2012.Mar.14
JICA/JST/NIED Symposium

JMA tsunami warning improvement plan

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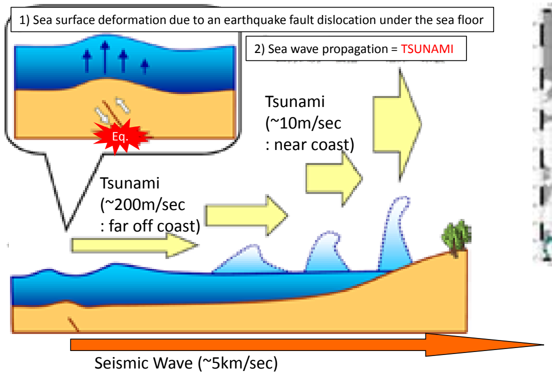
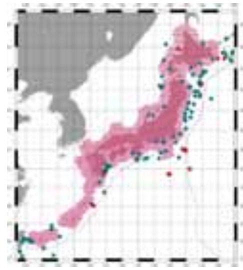
Technical Principle of Tsunami Warning





About 40% of near-Japan tsunamigenic earthquakes have caused tsunami that struck coast within 20 minutes.

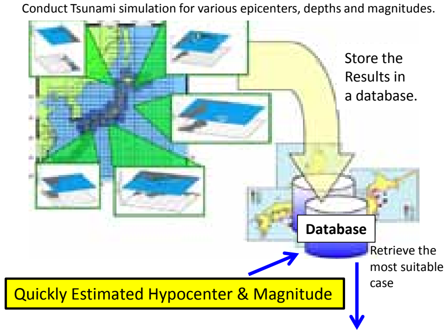
Prompt Tsunami Warning dissemination is essential to ensure max. time for evacuation, which can be realized only by taking advantage of propagation velocity difference between seismic and tsunami waves. Tsunami height can be forecast by the seismic wave analysis. -> Tsunami Warning

Warning should be updated with improved accuracy by using as many available seismic & sea level data as possible.

Tsunami Warning Dissemination

Establishment of Tsunami Simulation Database

Conduct Tsunami simulation for various epicenters, depths and magnitudes.



Quickly Estimated Hypocenter & Magnitude

Forecast Grade		Levels of Estimated Tsunami Amplitude
Warning	Major Tsunami	3 m, 4 m, 6 m, 8 m, 10 m or greater
	Tsunami	1 m, 2 m
Advisory		0.5 m

Disseminate the first warning in 3 minutes

Tsunami forecast block

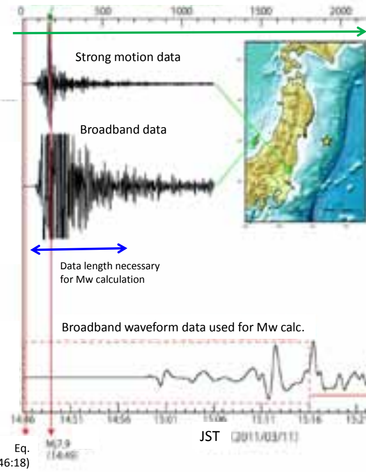
66 coastal blocks in total (basically, one for a prefecture)

Magnitude estimation on 11th of March and its problem

Calculated Mj (JMA magnitude) = 7.9 in 3 minutes to disseminate the first tsunami warning by using strong motion data.

Failed to calculate Mw (Moment magnitude) automatically in 15 minutes due to waveform data over-scale for most of the domestic broadband seismometers, and consequently, could NOT update the warning.

Collected unsaturated oversea broadband waveform data, and calculated Mw = 8.8 in 54 minutes. That was too late for the warning update based on the seismic data.



JMA evaluated Mj=7.9 as reasonable because the value was close to that of anticipated "Off the coast of Miyagi Eq." (7.5 to 8.0), and disseminated the first warning in 3 minutes.

JMA adopts two magnitude calculation methods, Mj and Mw. They are complementary to each other.

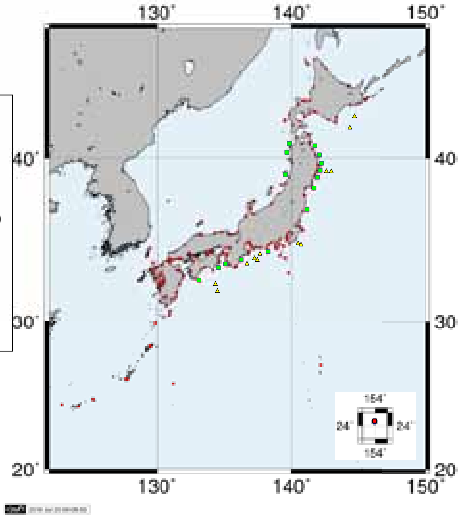
Mj : Quick!, but prone to underestimate for gigantic and/or tsunami earthquakes.
Mw : Accurate even for gigantic and/or tsunami earthquakes, but a longer time is necessary for calculation.

Focal mechanism

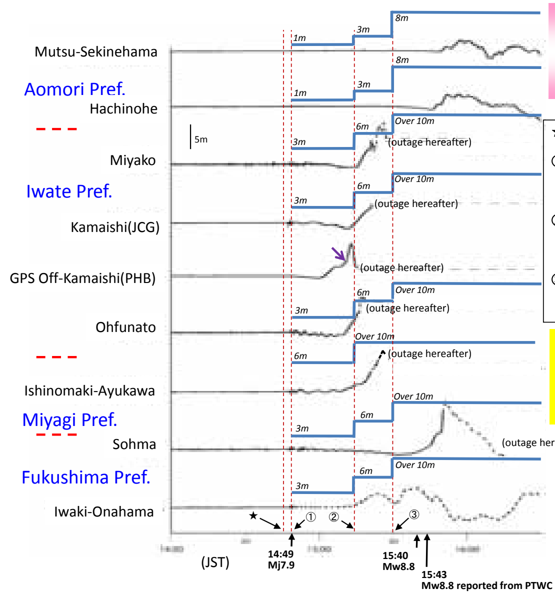
Sea Level Monitoring Stations (all are collected at JMA in realtime)

- Tide Gauge(172)
  - ・JMA(76)
  - ・JCG(20)
  - ・Port & Harbor Bureau(55)
  - ・GSI(14)
  - ・Cabinet Office(1)
  - ・Municipality, Private sector(6)
- Offshore Tsunami meter
  - GPS type(PHB)(15)
  - Pressure sensor(12)
    - ・JMA(6)
    - ・ERI(2)
    - ・JAMSTEC(4)

As of 2011.Oct.11



Tsunami Warning Updates
(Aomori to Fukushima Pref.)



