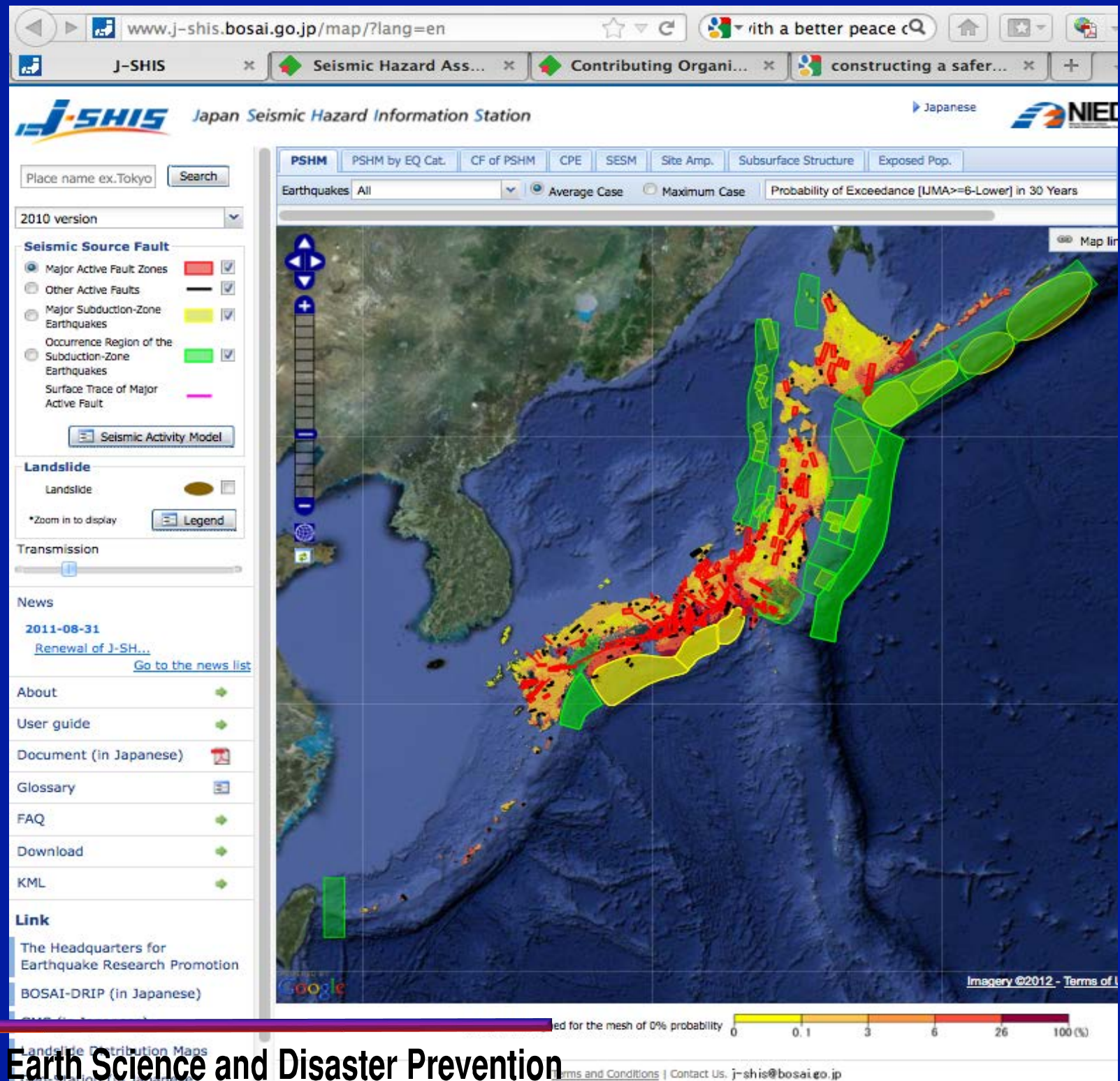
“The borderless world of Science” → enabling knowledge and data exchange each others.

