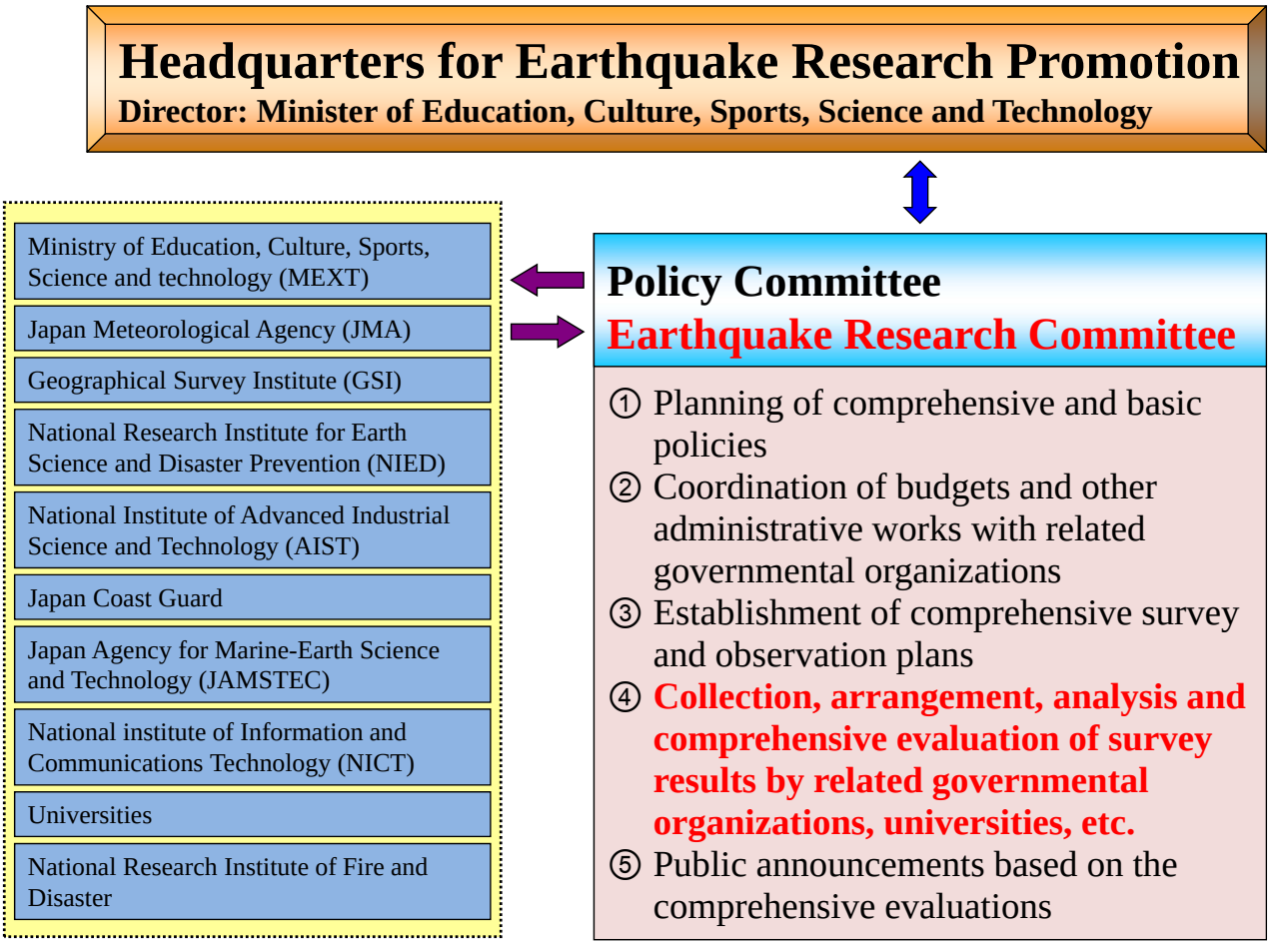
International Symposium on Earthquake and Tsunami Disaster Mitigation in Latin America
March 7, 2014

Earthquake Disaster Mitigation Research in Japan and International Collaboration

Y. Honkura

Japan Science and Technology Agency
SATREPS Program Officer



Headquarters for Earthquake Research Promotion

Director: Minister of Education, Culture, Sports, Science and Technology

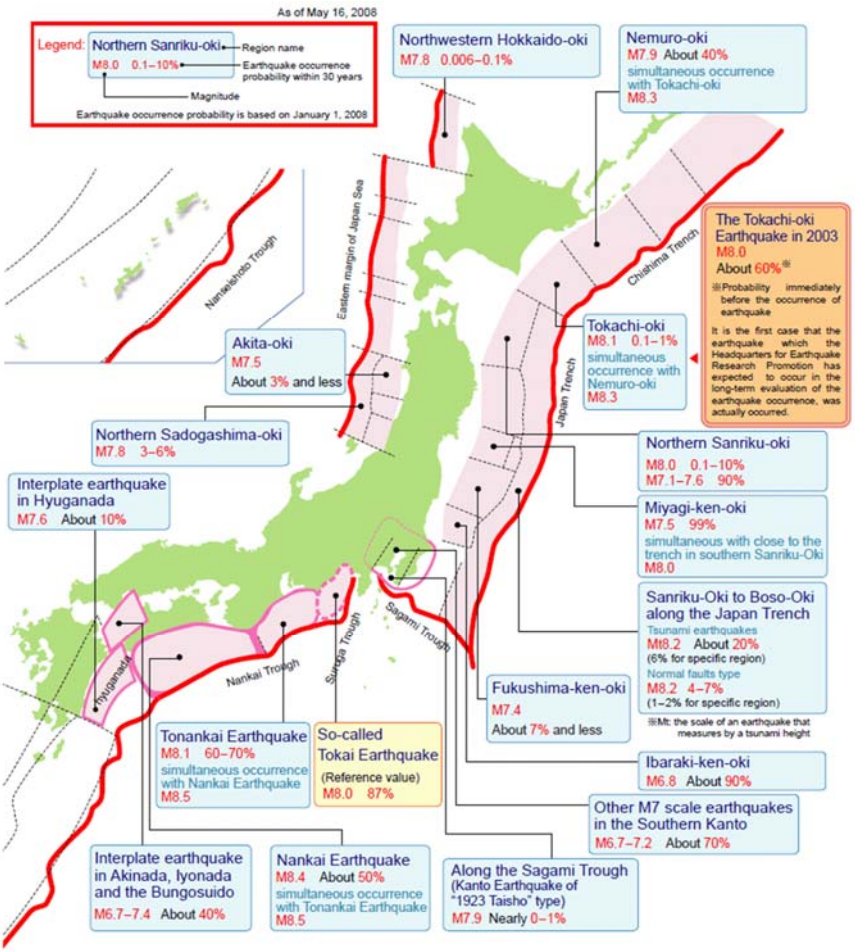
- Ministry of Education, Culture, Sports, Science and technology (MEXT)
- Japan Meteorological Agency (JMA)
- Geographical Survey Institute (GSI)
- National Research Institute for Earth Science and Disaster Prevention (NIED)
- National Institute of Advanced Industrial Science and Technology (AIST)
- Japan Coast Guard
- Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
- National institute of Information and Communications Technology (NICT)
- Universities
- National Research Institute of Fire and Disaster

Earthquake Research Committee

Monthly Evaluation of Seismic Activity in Japan

Data Information

Subcommittee: Long-term Evaluation of Earthquakes
Subcommittee: Evaluation of Strong Ground Motion
Subcommittee: Evaluation of Tsunamis