★3/11 14:46 Eq. Occurrence

①3/11 14:49 Tsunami Warning Dissemination
Iwate 3m, Miyagi 6m, Fukushima 3m (Major Tsunami), Pacific coast of Aomori 1m (Tsunami)

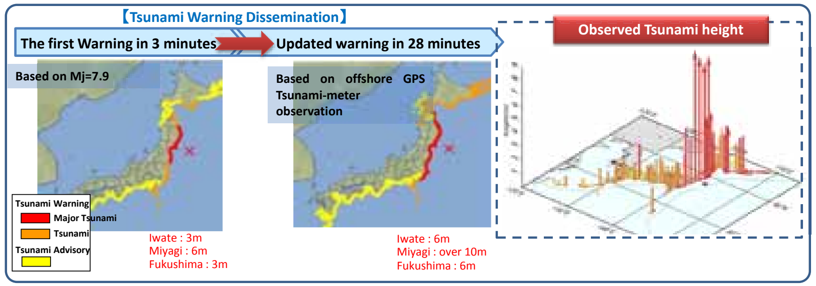
②3/11 15:14 Tsunami Warning Update
Iwate 6m, Miyagi over10m, Fukushima 6m, Pacific coast of Aomori 3m (Major Tsunami)

③3/11 15:30 Tsunami Warning Update
Iwate to Boso-peninsula over10m, Pacific coast of Aomori 8m (Major Tsunami)

JMA updated Tsunami Warning NOT by earthquake magnitude estimation, but by observed tsunami heights at GPS Tsunami meters and tide gauges.

Monitored in realtime
Recovered data by on-site inspection
Forecast Tsunami height

Problems of Tsunami Warning for Off the Pacific Coast of Tohoku Eq.



Major Problems

Sub.-1 Underestimation of earthquake magnitude used in the first tsunami warning in 3 minutes.
Sub.-2 Announced tsunami height estimate "3m" led to delays in evacuation.
Sub.-3 Failure in the prompt earthquake magnitude examination by Mw due to over-scale of domestic broadband seismometers, and insufficient warning update technology by using offshore Tsunami-meter (Pressure sensors data more offshore than GPS-type could not be used for the update) .
Sub.-4 Announced tsunami height observation "the initial wave height 0.2m" led to delays/interruptions in evacuation.

Investigated measures for Tsunami Warning improvement, in cooperation with intelligent persons, municipalities, broadcasting companies and other relevant organizations.

Principle policy to investigate how to improve Tsunami Warning

1 Early Warning and Update

・Disseminate the first warning as soon as possible. (as before)
・Update the warning with improved accuracy by using as many available seismic & sea level data as possible. (as before)
・Consider a possibility that updated warnings can not reach to residents due to power or communication link failure. → The first warning is important!

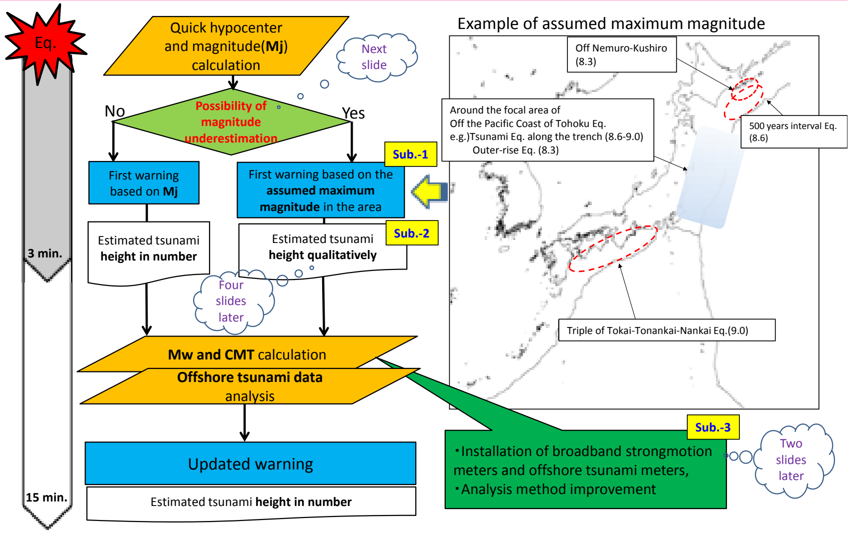
2 Safe Side Warning

Transmit the worst possible case within an uncertainty of tsunami height estimate due to an uncertainty of initial tsunami source estimate.

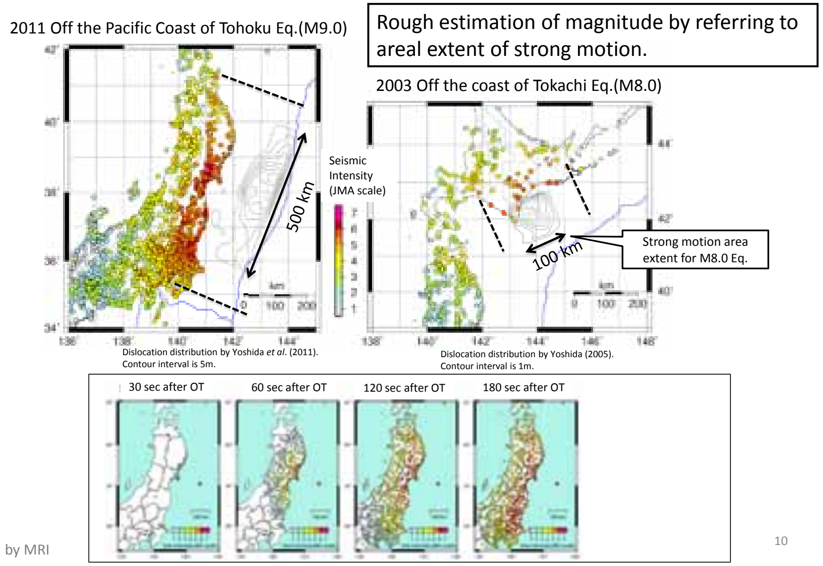
Enable to disseminate proper tsunami warning even to very rare gigantic earthquakes, while making public relations activities on the importance of "self-protection" (run to a high place when you feel a strong shaking near a coast without confirming JMA's warning!).

At the same time, improve the accuracy of warning for frequent M<8 earthquake to get reliance of residents on the warning.