Subduction zones → Crossing border connect the world



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National Research Institute for Earth Science and Disaster Prevention

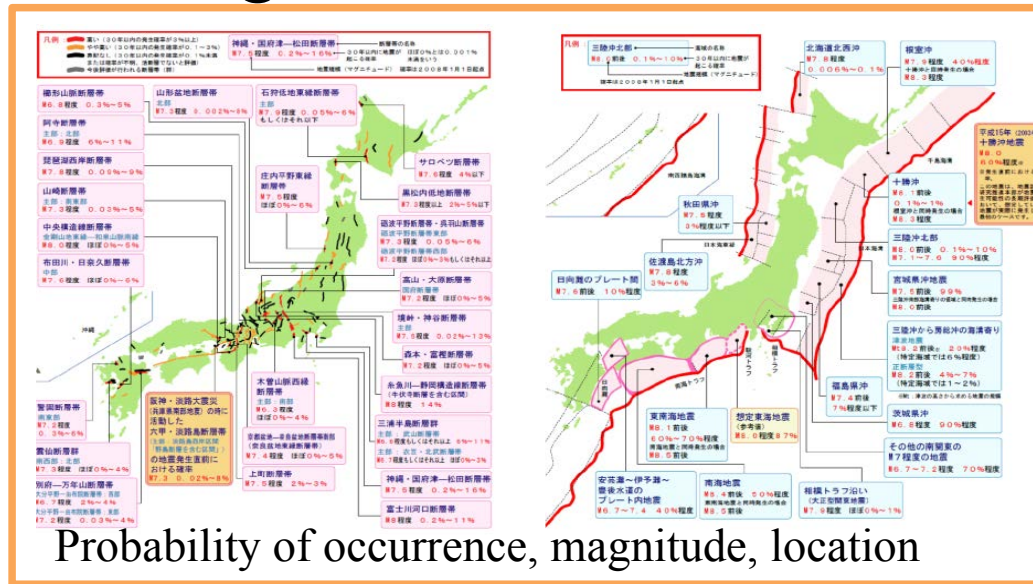


- H. Fujiwara : Seismic **Hazard Assessment** for Japan after the 2011 Tohoku Eq
- K. Hao : Probabilistic seismic hazard assessment in general issues
- K. Wen : Earthquake probability mapping and hazard mitigation program
- N. Morikawa : **Scenario earthquake** shaking maps in Japan
- S. Lee : 3D waveforms simulation for earthquakes and scenario events
- S. Aoi : Strong motion **observation** networks in Japan
- S. Lu : Seismic network and earthquake rapid report in Taiwan
- H. Matuyama : Construction of the detail **3D velocity structure**
- C. Wang : Seismic profiles from TAIGER project
- Li Zhao : Calibration on the 3D velocity structure of Taiwan
- H. Nakamura : Earthquake **Early Warning** in Japan
- Y. Wu : Developing of Earthquake Early Warning in Taiwan
- T. Maeda : **Long-period ground motion** simulation of great Nankai Trough EQ
- K. Ma : Building up Finite-Fault models for ground motion prediction program
- Asako Iwaki : Synthesis of **high-frequency ground motion** in Kanto area
- Y. Yen : Synthesis of high-frequency ground motion using Empirical G.F.
- J. Yeh : Taiwan Earthquake Loss Estimation