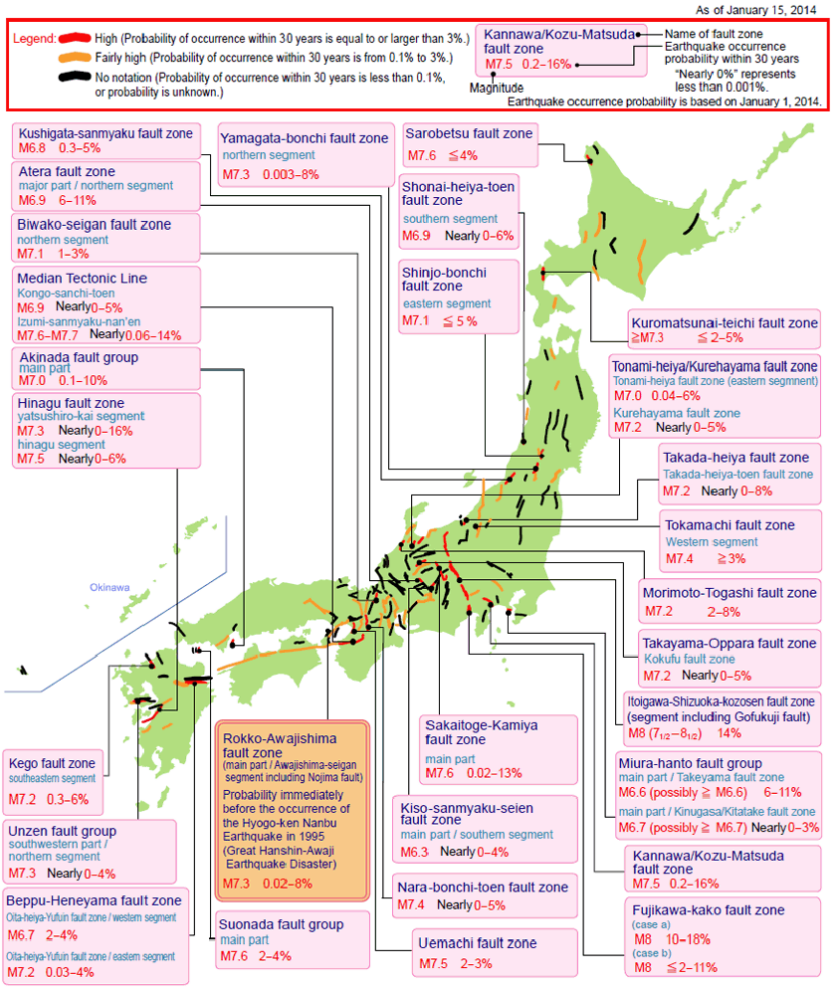
Long-Term Forecast of Large Earthquakes in Japan

Subduction-zone Earthquakes

After HERP, MEXT

Long-Term Forecast of Large Earthquakes in Japan

Inland Earthquakes along Active Faults



After HERP, MEXT

National Seismic Hazard Maps for Japan

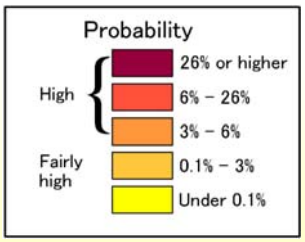
Survey and Observation of Earthquakes — **Research of Active Faults** — **Survey of Underground Structures**

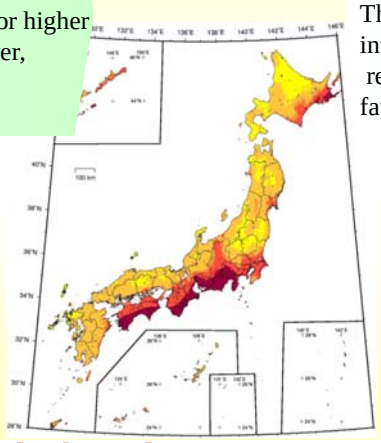
The promotion of earthquake research — ***comprehensive and basic policy for the promotion of earthquake observations, surveys, measurements, and researches –***

Long-term Evaluation of the Occurrence of Earthquakes — **Improvement of Methods to Evaluate(Predict) Strong Ground Motions**

Probabilistic Seismic Hazard Map

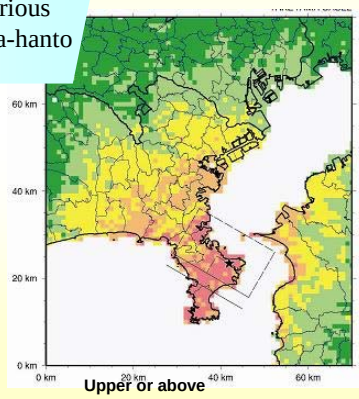
The probability of ground motions equal to or higher than seismic intensity 6 Lower, occurring within 30 years from the present.





Seismic Hazard Map for Specified Seismic Source Faults

The seismic intensities forecast for various regions around the Miura-hanto fault group.



