

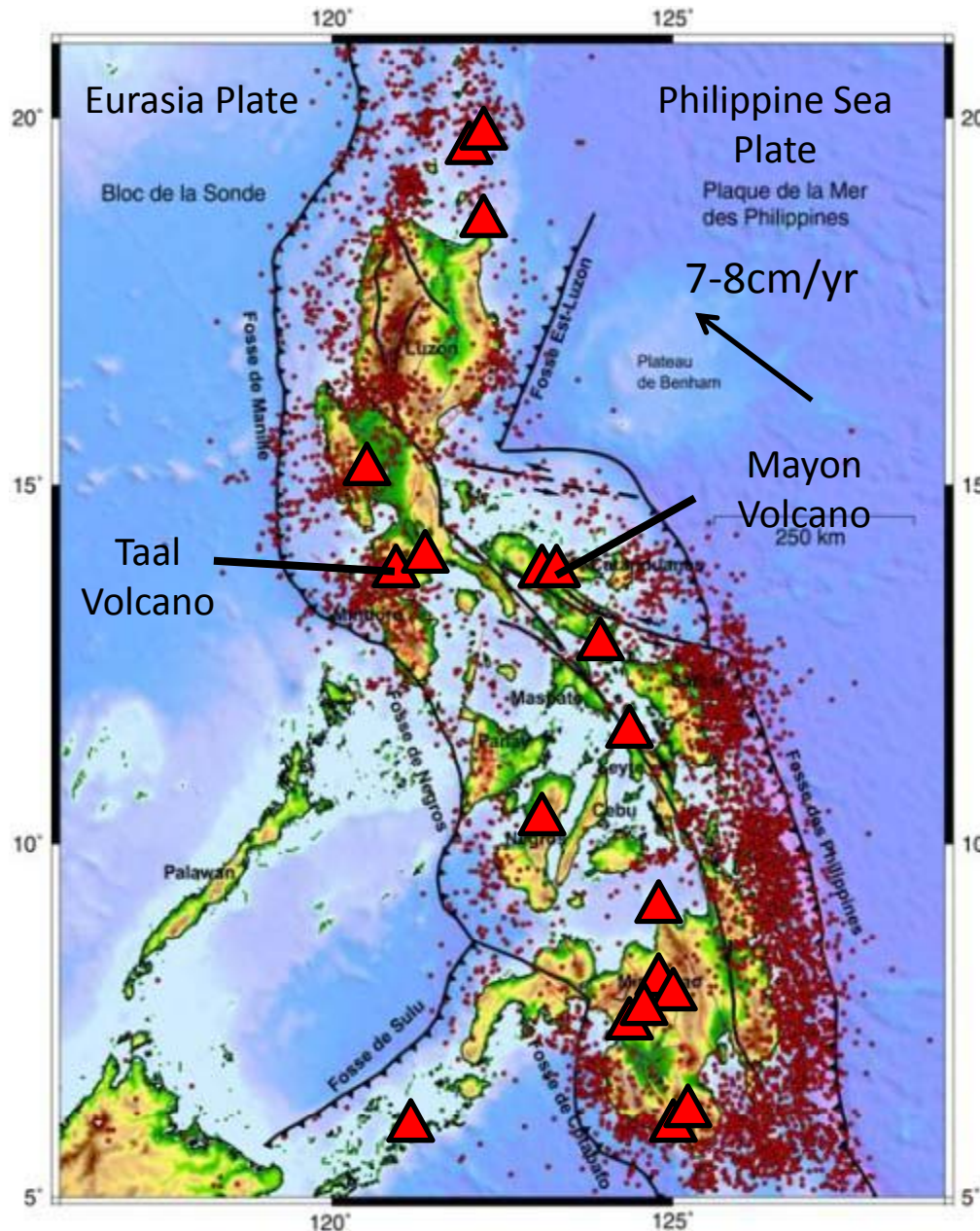
# Enhancement of earthquake and volcano monitoring in the Philippines:

## Progress report and strengthening of tsunami component of the project

**Hiroshi INOUE  
NIED**



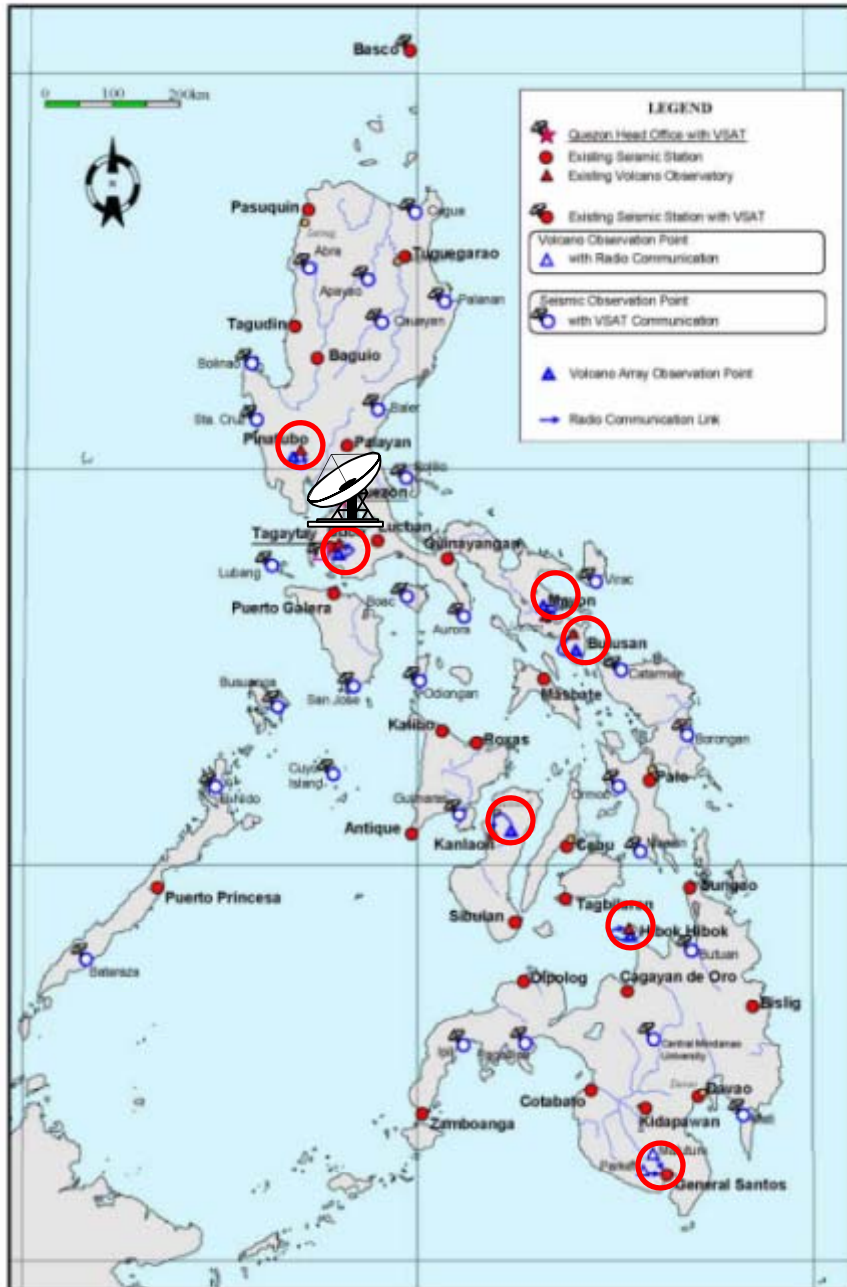
# Earthquakes and Volcanoes in the Philippines



- Past large earthquake(casualty) 1954  
 M8.3 Bacon, Sorsogon(13)  
 1955 M7.5 Lanao (291)  
 1968 M7.3 Casiguran (270)  
 1970 M7.3 Baler (15)  
 1976 M7.9 Moro Gulf (3,739)  
 1990 M7.8 Luzon (1,283)  
 1994 M7.1 Mindoro (83)

- Past large eruptions(casualties)  
 1911 Taal (1300)  
 1948 Hibok-Hibok(68)  
 1965 Taal (190)  
 1991 Pinatubo(870)  
 1993 Mayon(77)

# Modern earthquake and volcano network was established by the Japanese Grant-Aid project in 1999 and 2002



34 manned earthquake observatories (off-line, short period, broadband, SMS)