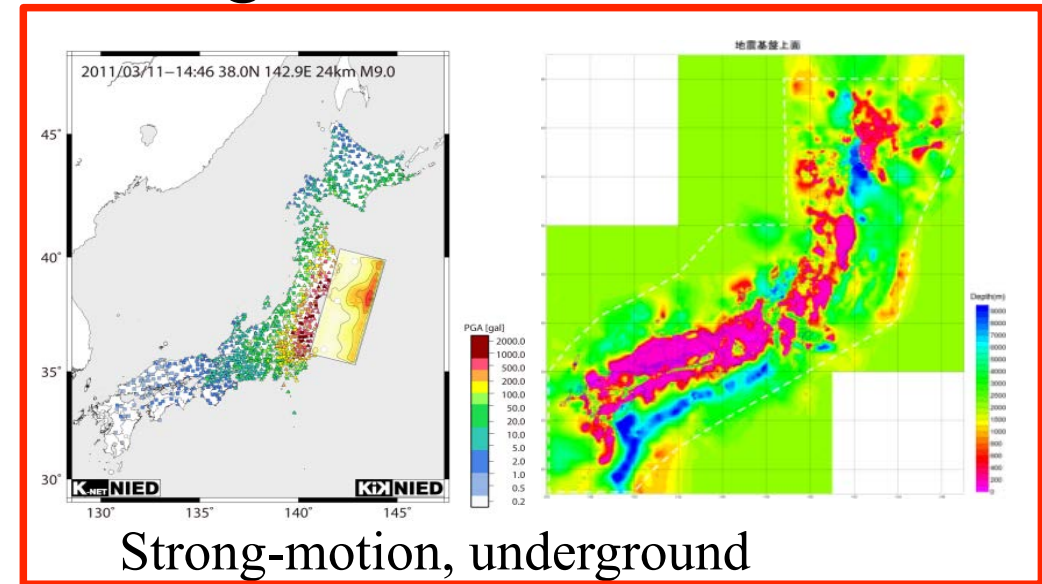


# National seismic hazard maps for Japan

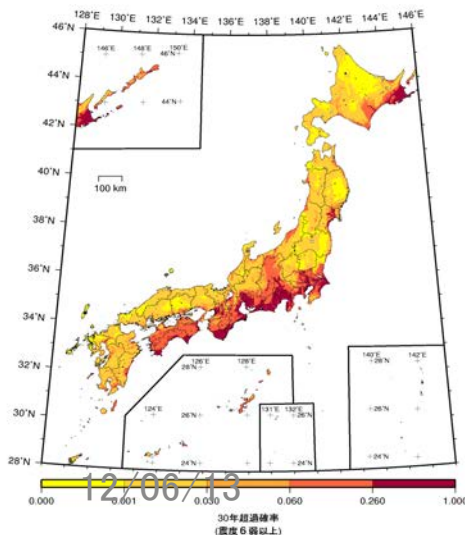
## Long term evaluation



## Strong-motion evaluation

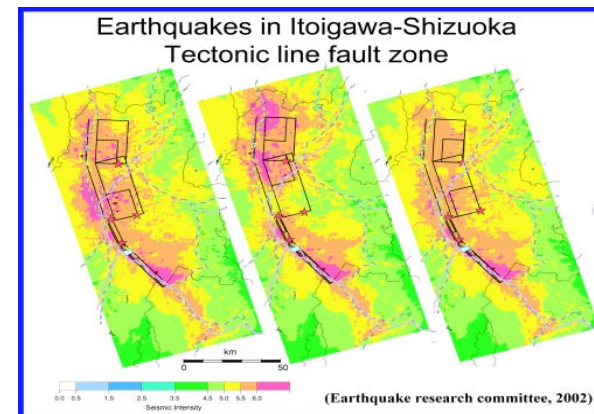


## Probabilistic Seismic Hazard Maps



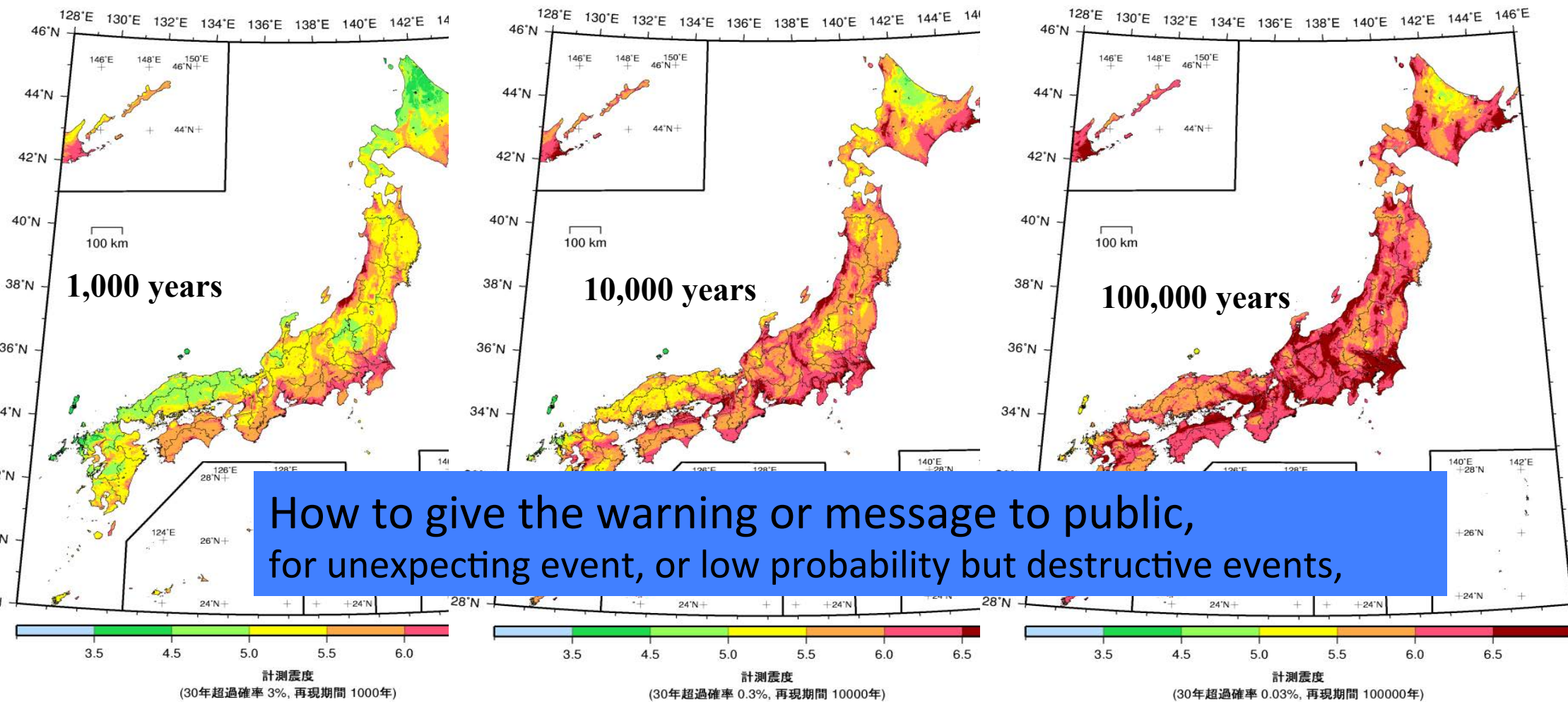
- Showing the strong-motion intensity with a given probability, or the probability with a given intensity.
- Considering all possible earthquakes.