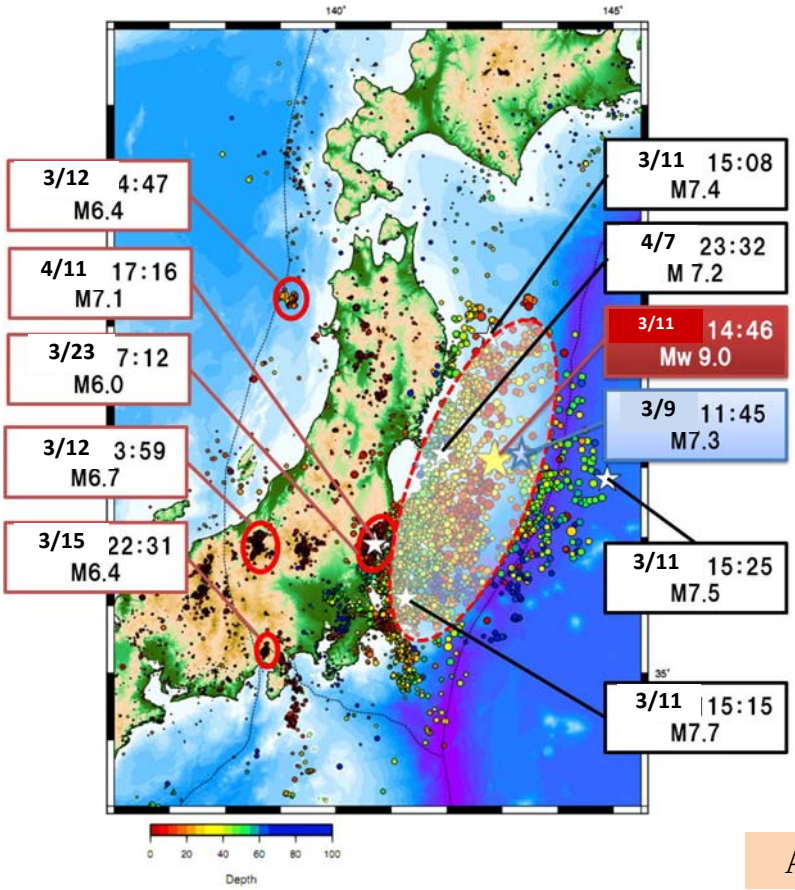
Seismic intensity

4 | 5 Lower | 5 Upper | 6 Lower | 6

These maps are expected to be used

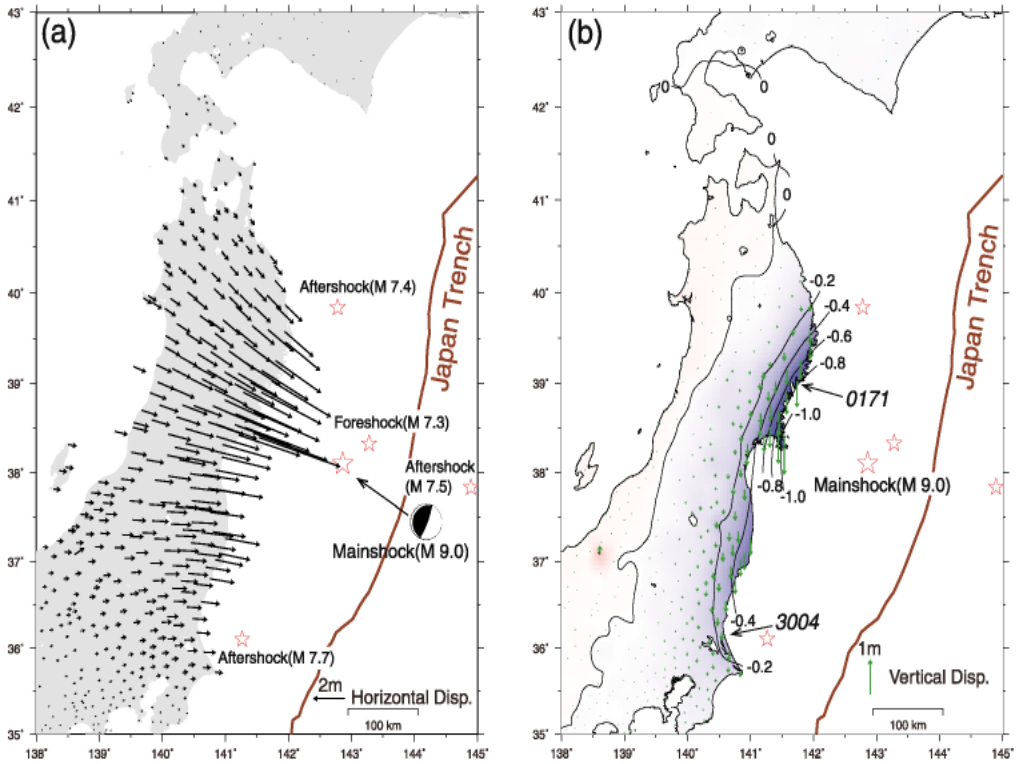
- to raise the public's awareness of earthquake disaster reduction
- to take the earthquake disaster reduction measures more effectively and efficiently
- to evaluate the risks of establishing important facilities and enterprises in a certain area.

2011 Great Tohoku Earthquake: Seismic Source Area and Seismicity Triggered by the Main Shock



After HERP, MEXT

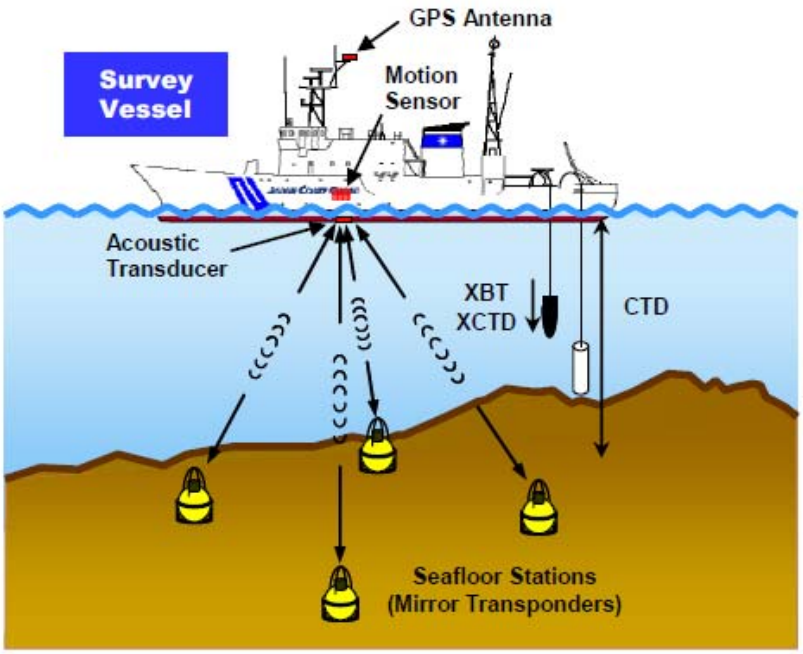
2011 Great Tohoku Earthquake: Crustal Deformation (GEONET)



After T Nishimura et al., Earth Planets Space, 63, 631-636, 2011

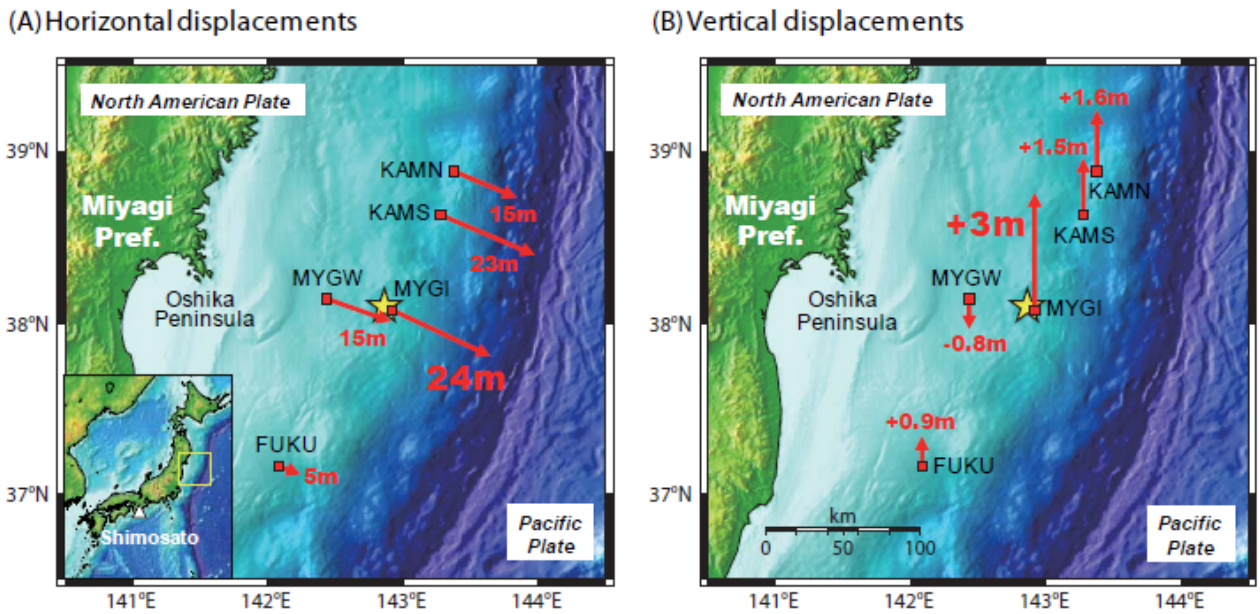
New Technology for More Accurate Long-Term Forecast of Subduction-Zone Earthquakes