General flow of planned improved Tsunami Warning Dissemination

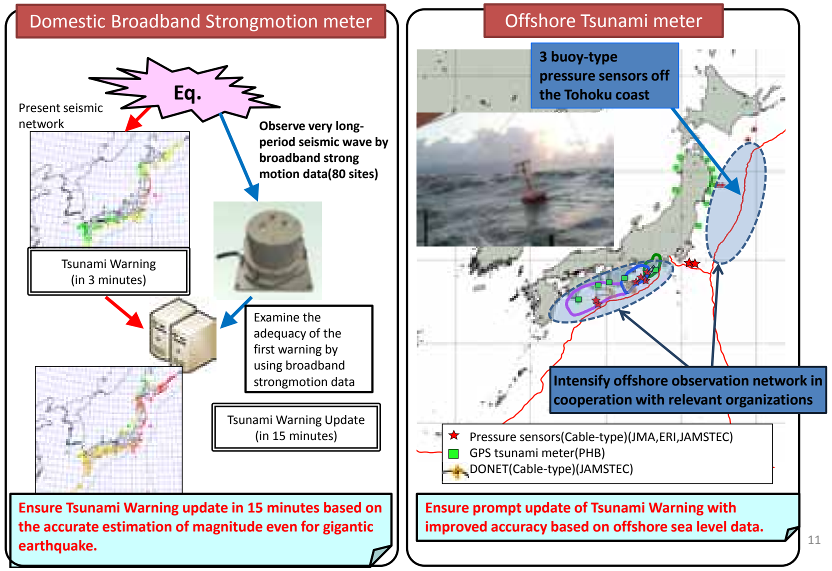


Example of monitoring method to recognize earthquake magnitude underestimation



by MRI

Deployment of broadband strongmotion meter & offshore tsunami meter

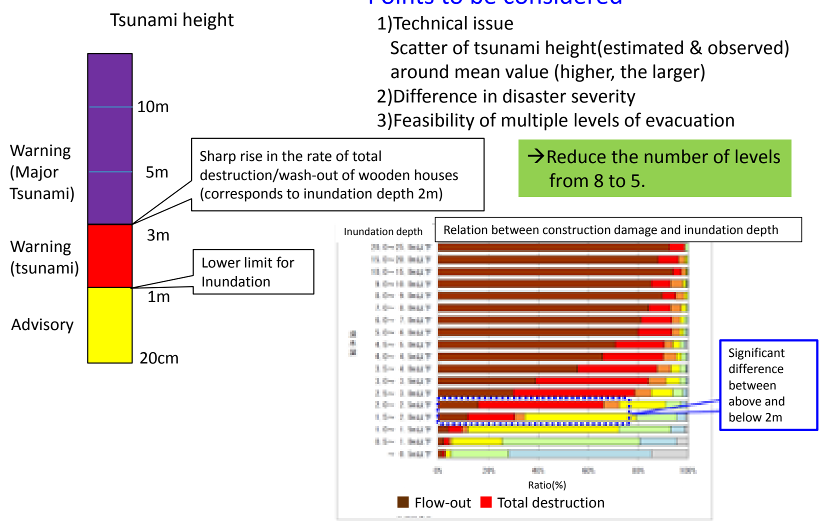


Examination of tsunami warning/advisory criteria and levels of estimated tsunami height

Points to be considered

1)Technical issue
Scatter of tsunami height(estimated & observed) around mean value (higher, the larger)
2)Difference in disaster severity
3)Feasibility of multiple levels of evacuation

→Reduce the number of levels from 8 to 5.



Improvements in Warning & Information Statement

○ Warning/Advisory criteria and levels of estimated tsunami height

present

Forecast Grade		Levels of Estimated Tsunami Amplitude
Warning	Major Tsunami	3 m, 4 m, 6 m, 8 m, 10 m or greater
	Tsunami	1 m, 2 m
Advisory		0.5 m

Improved

Upper bound of each level

In case of possible magnitude underestimation

Sub.-2

Levels of estimated Tsunami height	Expression In Number	Expression Qualitative
10m < H	Over 10m	Huge
5m < H <= 10m	10m	Huge
3m < H <= 5m	5m	Huge
1m < H <= 3m	3m	High
20cm <= H <= 1m	1m	(---)

○ Tsunami observation information Sub.-4

・Report the arrival time and initial polarity of tsunami, because the fact that "tsunami has arrived" is important to urge residents to evacuate.

・Report the height of tsunami **only after** the height grows larger than the criteria height of one grade below the presently valid warning/advisory. (i.e. 1m when the Major Tsunami is valid)
While the height is smaller than the threshold above, expression is just "now observing", not to give residents an underestimating threat.

○ Information on the offshore tsunami observation

Establish a new information on the offshore tsunami observation(independently issued from coastal observation information) to emphasize its importance.

Scenario of Tsunami Warning for a huge Eq. anticipated along the Nankai-trough after the improvement

Earthquake Early Warning

Judgement on gigantic Eq.

Detailed Analysis

GPS-type, Pressure-type, coastal tsunami meters data watch → Warning Update if necessary

Eq.

3 min.

15 min.

40 min.

M8.0 Off Wakayama Pref., Mj8.0

Mw8.7

Mw8.7

time

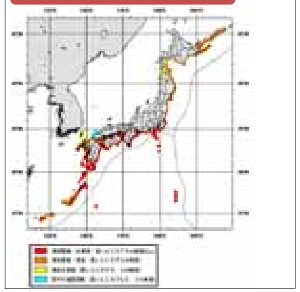
Mw and CMT Calc.

Judge the possibility of magnitude underestimation, and disseminate the first warning based on the assumed maximum magnitude of the area(9.0).

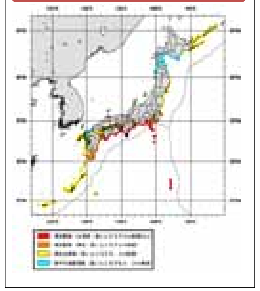
Warning Update if necessary

Improvements

Tsunami Warning for M9.0



Cf. Tsunami Warning for M8.0



Other important issues

1) Closer link between Tsunami Warning and Hazard Map

2) Secure warning/information transmission route to residents at risk
→ cooperation with telecommunication companies and municipalities

3) Education on Tsunami Disaster Mitigation
・"Self-Protection" is the basis!
・Physical properties of Tsunami
Strikes repeatedly, initial wave is not always the biggest, etc.
・Philosophy of the "Tsunami Warning"
Its meaning(How severe the disaster will be)
Not just a forecast, but transmits the worst possible case within an uncertainty
(Show reasons why an estimation has an uncertainty)
Updated with improved accuracy

<< Summary >>

○ The First Warning
・Disseminate in 3 minutes.
・In case a possibility of magnitude(Mj) underestimation is recognized, the first warning is disseminated based on the assumed maximum magnitude of the area, and estimated tsunami height is mentioned just qualitatively as an emergency message.

○ Warning Update
・To secure the update of the first warning in 15 minutes based on Mw(& CMT), broadband strongmotion meters are deployed.
・For earlier and more accurate update of the warning, offshore tsunami meters are deployed in cooperation with relevant organizations.
・Develop/Improve seismic and sea-level data analysis method for warning update.

○ Warning/Information statements
・Reduce the number of levels of estimated tsunami height from 8 to 5, considering the scatter of tsunami height, and for closer linkage of warning to Hazard Map.
・Observed tsunami height is NOT reported in number while the height is small, not to give underestimating threat to residents.

○ Disaster Mitigation Education
・Education and Public relations activity are very important for more effective disaster mitigation.

Multi-disciplinary Hazard Reduction Program from Earthquakes and Volcanoes in Indonesia

Science and Technology Research Partnership for Sustainable Development (SATREPS)

Kenji Satake, University of Tokyo
Hery Harjono, Indonesian Institute of Science

Earthquakes with > 1,000 fatalities in last decade

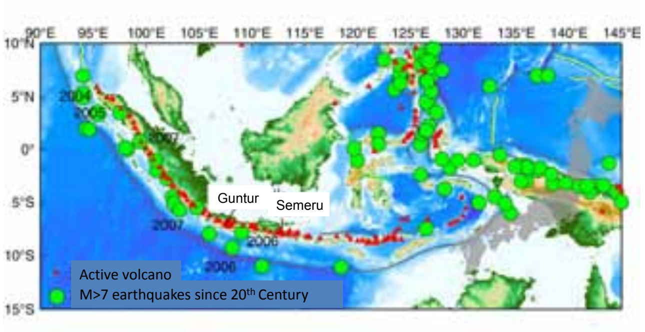
Date	Region	M	Fatalities
2011/3/11	Tohoku, Japan	9.0	20,896
2010/1/12	Haiti	7.0	222,570
2009/9/30	Padang, Indonesia	7.5	1,117
2008/5/12	Sichuan, China	7.9	87,587
2006/5/26	Java (Jogjakarta), Indonesia	6.3	5,749
2005/10/8	Kashmir, Pakistan	7.6	86,000
2005/3/28	Sumatra (Nias), Indonesia	8.6	1,313
2004/12/26	Sumatra (Aceh), Indonesia	9.1	227,898
2003/12/26	Bam, Iran	6.6	31,000
2003/5/21	Algeria	6.8	2,266
2002/3/25	Afghanistan	6.1	1,000
2001/1/26	Bhuj (Gujarat), India	7.6	20,023