## Scenario Earthquake Shaking Maps



- Showing the strong-motion intensity around the fault for a specified earthquake.

# Strong-motion maps considering **low-probability** earthquakes



Major earthquakes on active faults and subduction zone with low-probability.

Regarding the PSHA for low probability, at present it is insufficient to evaluate the uncertainty for low probability of M8-class earthquakes and it is necessary to improve techniques for them.

# How to reduce the variation of uncertainty

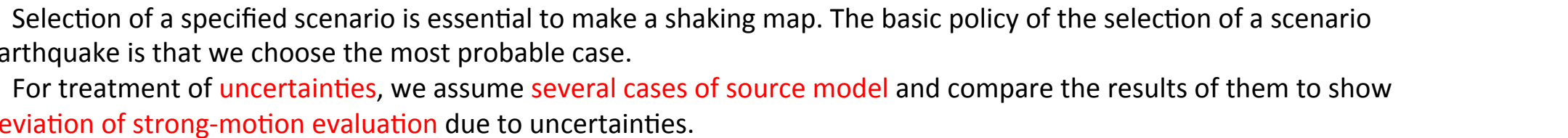
- GMPE => PGA and PGV (now in PSHA, but, large variance in values)
- Requirement of a fine 3D velocity structure for modeling of high frequency.
- Fault Segment, geometry, mechanism

Steps: PSHA => Simulation-based PSHA (Japan)

To reduce the variation.