GPS/Acoustic Seafloor Geodetic Observations



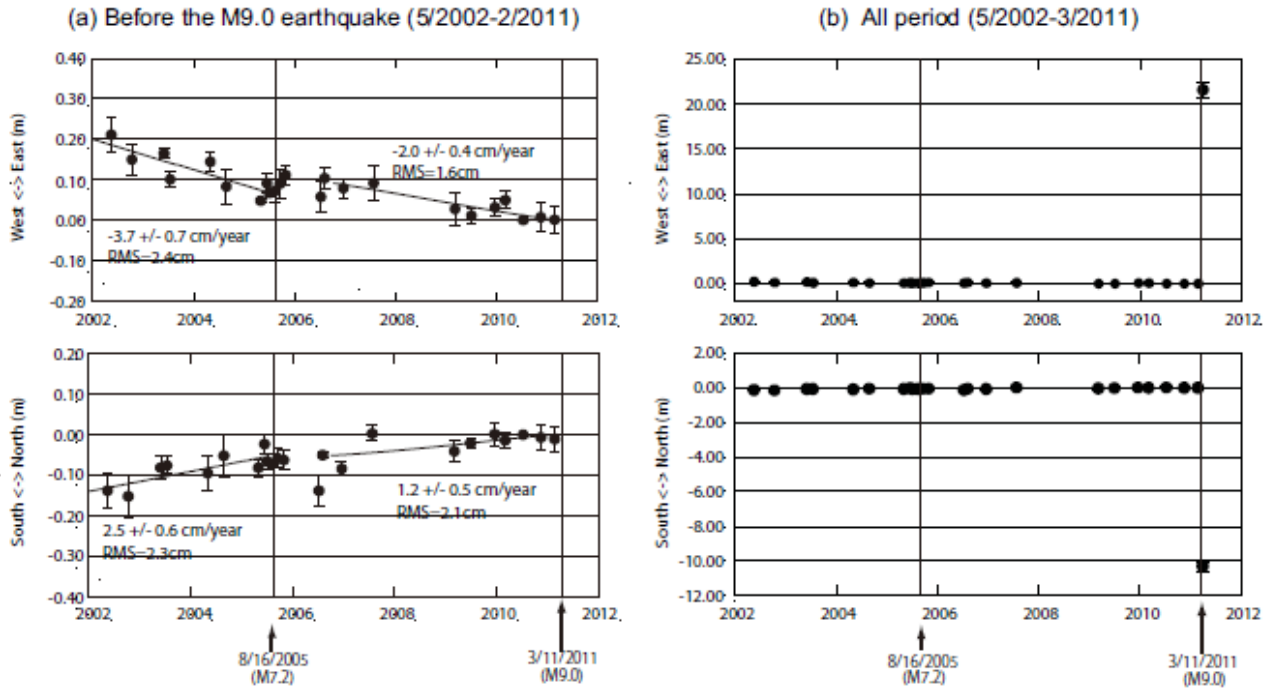
After M. Sato, Japan Coast Guard

Coseismic Displacement Off the Coast of Miyagi Prefecture



After Sato et al., Science, 19 May 2011.

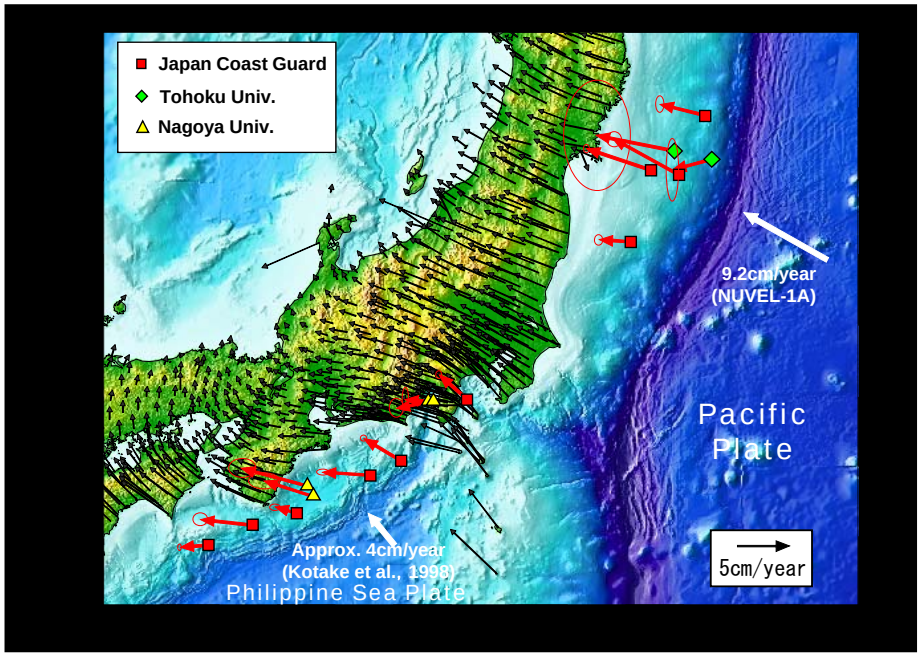
Displacement before the 2011 Great Tohoku Earthquake



After M. Sato, Japan Coast Guard

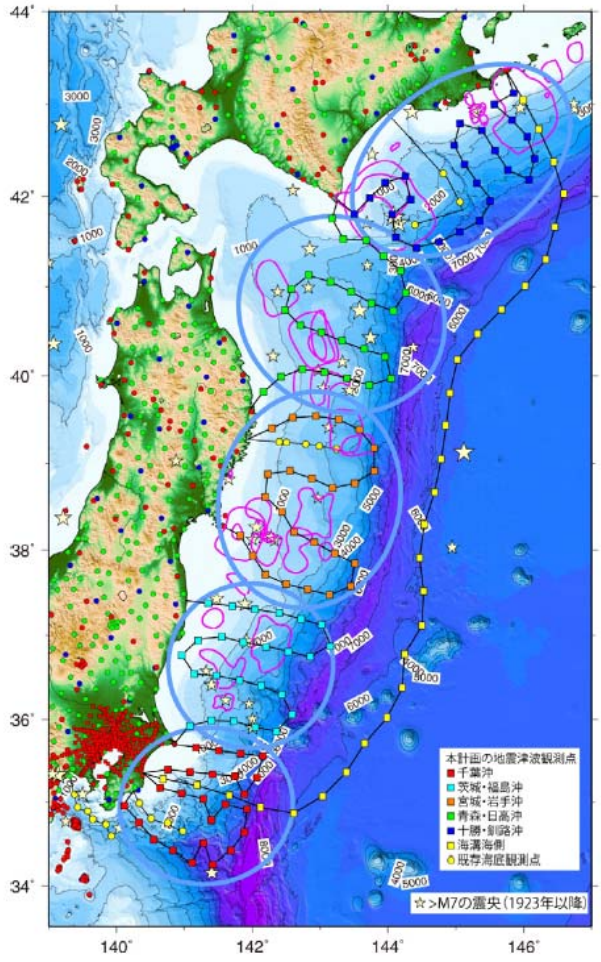
Steady Crustal Movements Caused by Subduction of Oceanic Plates

(vs Eurasian plate)



The velocity vectors detected by GPS/acoustic seafloor geodetic observations are generally consistent with those detected by on-land GPS measurements.

After M. Sato, Japan Coast Guard



Sea-Floor Cable Systems to be Installed in Northeastern Japan

- **Pressure Measurements: Monitoring of Vertical Movement of Sea-Floor**
- **Seismic Observations**

After HERP, MEXT

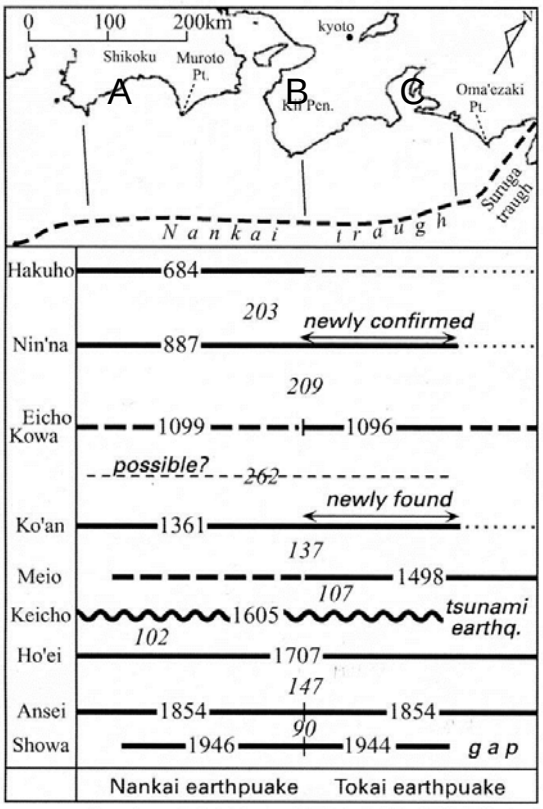
Next Mega-Thrust Earthquake in Japan?