Of these 12 events, 10 occurred in Asia and 4 in Indonesia

Indonesia and Japan

Similarities
- -Tectonic background: subduction zone
- -Large population
- -Need and interest for disaster mitigation

Differences
- -Social and cultural background
- -Scientific achievements for disaster mitigation



Indonesia and Japan

Many government sectors involved in natural disaster reduction
→overarching network is needed (top down, bottom up)

Indonesia	Japan
RISTEK	MEXT
DIKNAS	MEXT
ESDM	METI
DKP	MAFF
PU	MILT
KOMINFO	MIC
DEPDAGRI	MIC
LIPI	JSPS
BPPT	JST
BNPB	CO
BMKG	JMA
BAKOSURTANAL	GSI
LAPAN	JAXA

Governmental Committee

Central Disaster Management Council

Headquarter of Earthquake research Promotion

BNPB

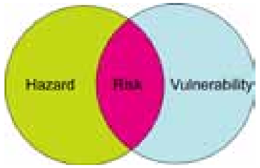
Researcher's Committee

Disaster Research Forum

Earthquake and Volcanic Eruption Prediction Consortium

Natural Disaster Res. Consotrium

Multi-disciplinary Hazard Reduction Program from Earthquakes and Volcanoes in Indonesia



Disaster Risk =
Natural Hazard X Society's Vulnerability

Scientific Observations — Infrastructure

Research

(1) Eq. Forecast
(2) Volcanic eruption

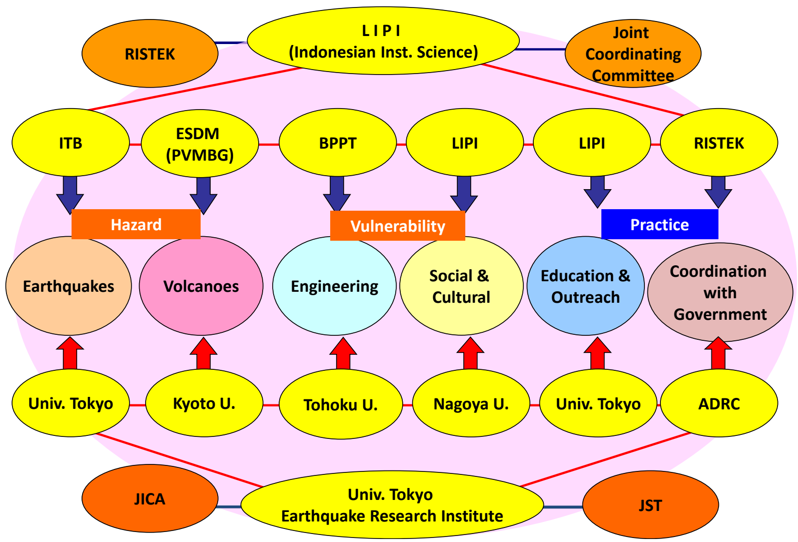
(3) Engineering
(4) Social Sciences

(5) Education and Awareness

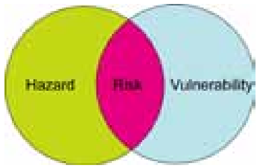
Practice

(6) Coordination with Governments

Project Structure



Multi-disciplinary Hazard Reduction Program from Earthquakes and Volcanoes in Indonesia

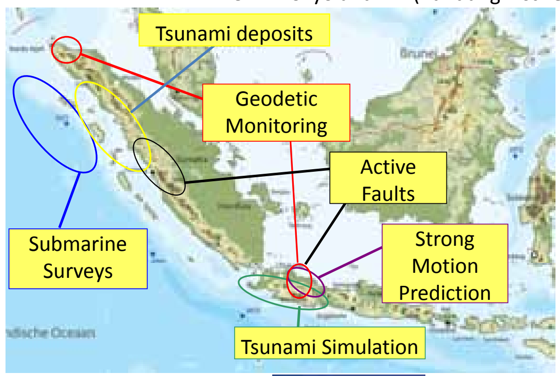


Disaster Risk =
Natural Hazard X Society's Vulnerability

	Subgroups	Japanese members	Indonesian members
Earthquakes	6	55	29
Volcanic eruptions	4	19	21
Engineering	4	23	15
Social sciences	4	24	13
Disaster education	3	22	27
Total	21	143	105

Group 1: Earthquake and Tsunami Forecast

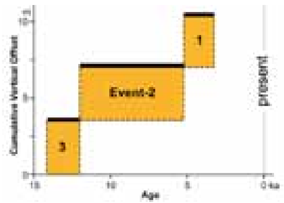
Univ. Tokyo and ITB (Bandung Inst Tech)



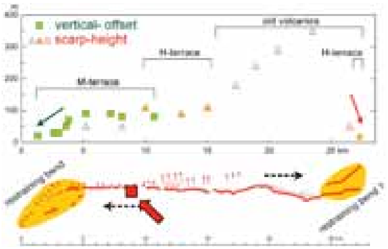
1-1 Paleoseismicitiy and long-term evaluation of earthquake occurrence of Lembang Fault, West Java

Active fault survey near Bandung
・Fault segment of 27-km long
・Recurrence interval of faulting: 3.5-5.5 ky
・Most recent event occurred 3-5 ky ago

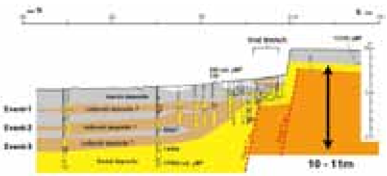
Long-term evaluation of large earthquake
・Earthquake magnitude: ～*M* 7
・Earthquake probability: 0.1-5 % in 30 years



Paleoseismicity of the fault



Geometry and displacement along the fault



Geological section of a fault scarp
・3 colluvial deposits related to faulting
・Cumulative slip: 10-11m since 12-14 ka

1-2 Study of historical earthquakes based on tsunami deposit and coastal geology

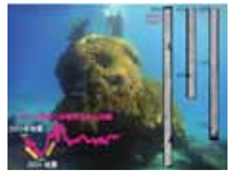
Tsunami Deposits

- Modern and paleo tsunami deposits on west coast of Sumatra
- In Lampuuk, Aceh, two paleo-tsunami layers, inundated several km, dated between 16th and early 19th C
- The 1797 tsunami was large enough to affect the wide area along the central to northern Sumatra.

The 2004 and paleo-tsunami deposits in Lampuuk, Aceh, Sumatra Is.