**The shaking maps are evaluated for 490 scenario earthquakes of almost all of major faults in Japan.**

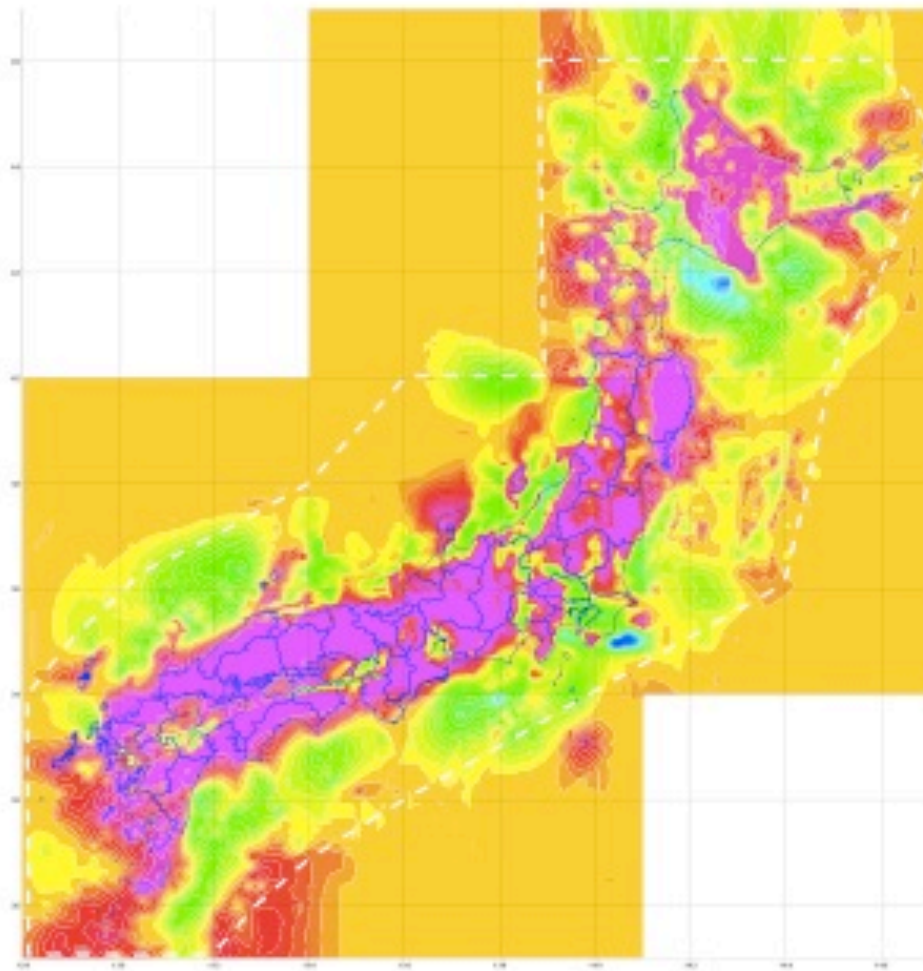




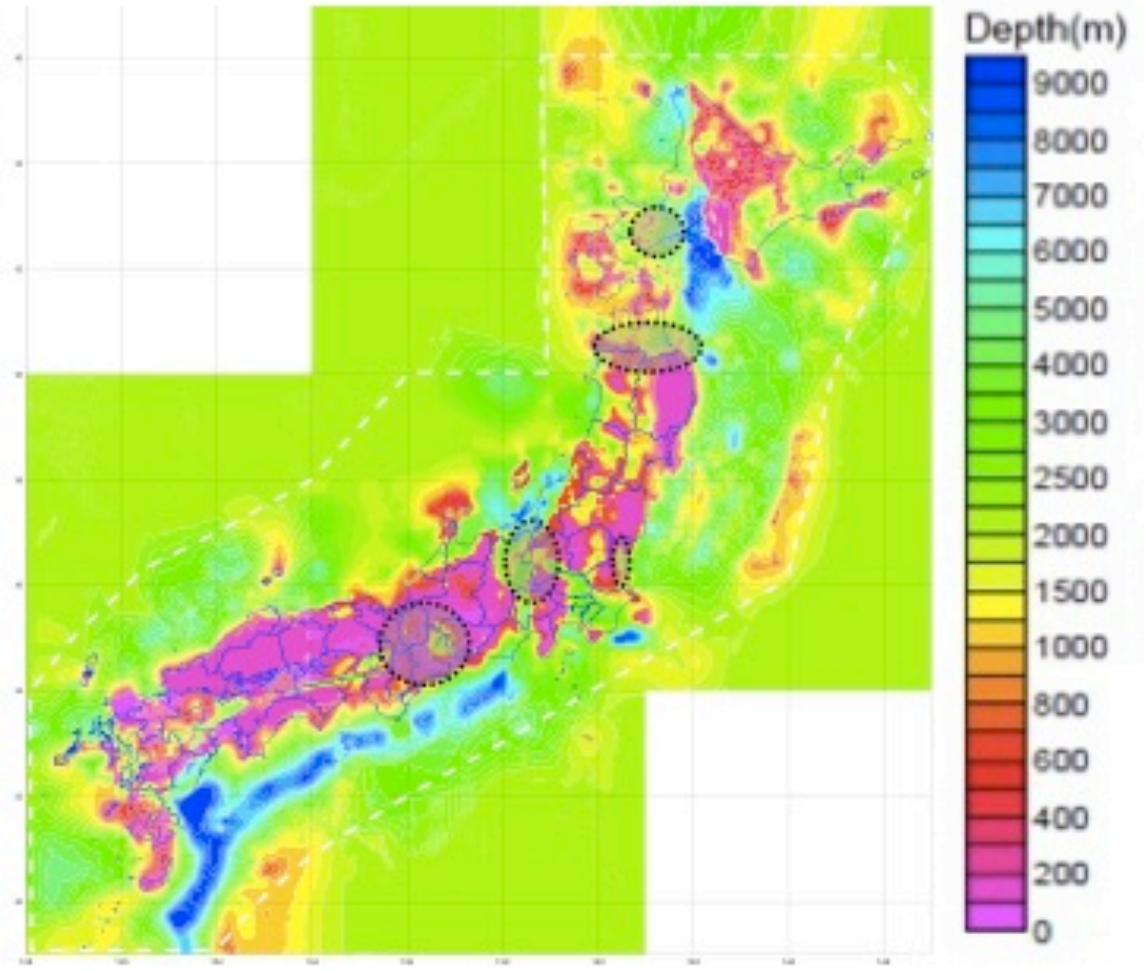
# 1st-order velocity layered model(1)