Nankai Trough Earthquake

Probability of occurrence within 30 years
M8 ～ M9: 60 ～ 70%

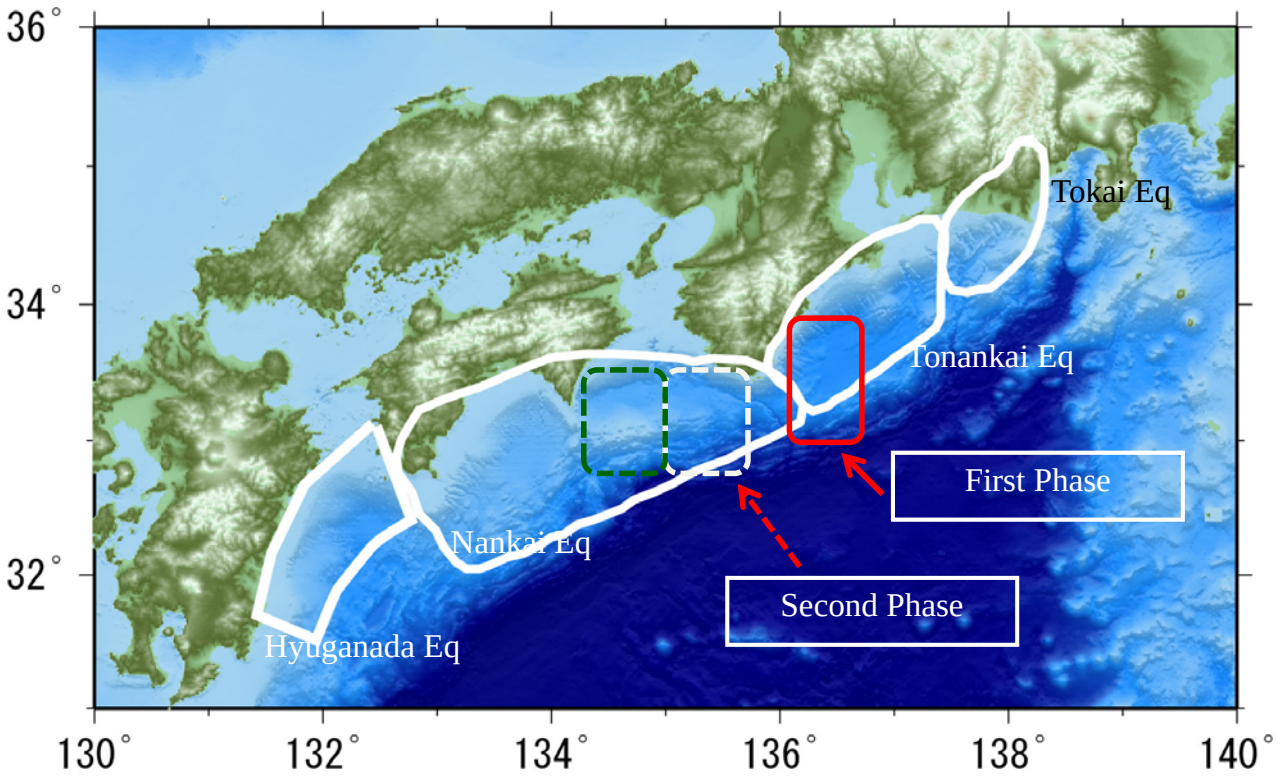
If a few earthquakes occur successively, what will be the time lag between them.

•1707	A – C	Mw 8.7	
•1854	B – C	Mw 8.4	32 hrs
	A	Mw 8.5	
•1944	B	Mw 8.2	2 yrs
1946	A	Mw 8.4	