Coral Drilling

- Underwater drilling of massive *Porites* colony in S. Pagai Is., Mentaiwai Is., Sumatra, and Simeulue
- Clear density bands (annual bands) in coral cores show environmental changes since 1750's
- Geochemical analysis to reconstruct water depth changes due to earthquakes



Underwater drilling of a coral, X-radiographs. and time series of carbon isotope

1-3 Crustal deformation monitoring using space geodesy and gravity

Crustal deformation using GPS

(1) Post-seismic relaxation of 2004 earthquake in Aceh
(2) Shallow coupling and deep slow-slip of Sumatra fault
(3) Locking depth of Lembang-Baribis faults in west Java
(4) Continuous GPS observations in Aceh and west Java

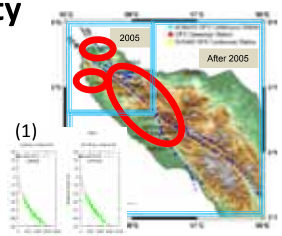
Gravity surveys in Java Island

(5) A10 Absolute Gravimeter in Jakarta, Bandung and Semarang showed vertical ground vertical motions

InSAR analysis

(6) Land subsidence around Semarang area

(1)



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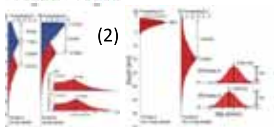

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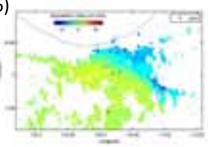

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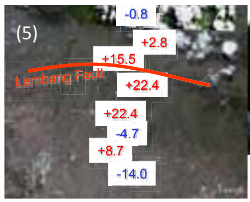

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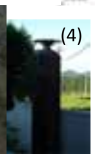

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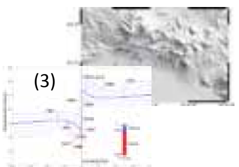


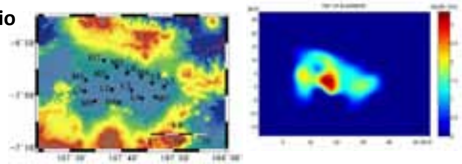
1-4 Strong motion prediction

Strong motion prediction for scenario earthquake in Bandung Basin

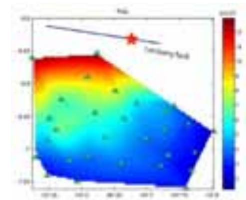
(1) Microtremor survey at 30 sites in the Bandung Basin
(2) 3D velocity structure model
(3) Scenario eq for Lembang fault
(4) Strong motion prediction

Verification of source model

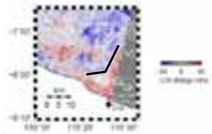
(5) A source inversion using seismic and SAR data for the 2006 Jogjakarta earthquake

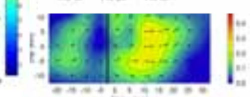


(1) Microtremor survey in the Bandung Basin (left)
(2) Estimated 3D velocity structure (basement depth, Right).



(4) Strong ground motion of Bandung basin from a scenario eq. on Lembang fault





(5) SAR interferometry and source fault for the 2006 Jogjakarta eq.(top) The slip distribution from seismic and SAR data (bottom)

1-5 Submarine active faults off NW Sumatra

Present distribution and activity of submarine active faults

- MNBS survey found numerous thrust faults and thrust-related folds parallel trench
- High-resolution MCS survey confirmed :

i. these thrust faults and thrust-related folds were more active toward the trench

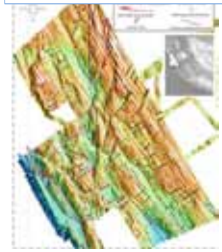
ii. a thrust (splay) fault in the middle of the outer-arc high was recently active

iii. thick sediments were scraped off the oceanic plate and thrust up on the island arc crust

Paleoseismology of submarine active faults

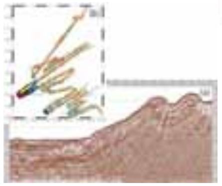
(1) Turbidites from Sumatra forearc indicate averaged recurrence interval of 330 years

(2) Grain composition, grain size, and grain fabric as criteria distinguishing between event deposits (turbidite mud) and normal deposits (hemipelagic mud).

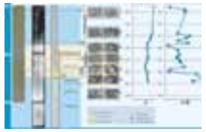


Distribution of active submarine faults, geologically identified from detailed

Thick sediments thrust up on the island arc crust



Tentative correlation of turbidites in the piston cores collected from the Sumatra forearc region



Classification between hemipelagic mud and turbid mud in the Sumatra forearc region

1-6 Prediction of tsunami using numerical simulation

Evaluation of tsunami risk at Pelabuhanratu

(1) Bathymetry and topography survey

(2) Tsunami run-up simulation of a scenario earthquake (Mw8.5) off Java

(3) Tsunami hazard map by the local government for evacuation area and evacuation

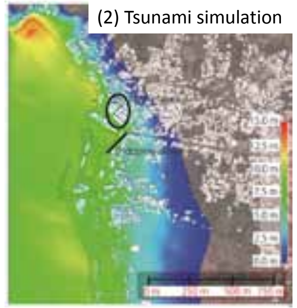
(4) Results were published in JDR

Evaluation of tsunami at Pangandaran and Cilacap

(5) Bathymetry and topography surveys

(6) Numerical simulation for the 2006 earthquake

(7) Tsunami run-up simulation of a scenario earthquake at earthquake at Cilacap



(2) Tsunami simulation

(3) Hazard map

The 2010 Mentawai earthquake and tsunami: Survey and modeling

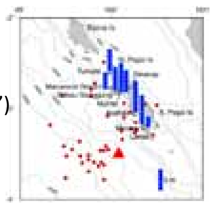
Tsunami damage (400 death) from M 7.2 earthquake

Joint field survey of Groups 1,3 and 6 (2 weeks after eq.)

- Tsunami warning of BMKG did not reach affected coasts
- Tsunami heights: 4 – 7 m
- Weak ground shaking, large tsunami (“tsunami earthquake”)
- Survey results were submitted to UNESCO and GOI

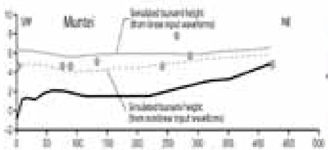
Modeling and Simulation

- Max slip ~ 3m near trench axis
- This model produced measured inundation
- The results submitted to international Journal (Pageoph)

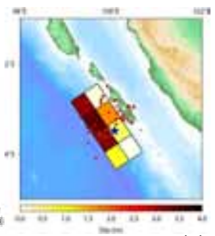


Measured tsunami heights

Damage in Muntei



Measured and computed tsunami



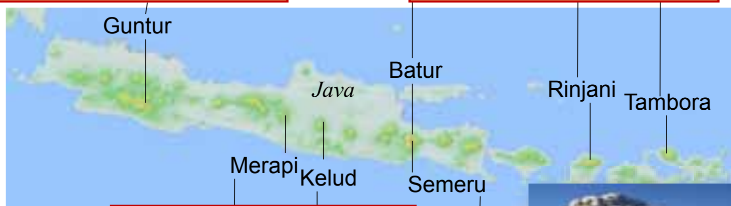
Tsunami source model

Group 2: Volcanic Eruption Forecast

Kyoto Univ. and PVMBG

Mid- and Long-term forecast and activity monitoring

Very large eruption: space and temporal distribution



Development of evaluation method of volcanic activity

Short-term prediction and eruption mechanism

Lava dome in Kelud volcano

Eruption of Semeru volcano

2-1 Mechanism of volcanic explosion and short-term prediction

Tilt observation at Semeru volcano

Tilt observation to predict the magnitude and styles of volcanic explosions. Further investigations to improve reliability.