Depth distribution of the upper surface of example layers

● modified area



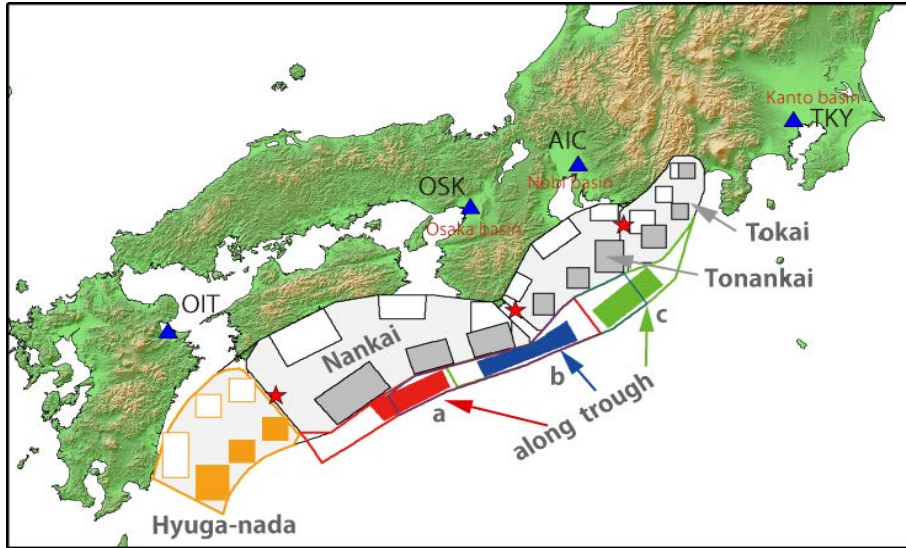
Upper surface of the layer No.25  
( $V_s = 2.1\text{km/s}$ )



Upper surface of the seismic bedrock  
( $V_s > 3.1\text{km/s}$ )



# Characterized source model for the Nankai trough earthquakes



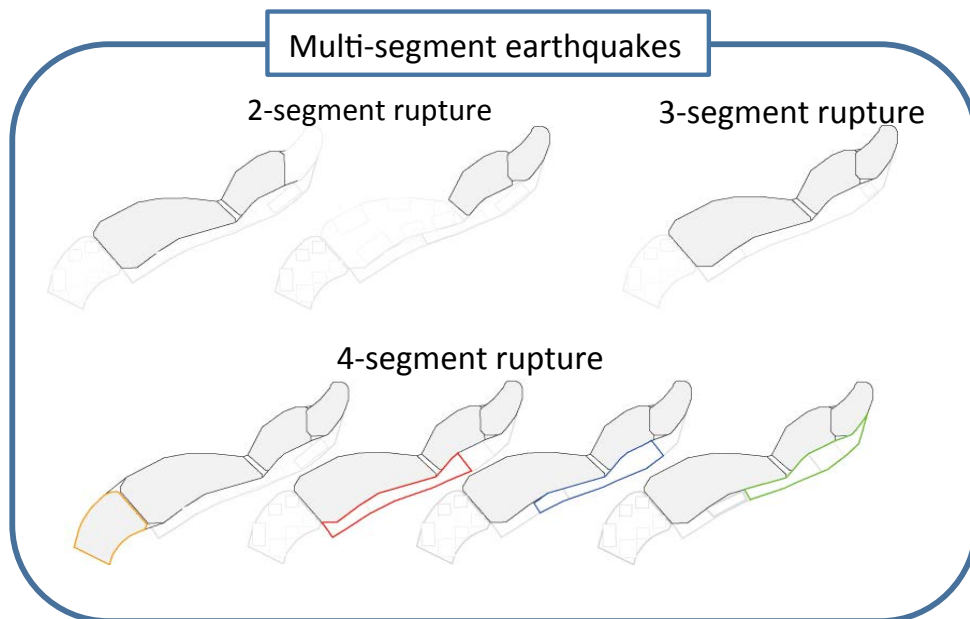
## • Source areas ( 14 cases x 3 )