After Y. Kaneda, JAMSTEC

Seafloor Cable Networks along the Nanakai Trough



After Y. Kaneda, JAMSTEC

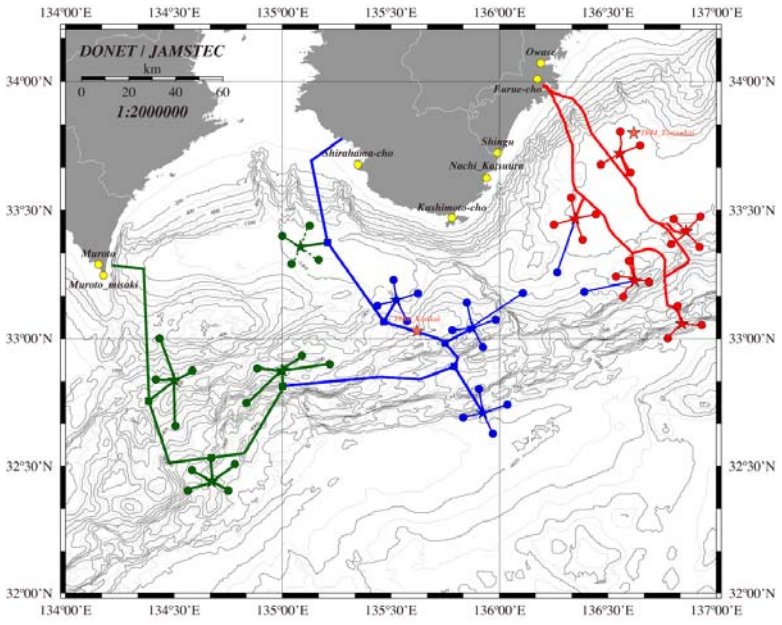
DONET-1 and DONET-2

○**DONET-2**
- First phase: 2011– 2015
- Second phase: 2016 – 2020

○**DONET-1** is in operation

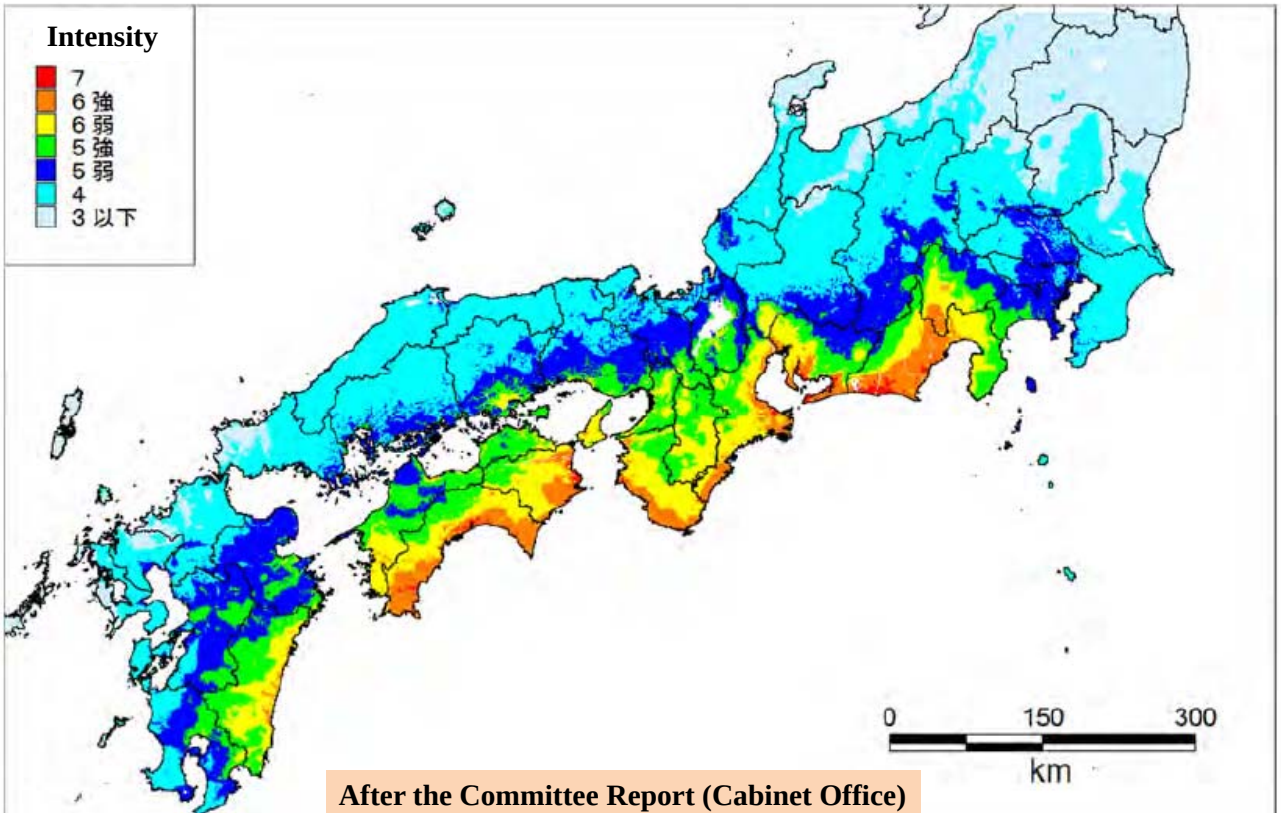
○Main Systems
(compared to DONET-1)

・Cable length:	350km	(250km)
・Branching:	7	(5)
・Node::	7	(5)
・Equipment:	28	(20)



After Y. Kaneda, JAMSTEC

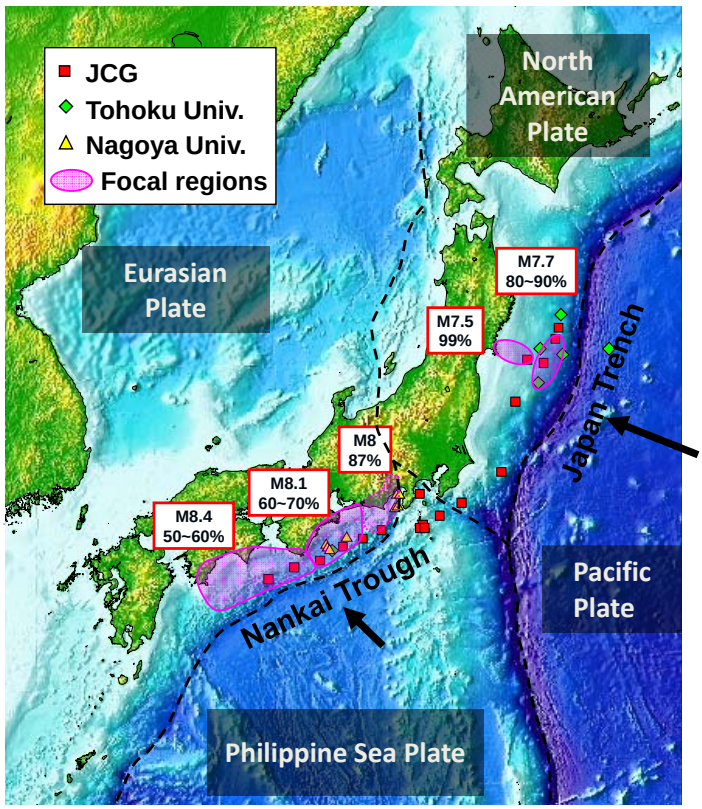
Project for Research on Earthquake Disaster Prevention in the Nankai Trough Region
→ Estimation of Strong Ground Motion by the Cabinet Office



After the Committee Report (Cabinet Office)

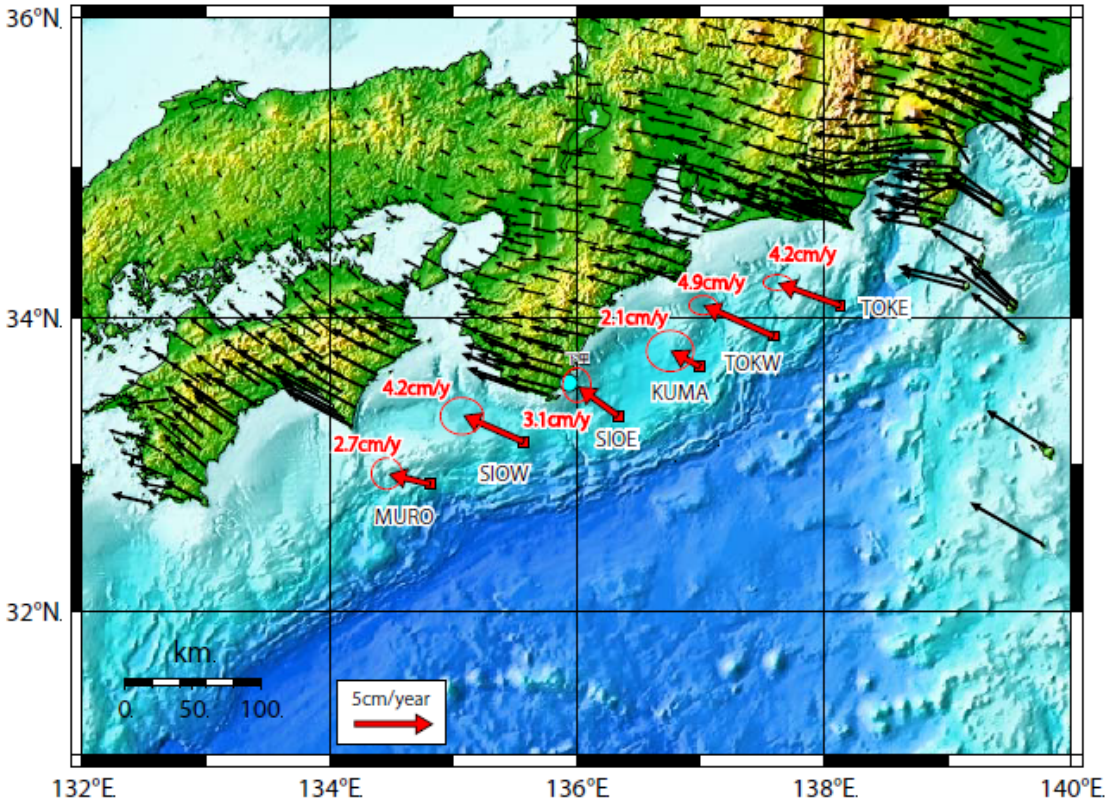
Distribution of Seafloor Observation Sites before the Tohoku Earthquake

- Landward slope of the Major trench
  - ・Japan Coast Guard : 18 about 100km interval
  - ・Tohoku Univ. : 6 mainly off Miyagi Pref.
  - ・Nagoya Univ. : 8 Suruga bay, Kumano basin
- Water depth 400 - 5500m