1. **Eruption style**

   Vulcanian explosion

   Volcano starts to inflate about 200-300s before each eruption. The inflation accelerates with time, suggesting gas volume expansion in magma.

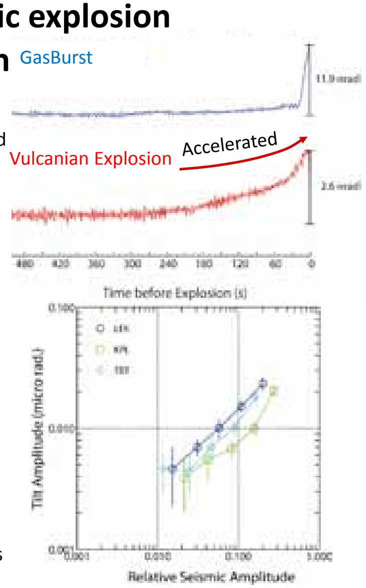
   Gas burst

   Volcano constantly inflates about 20s before each burst.

2. **Eruption magnitude**

   Large explosions with large seismic follow large inflations.

The results published in international journals (Bull. Volcanology and JDR)

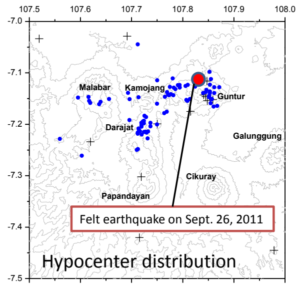


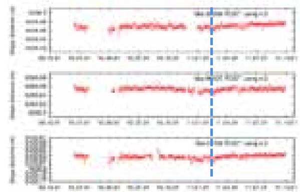
2-2 Long-term prediction and tectonics

Seismic observation (Guntur, Sinabung)
Detection of ground deformation of volcanoes by GPS (Guntur, Sinabung and Merapi)

Result and evaluation of volcanic activity
・Seismicity in 3 hydrothermal areas around Guntur
・Detection of inflation of Guntur 5 months before seismic crisis in September 2011 → Repeat of magma intrusion
・No ground deformation at Sinabung → No precursor to magmatic eruption
・Restart of inflation of Merapi after the 2010 eruption → Entering into preparation stage of forthcoming eruption
・Published in JDR

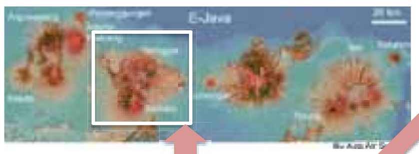
Outcome
・Utilized for alert level issued by PVMBG and enhancement of monitoring
・Feedback to prediction and evaluation of volcanoes in Japan

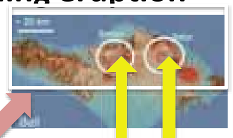




Inflation of Guntur volcano

2-3 Geological evaluation of frequency and process of caldera-forming eruption

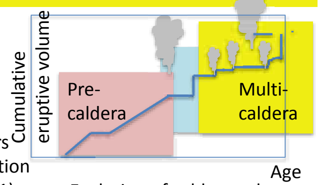




2-3-2. Temporal and spatial frequency of caldera-forming eruptions (K-Ar age dating)
Bali: Pre-caldera stage active periods at[~ 0.5 Ma] and [< 0.2 Ma].
Tengger caldera region: Two caldera-formations older than 0.3 Ma

2-3-1. Explosive eruptions associated with Batur and Bratan calderas (stratigraphy and 14C dating)
Large volume eruptions with pyroclastic flow [5 times in Batur], and [3 times in Bratan] during 29 -6 ka. 10 plinian eruptions of intermediate volume

2-3-3. Long-term precursor to caldera-forming eruption:
Decrease in eruption rate, increase in SiO2 and ratio of explosions (5-10k years before).



Evolution of caldera volcano

Output: Review paper, and (in prep.) international papers
Outcome: Capacity building in field survey, and contribution to hazard mitigation for global eruptions in WS (G-EVER 1)

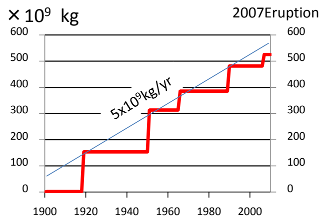
2-4 Evaluation of volcanic activity and proposal

Investigation of volcanic activity of Kelud volcano in the past and at present
Joint report of G2-4 and G4-4 to two regencies around Kelud volcano

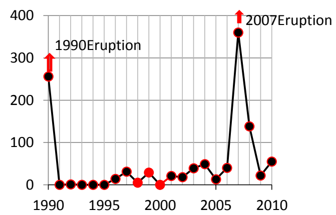
Evaluation of volcanic activity of Kelud
・Lava dome extruded by the 2007 eruption was much smaller than the volume expected from magma production rate in the 20th century
・Number of volcanic earthquakes after the 2007 eruption has turned into increase in 2010.
→Magma supply and storage has already started, and Kelud volcano may erupt in a decade.

Proposal
Eruption scenarios, volcano monitoring and countermeasure s to mitigate volcanic disaster to ward eruption in near future are explained to PVMBG and two regencies.

Published in JDR



Cumulative mass of magma ejected by eruptions at Kelud volcano



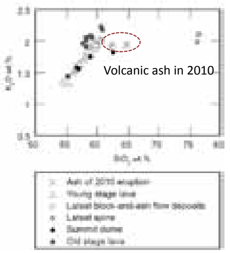
Annual number of earthquakes

Quick response to 2010 Sinabung & Merapi eruptions

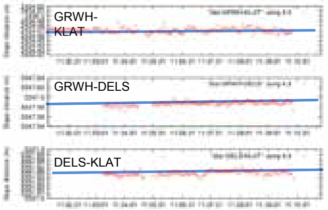
・Sinabung: experts, geophysical observation (6 seismometers, 4 GPS), geological survey and dating
・Merapi: experts, observation (4 GPS), ion-chromatograph, collaboration of JDR team

Observation results and evaluation
・2010 eruption of Sinabung is phreatic.
・History of eruptions and eruption scenario
・ No ground deformation at Sinabung → No precursor to magmatic eruption
・Merapi: Drastic change of chemistry of deposits between October and November→Change in conduit system and long-term activity
・ Restart of inflation after the 2010 eruption → Restart of accumulation of magma

Outcome
・Utilized for alert level issued by PVMBG and enhancement of monitoring
・Report to vice-president of Indonesia



SiO_2-K_2O diagram for Sinabung product



Restart of inflation of Merapi

Group 3: Engineering Approach for Reducing Vulnerability

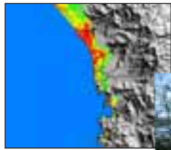
Tohoku Univ. and BPPT

3-1 Effective use of tsunami hazard map
Official hazard map in Padang

3-2 Coastal vegetation for tsunami
Tsunami forest:
field test, lab test, simulation