### ◆ Single-segment earthquake

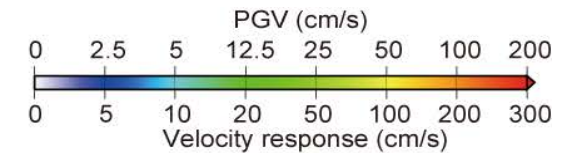
- Nankai (ANNKI: Mw 8.5),
- Tonankai (ATNKI: Mw 8.2),
- Tokai (ATOKI: Mw 8.0),
- Hyuga-nada (AHGND: Mw 8.3),
- and along the trough (ATRGH: Mw 8.1) 3 cases (a, b, c).
  - 36 hours/ 1 scenario
  - 60000 steps (120 Hz)
  - Itanium 1.66GHzx256Core
  - Memory 130 GB

### ◆ Multi-segment rupture simultaneously

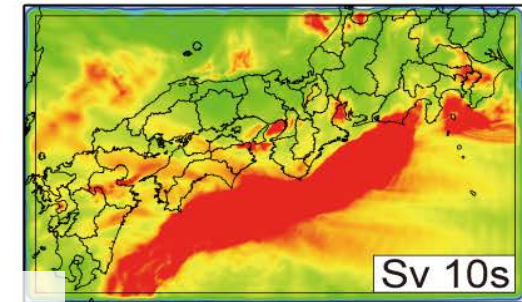
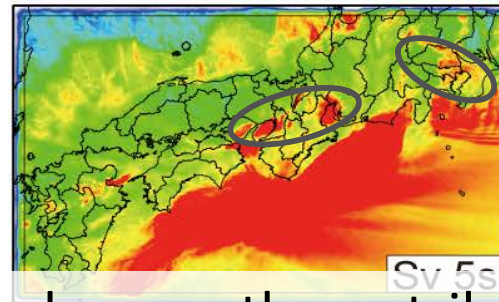
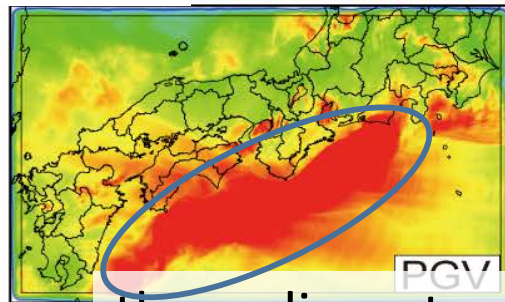
- 2-segment rupture
  - Nankai + Tonankai (ANNI1: Mw 8.7)
  - Tonankai + Tokai (ANNI2: Mw 8.4)
- 3-segment rupture
  - Nankai + Tonankai + Tokai (ANNI3: Mw 8.8)
- 4-segment rupture
  - 3-segment + along the trough (ANNI4: Mw 8.9)
  - 3-segment + Hyuga-nada (ANNI5: Mw 8.9)
- Seismic moment are calculated using scaling model



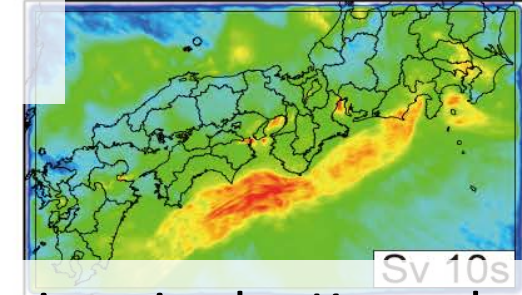
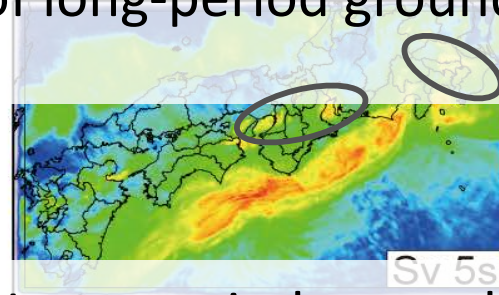
# Maps of Peak ground velocity (PGV) and Velocity response (Sv)