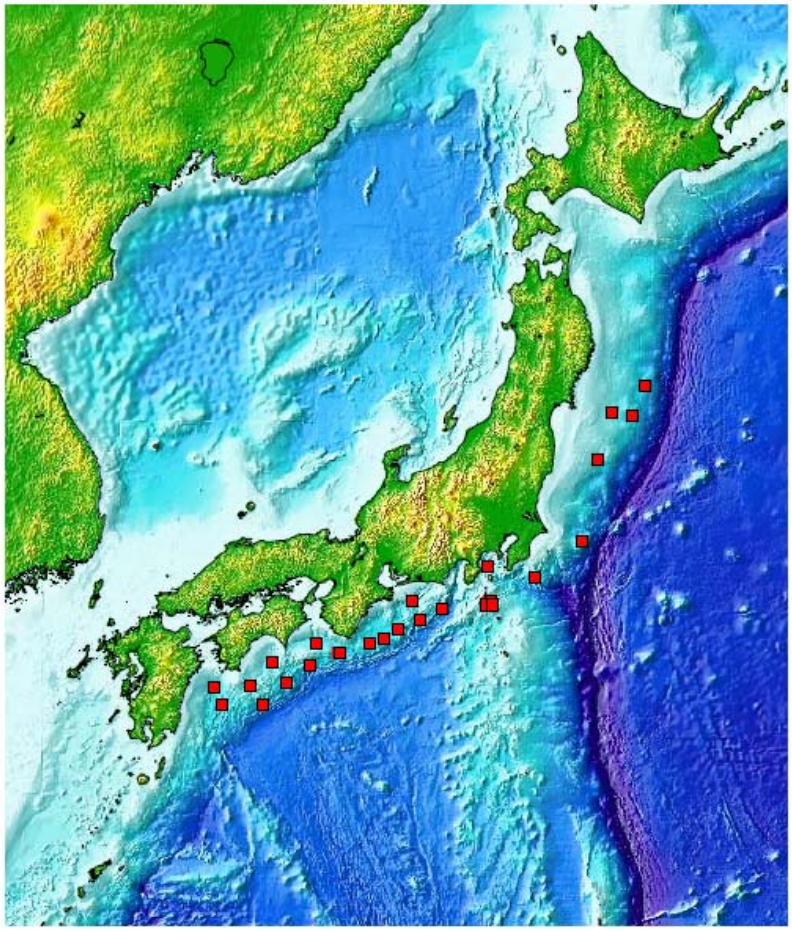


After M. Sato, Japan Coast Guard

Non-Uniform Distribution of Crustal Movement in the Nankai Trough Region



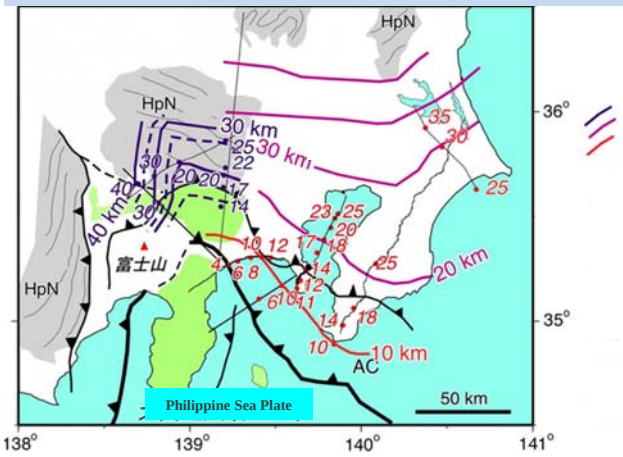
After M. Sato, Japan Coast Guard



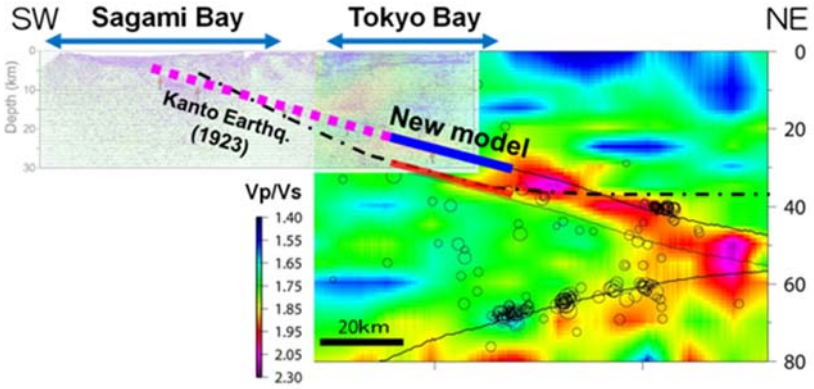
GPS/Acoustic Seafloor Geodetic Observations Intensified along the Nankai Trough After the 2011 Great Tohoku Earthquake

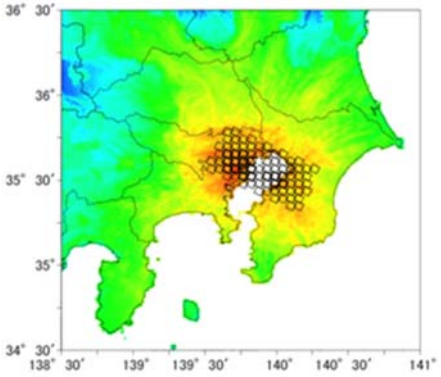
After HERP, MEXT

Project for Earthquake Disaster Prevention and Mitigation in the Metropolitan Area



Depth to Philippine Sea Plate (km)





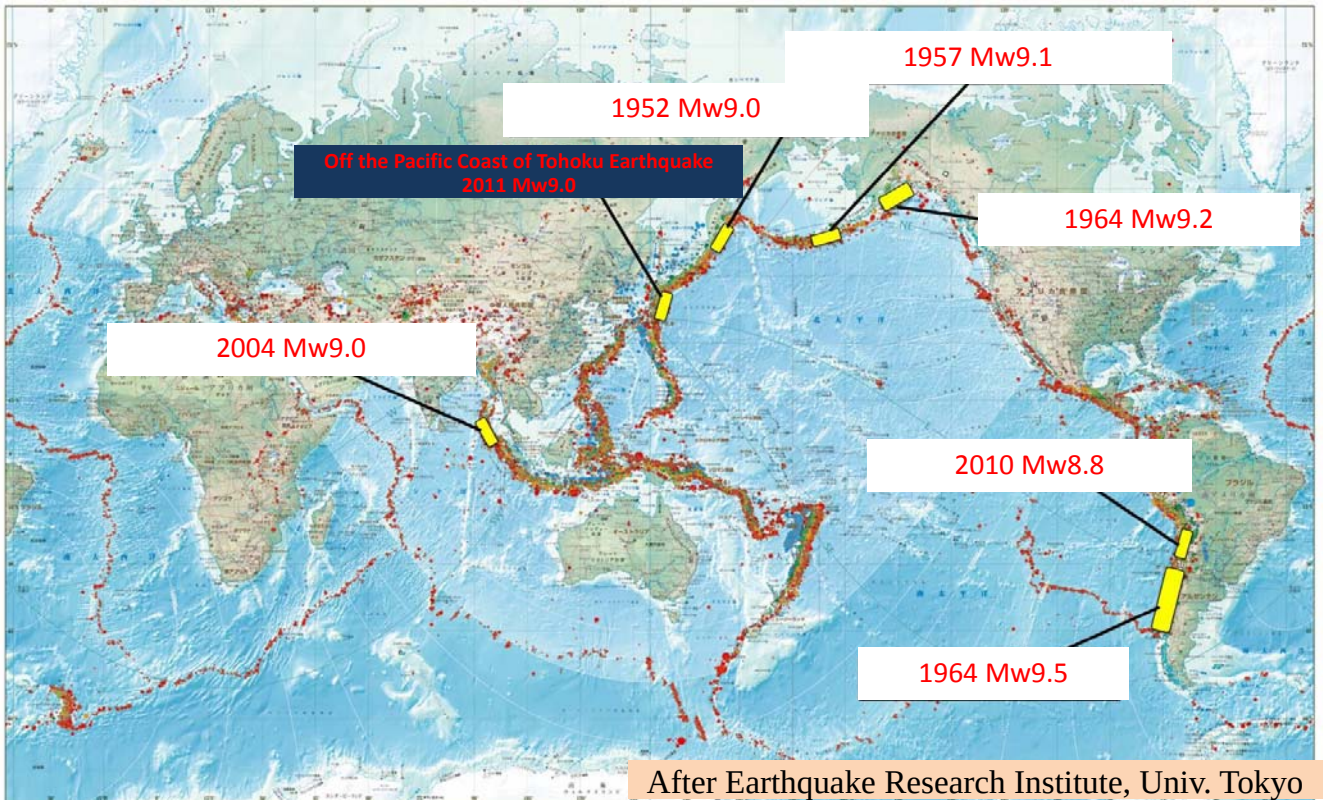
Estimation of Strong Ground Motion In the Tokyo Area