3-3 Liquefaction mitigation
Ground condition measurements
Liquefaction hazard maps

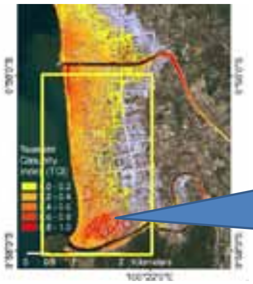
3-4 Building code and retrofitting bldgs
PP band method




3-1 Effective use of tsunami hazard map

Padang: Seismic gap
Tsunami hazard maps made by various agencies
6 kinds → Discussion for official hazard map

2009 Padang earthquake (depth 80 km, 1000 deaths)
- Many tsunami evacuation buildings were collapsed
- New tsunami evacuation buildings were assigned
- Evacuation index: evacuation capacity based on flow speed and arrival time



Tsunami evacuation bldg

Heavily damaged in 2009

3-2 Reduction of tsunami damage through the practical use of vegetation

(1) Field test at Pariaman
- Casuarina
- Measurements of felt trees

(2) Indoor experiments at BPPT
- Measurement of bore typed tsunami

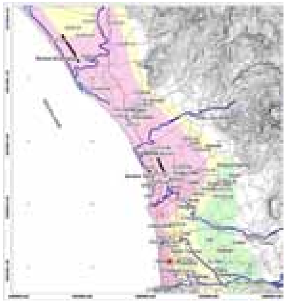
(3) Numerical analysis of green belt
- Guidelines

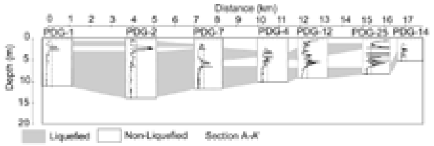
(4) Tsunami surveys in Mentawai
- Tsunami damage and effects of trees

3-3 Technology development for mitigating hazards due to liquefaction

In Bantul and Padang
・Microtremor measurements
・Geotechnical drilling
・Liquefaction from 2009 Eq.

Liquefaction potential map

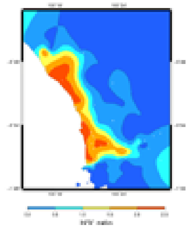




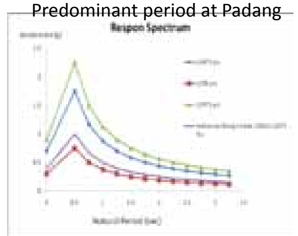
3-4 Investigation of design ground motion and implementation of earthquake safer housing by both technological and social approaches

In Padang
(1) Subsurface structure and predominant period based on microtremor measurements
(2) Proposal of design response spectra

Technology transfer of retrofit method
PP band
Bamboo mesh



Predominant period at Padang

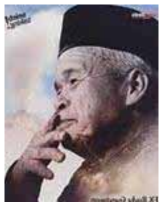


Design response spectra

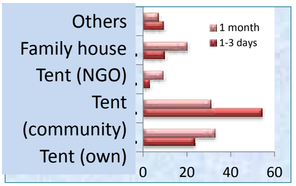
Group 4: Social and Cultural Approach for Reducing Vulnerability

4-1: Community-based Disaster Preparedness
Role of community and social capital
4-2: Social and Cultural Background
Local knowledge
4-3: Recovery Process from Disasters
Lifelines
4-4: Information and Psychology
Kelud Crisis

Nagoya Univ. and LIPI



Extra Joss



4-1 Community-based disaster preparedness

Recommendations

- A little community approach especially in the preparedness phase
- Disaster management scheme should be local, paying attention to nature of hazard, and based on social/geographical conditions, in bottom-up style
- Networking mechanism between government and community at regional level, with an intermediate organization including university as a facilitator
- Social sciences on natural disaster are still underdeveloped, and should be supported by continuing international academic exchange

Collaborative Research in Ache and Yogyakarta

- Preliminary evaluation about community functions

Outputs

- Collaborative Volumes of Research Papers (2009-2011: Above right)
- Workshop dissemination of fieldwork results (2011: Below right)
- *Orang orang yang bertahan dari tsunami* (2011: Right)
- *Community approach to disaster* (Forthcoming)

Community function	Intermediate	Aggregate	Education
Preparedness	×	×	×
Emergency response	×	△	×
Reconstruction	○	△	△

Note: ○△× Intensity of function; Degree of expectation

4-2 Information mapping system on disaster and society

Created and Released the Information Mapping System on Disaster and Society (pic.1)

- To grasp overall picture of disaster afflicted area through online mapping system
- By collecting online articles of Indonesian newspapers on disaster immediately after disaster
- By automatically categorizing articles by themes and locations and locating the articles on maps
- Images, field notes, manuscripts and other types of information can also be added
- For information gathering for relief aid, and archiving the rehabilitation and reconstruction process etc.
- For promoting disaster tourism and social alert (minor disasters as early warning for social instability)

Workshop for technology transfer of the system

- To the Governor of Aceh and state agencies (education, tourism, development and statistics)

Findings shared with society by TV and radio programs

Information Mapping System on Disaster and Society

Workshop at Banda Aceh in Dec. 2012 (5 days, 44 papers, total 600 participants)

4-3 Long term recovery

Outcomes

- Sharing outputs about the 2004 Indian Ocean Tsunami Research
- Sharing techniques for long term recovery research
- Collaborative survey about long term recovery process from the 1995 Kobe Earthquake and the 2004 Indian Ocean Tsunami
- Survey on recovery process of water supply system in Banda Aceh
- Sharing information about recovery studies about the 3.11 East Japan Earthquake Disaster
- Development of recovery process data sets from the 2004 Indian Ocean Tsunami in Banda Aceh

Common Framework of Recovery Process

Recovery Process from the 2004 Indian Ocean Tsunami in Banda Aceh

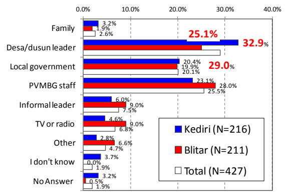
4-4 Warning dissemination and residents' psychological process under natural disasters

Aim

Requirements for development of a more suitable warning system.

Methods

・Case study: Volcanic eruption of Mt. Kelud in 2007.
The volcanic alert level reached the highest level 4 (AWAS)
The evacuation order has been issued.
・Group-interviews to the affected people.
・Mass-survey: Two-step random sampling.
N=427 (Valid response rate: 94.9%)



Trustiness of information source

Possession	Kediri		Blitar	
Rate	Lowest	Highest	Lowest	Highest
TV	83.7%	97.7%	56.1%	82.5%
Radio	32.6%	65.1%	36.6%	90.2%
Handy phone	48.8%	77.3%	35.0%	62.2%

Local difference: communication media

Results and Recommendations

・Evacuation rate: 52.9% (Kediri Regency)
87.1% (Blitar Regency)
・A critical role played by leaders of villages (desa/ dusun) for information dissemination.
・A variety of information dissemination tracks is essential.
・Technical terms are required to be reviewed by PVMBG.
・Legally including the mass-media into the disaster management system is necessary.
Ex. "Designated Public Corporations" in Japan