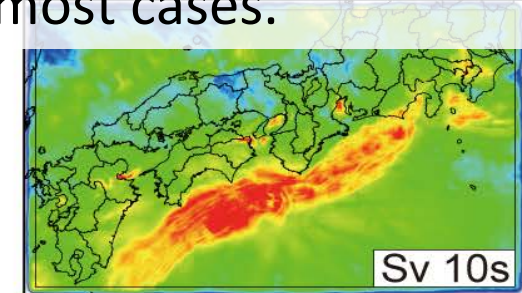
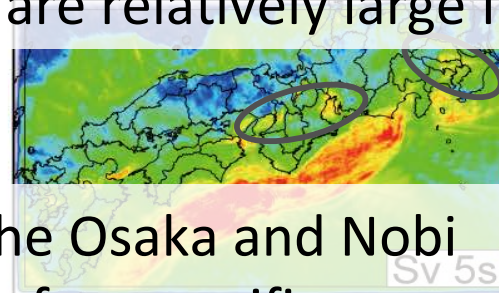
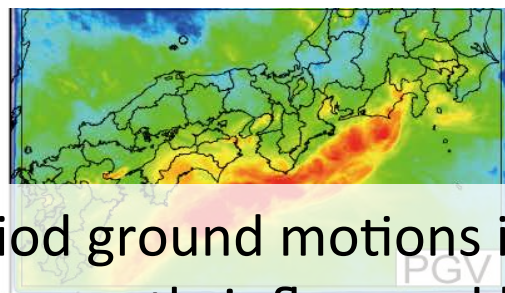
Maximum



Median



Interquartile range (IQR)



the sedimentary wedge greatly contributes to the generation of long-period ground motions

Long-period ground motions in the Kanto basin are relatively large for most cases.

Long-period ground motions in the Osaka and Nobi basins are greatly influenced by a few specific scenarios.



New Release →

[www.j-shis.bosai.go.jp/intl/cjk](http://www.j-shis.bosai.go.jp/intl/cjk)

Continuously Practice →

Trilateral cooperative program  
enabling knowledge data  
exchange

Supported by each individual  
countries

Goal →



12/06/13

National Research Institute for Earth Science

**SEISMIC HAZARD ASSESSMENT FOR THE NEXT GENERATION MAP**  
Japan-China-Korea Cooperative Research Projects supported by JST-MOST-NRF

Over 90% of natural disasters have occurred in Asia and millions of people have lost their lives and homes by the recent earthquakes, tsunami and natural disasters. Earthquake prediction is not available in short-term, however, Probabilistic Seismic Hazard Assessment (PSHA) in long-term is considered as a scientific way to define earthquake area/zones and to guide urban planning and engineering management.

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A strategic cooperative program (2010-2013) of "Seismic Hazard Assessment for the Next Generation Map" was finally selected after individual examinations by committees of MOST, NRF and JST, in China, Korea and Japan, respectively. The goal of this strategic project is to improve the PSHA methodology for the next generation maps in the three countries. To achieve this goal, the following approaches are planned:

- 1 to review the data and the methodologies adopted in the current PSHA maps of the three countries and evaluate if there is anything to be improved or added in each of the countries;
- 2 to compare the data and the methodologies with the state of the art technology and see if anything could be accepted for the next generation maps;
- 3 to develop a procedure to establish ground motion attenuation relationships for the maps;
- 4 to combine the probabilistic seismic hazard assessment and the deterministic approach of scenario earthquake for potential large earthquake and to prepare an example map for each country.

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This site is a communication forum to deal with theories, methodologies, data and related issues. We encourage people from all of over world to exchange their own experiences and individual methods.

**Activities**

- 1st Annual meeting**  
Hosted by HIT in Harbin, China on Nov 25-30, 2011.
- 2nd Annual meeting**  
Will be hosted by KIGAM in Korea, 2012.
- 3rd Annual meeting**  
Will be hosted by NIED in Japan, 2013.

**Links**

Japan Seismic Hazard Information Station J-SHIS

哈尔滨工业大学 HARBIN INSTITUTE OF TECHNOLOGY NIED KIGAM

Home | The 1st Annual Meeting | The 2nd Annual Meeting | The 3rd Annual Meeting | Links