After Project Report

Project for Earthquake Disaster Prevention and Mitigation in the Metropolitan Area

After Project Report

World Seismicity Map



After Earthquake Research Institute, Univ. Tokyo

SATREPS Projects over the World
(39 countries, 77 projects)

Asia: 13 countries, 40 projects
Africa: 14 countries, 20 projects
Latin America/Caribbean: 8 countries, 13 projects
Other Regions: 4 countries, 4 projects

SATREPS Projects for Natural Disaster Prevention

- Research project on disaster prevention/mitigation measures against floods and storm surges in Bangladesh
- Integrated study on mitigation of multimodal disasters caused by ejection of volcanic products
- Earthquake and tsunami disaster mitigation in the Marmara region and disaster education in Turkey
- Development of landslide risk assessment technology and education in Vietnam and other areas in the Greater Mekong Sub-region
- Enhancement of technology to develop tsunami-resilient community
- Magmatic fluid supply into Lakes Nyos and Monoun, and mitigation of natural disasters in Cameroon
- Research and development for reducing geo-hazard damage in Malaysia caused by landslide & flood
- Enhancement of earthquake and volcano monitoring and effective utilization of disaster mitigation information in the Philippines
- Observational studies in South African mines to mitigate seismic risks
- Information network for natural disaster mitigation and recovery
- Enhancement of earthquake and tsunami disaster mitigation technology in Peru
- Risk identification and land-use planning for disaster mitigation of landslides and floods in Croatia
- Multi-disciplinary hazard reduction from earthquakes and volcanoes in Indonesia
- Study on GLOFs (Glacial Lake Outburst Floods) in the Bhutan Himalayas

JST: Strategic International Research Cooperative Program

＜J－RAPID＞

Cooperative Research Projects with France

- Quantitative assessment of nonlinear soil response during the great The 2011 off the Pacific coast of Tohoku Earthquake
- Dynamics of The 2011 off the Pacific coast of Tohoku Earthquake: from long term stress accumulation to asperities
- Crustal seismic velocity changes and deformation associated with The 2011 off the Pacific coast of Tohoku Earthquake
- Disaster Evacuation and Risk Perception in Democracies
- The 2011 off the Pacific coast of Tohoku Earthquake from Earth to Oceans and Space: a critical case-study to improve earthquake and tsunami anticipation
- Paleoseismology and paleotsunamis of the NE Japan subduction zone and relationships with The 2011 off the Pacific coast of Tohoku Earthquake: Constraints on the seismic cycle
- Interdisciplinary study on the mitigation of NaTech risks in a complex world: learning from Japan experience applying ERRA NaTech method, iNTeg-Risk project

Cooperative Research Projects with the U.S.

- Field Investigation on Humanitarian Logistic Practices under Cascading Disasters and a Persistent Threat: The Great Eastern Japan Earthquake
- Response to The 2011 off the Pacific coast of Tohoku Earthquake: Participation in Marine Geophysical Surveys of the Quake Rupture Zone
- Recovery Activities Using Underwater Robots in Tsunami- devastated Areas
- Site Characterization for Geotechnical Hazards Associated with Soil Liquefaction Prevailing in Kanto Region Based on Geotechnical Field Investigations
- Study on Design Method of Multistory Building Against Tsunami and Tsunami Debris
- IT Virtualization for Disaster Mitigation and Recovery
- Tsunami Reconnaissance of The 2011 off the Pacific coast of Tohoku Earthquake in Japan and Pacific Islands
- Evaluation of the Seismic Performance of Bridges during The Great Eastern Japan Earthquake
- US-Japan Collaborative Study on Seismic Damage of Buildings and their Mechanism

- US-Japan Collaborative Study on Seismic Damage of Buildings and their Mechanism
- US-Japan Collaborative Investigation of Geotechnical Problems Relating to The 2011 off the Pacific coast of Tohoku Earthquake
- Investigation on the Performance of Buildings with Structural Walls in The Great Eastern Japan Earthquake
- The Role of Urban Development Patterns in Mitigating the Effects of Tsunami Run-up
- Flow Dynamics/Morphological Impacts of The 2011 off the Pacific coast of Tohoku Earthquake Tsunami, Japan
- Evaluation of the potential of large aftershocks of The 2011 off the Pacific coast of Tohoku Earthquake
- Social Networking Services in the Crisis and Immediate Post-Catastrophe Response Processes

Cooperative Research Projects with Indonesia

- Urgent surveys for evacuation and measures from unexpected large tsunami

CONCERT JAPAN
Connecting and Coordinating European Research and Technology Development with Japan

Resilience Against Disasters

<Germany, Slovakia>
Increasing Resilience of Urban Planning (URBIPROOF)

<Romania, Austria, UK>
Road Networks for Earthquake Resilient Societies (ROADERS)

<Switzerland, Italy, Germany>
Resilience against Disasters Using Remote Sensing and Geoinformation Technologies for Rapid Mapping and Information Dissemination (RAPIDMAP)

<Turkey, Germany>
An Innovative Tie System for Improving the Monolithic Behavior of Masonry In-filled Reinforced Concrete Frames (INFILTIE)

<Norway, Germany, Turkey>
Risk Assessment and Design of Prevention Structures for Enhanced Tunami Disaster Resilience (RAPSODI)

Strategic International Research Cooperative Program with National Natural Science Foundation of China (NSFC) and Ministry of Science and Technology (MOST)

- **Research on the Seismic Evaluation and Mitigation Technology of Urban Super-tall Buildings**
- **Refined Analysis and Damage Control of Earthquake Disaster Impact on Bridge Structures**
- **Development of Massive Computation System for Evaluation and Mitigation of Earthquake Disaster Impact on Urban Area**
- **Sino-Japanese Comparative Research on Earthquake Catastrophe Management**
- **Paleoseismicity and Future Earthquake Potential of the Northeastern Portion of the Longmenshan Fault Zone and its Branches**

Final Comments

1. Occurrence of a large earthquake is often a rare event for one country and accumulation of knowledge and experiences is usually slow if it is closed within the country.
2. An effective way to overcome such a problem is to collaborate with other countries facing the same problem and share knowledge and experiences acquired in respective countries.
3. Formation of a sustainable researcher network is thus important for progress in earthquake and tsunami researches.

I hope this symposium will be an important step towards more strong partnership between Latin American countries and Japan, as well as among countries in Latin America.

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March 7, 2014

Thank you for your attention