Group 5: Disaster Education Promotion and Disaster Consciousness

Fuji Tokoha Univ., Univ. of Tokyo , LIPI

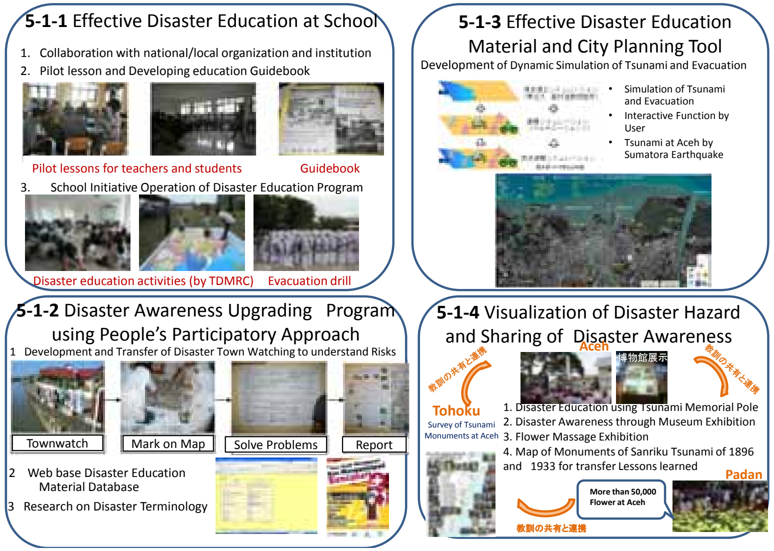
G5-1 Education, Outreach and Capacity building

5-1-1 Effective disaster education at school
5-1-2 Disaster Awareness Upgrading Program using People's Participatory Approach
5-1-3 Effective Disaster Education Material and City Planning Tool
5-1-4 Visualization of Disaster Hazard and Sharing of Disaster Awareness

G5-2 Collection and Transfer of Disaster lessons

G5-3 Development and Testing of Disaster Education Materials on the Internet

5-1 Education, outreach and capacity building



5-2 Research on effective methodology for collecting and diffusing of disaster lessons

5-3 Development and testing of disaster education materials on the Internet

1. Develop and Implement of Internet based distance education system
2. Delivered International Workshop and Lectures of Disaster Education

- Able to participate at any place without attending on site
- SOI Asia Project (School on Internet Asia,) system
- Widely covered of Asia region including Indonesia, Japan
- Connects to Indonesian Research and Education Network (INHERENT)

Distance International Workshop

- 2009.4.21 "Multi-disciplinary Hazard Reduction Program from Earthquakes and Volcanoes in Indonesia Kick-off Workshop"
- 2009.10.12,13 " International Workshop on Multi-disciplinary Hazard Reduction from Earthquakes and Volcanoes in Indonesia and Beyond"
- 2010.2.23-3.8 "Technical workshop for Indonesian distance learning environment operators "
- 2010.7.12-14 "International Workshop on Geodynamics and Disaster Mitigation of West Java"

Prepare and Distribute Distance Education Lectures

- Ask lectures of this research output by this project
- Deliver these lectures to Indonesia and south east Asian countries through distance education system

Group 6: Coordination with Governments

ADRC and RISTEK

Activity within the project
-Annual multi-disciplinary workshop
-Group leader meetings and JCC
-Inter-group meetings/discussion
-Publication of JDR special issue

Outreach Activities
-Newsletters
-TV program (IPTEK Talks)

Institutional Activities
-Recommendation at 2011 workshop
-Papers on policy aspects of 2010 Mentawai tsunami and 2011 East Japan earthquake
-Visit and discussion at Central Disaster Management Council and Headquarters of Earthquake Research Promotion

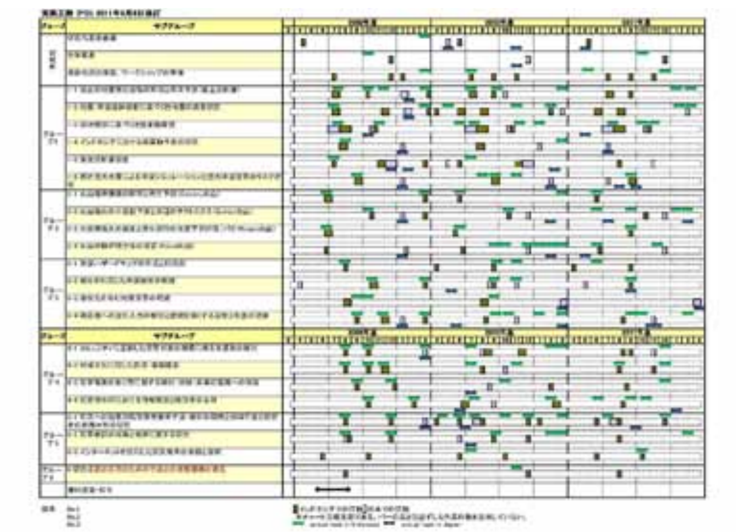
Exchange of Researchers

FY		Persons	Days
2009	Japanese visit Indonesia	90	905
	Indonesian visit Japan	14	187
	Graduate Student Fellowships	2	
2010	Japanese visit Indonesia	100	959
	Indonesian visit Japan	56	558
2011 (-Jan)	Japanese visit Indonesia	87	751
	Indonesian visit Japan	23	216

Meetings and Workshops

2009-2010	
April	JCC, Kick-off workshop (Bandung)
October	International Workshop (Banda Aceh)
March	JCC, Group Leader Meeting (Jakarta)
2010-2011	
May	JpGU, Group Leader Meeting (Chiba)
July	International Workshop (Bandung)
November	International Workshop (Kobe)
2011-2012	
May 6	JCC, Group Leader Meeting (Jakarta)
May	JpGU, Group Leader Meeting, Sendai trip
October	Final Workshop (Jakarta)
March	Joint Workshop with Philippine Project, Sendai Symposium

Plan of Operations



Outputs

	Japanese	International (English)
Original papers	38	53
Reviews or articles	18	12
Invited talks	3	10
Oral presentations	47	85
Poster presentations	15	25

J. Disaster Research (Open-access refereed journal)
1st issue of 2012（Vol. 7 No.1） Special issue for this project
10 original papers and 2 review papers

Workshops

	Within project	Open to public
Project	11 (incl. JCC)	5
Each group	5	56

J. Disaster Research

Media Coverage

	Japan	Indonesia
Awards	5	8
Newspaper	17	56
TV / Radio	6	7

Examples of Outcomes

- Emergency rescue team for Merapi volcano (Japanese govt)
- J-RAPID (JST, joint survey for East Japan Eq. and Tsunami)
- Consulting research from pertroleum company
- Information mapping system
- Tsunami evacuation simulation system (RISTEK project)

Summary

1. A pilot project of SATREPS
2. Joint surveys and research between Japan and Indonesia
    - Many papers and presentations
    - Technology transfer, capacity building
3. Inter-disciplinary and inter-institutional collaboration
    - Natural sci., engineering, humanities and social sci.
    - Collaboration across universities and govt agencies
4. Coordination of researchers, govt. and local people
    - Disaster education (research and practice)
    - Knowledge transfer
    - Proposal of convert JCC to a permanent committee
5. Urgent and flexible response to recent disasters
    - 2009 Padang earthquake, 2010 Mentawai eq.
    - 2010 Sinabung and Merapi eruptions