29 VSAT short-period seismometers



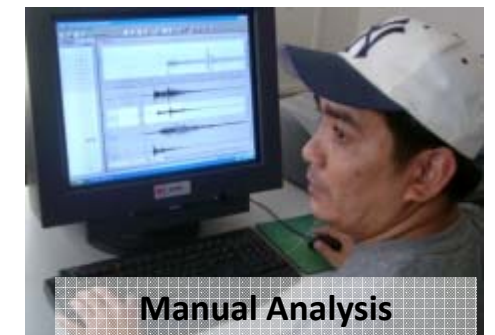
6 Volcano Observatories



3 wireless telemetry short period x 6 volcanoes

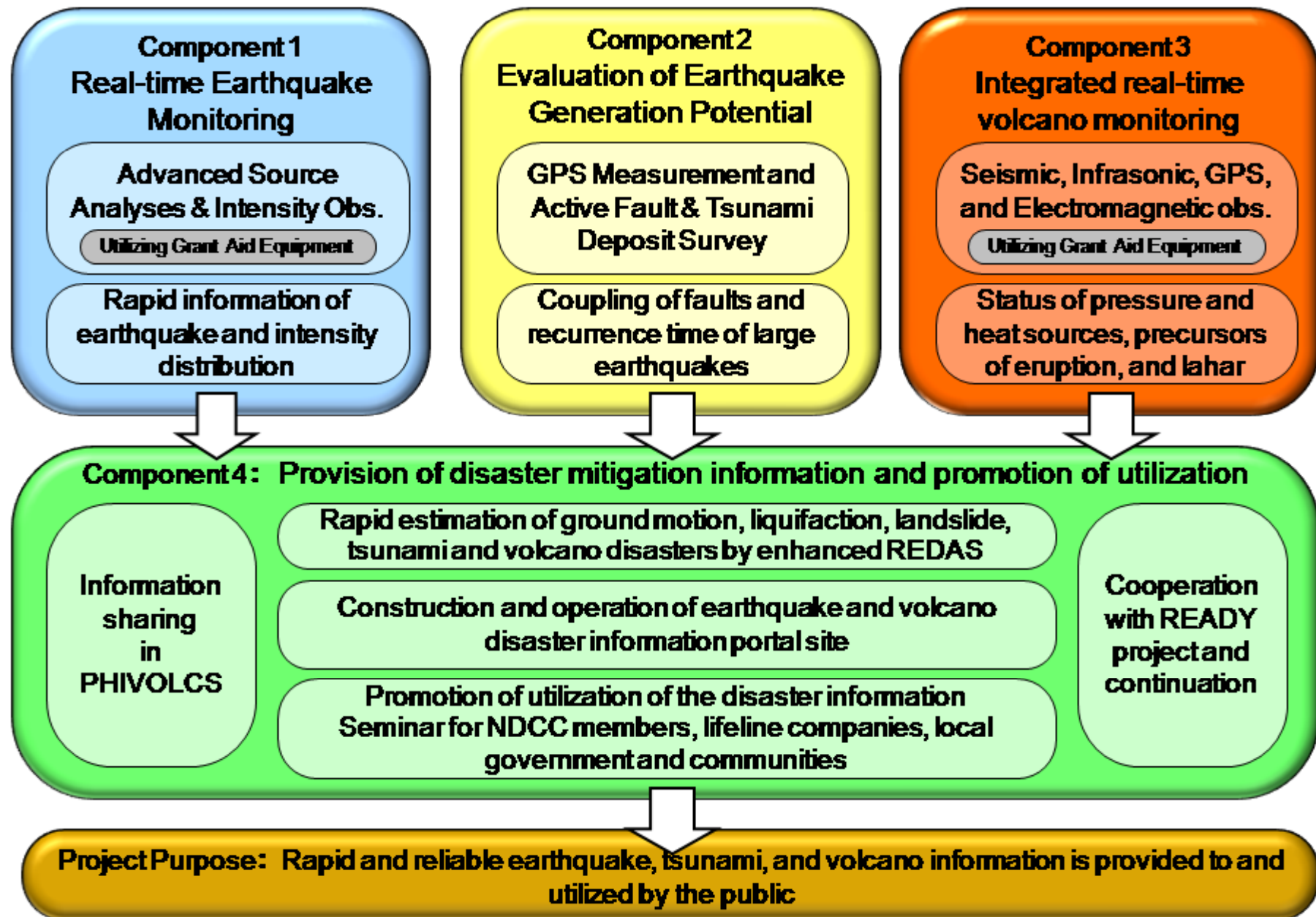


Data Processing Center

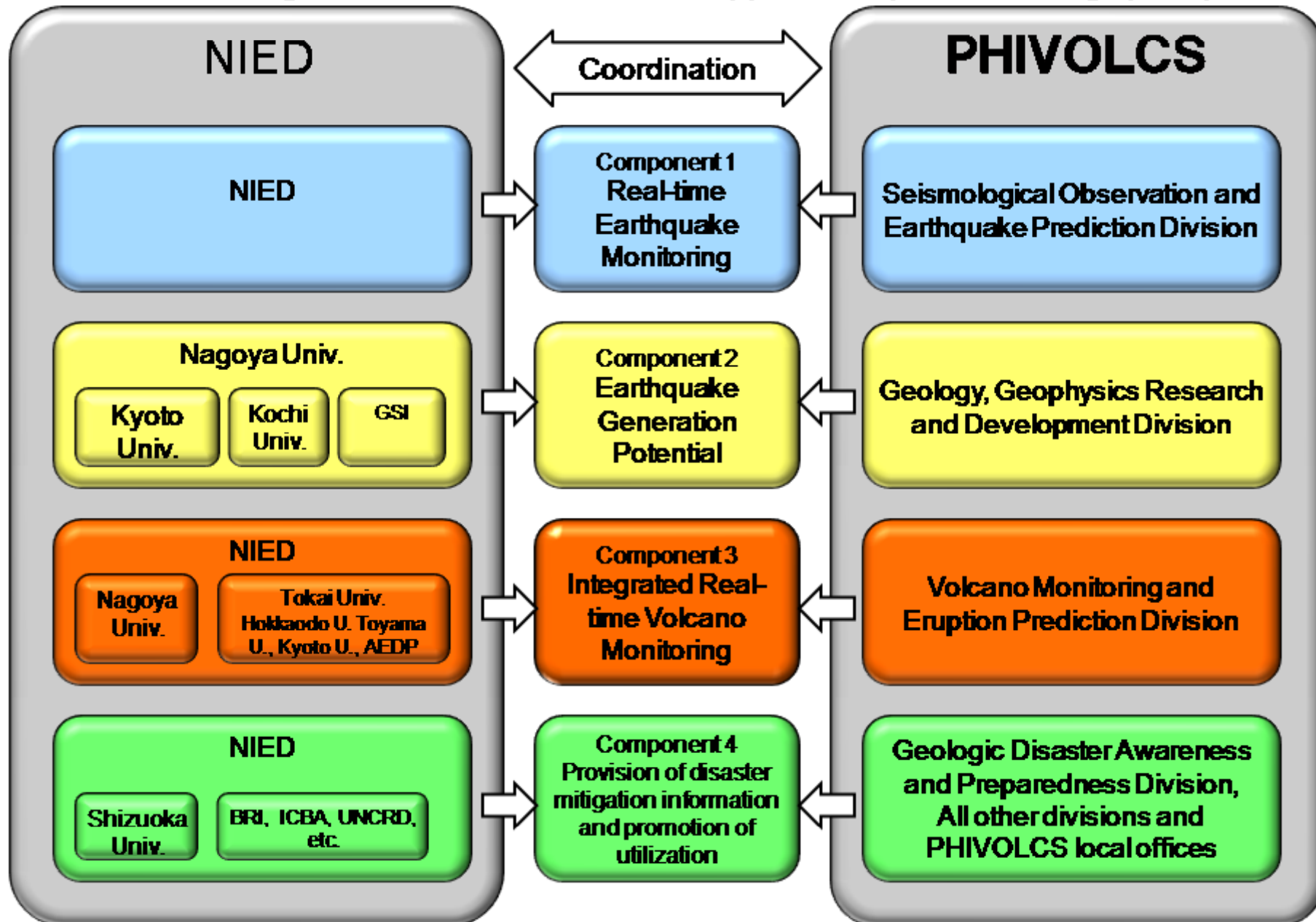


Manual Analysis

# Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information in the Philippines : Master Plan Image



# Enhancement of Earthquake and Volcano Monitoring and Effective Utilization of Disaster Mitigation Information in the Philippines: Operation Image



# The 1<sup>st</sup> Joint Coordination Meeting and Kick-off Workshop February 2010, at PHIVOLCS, Manila



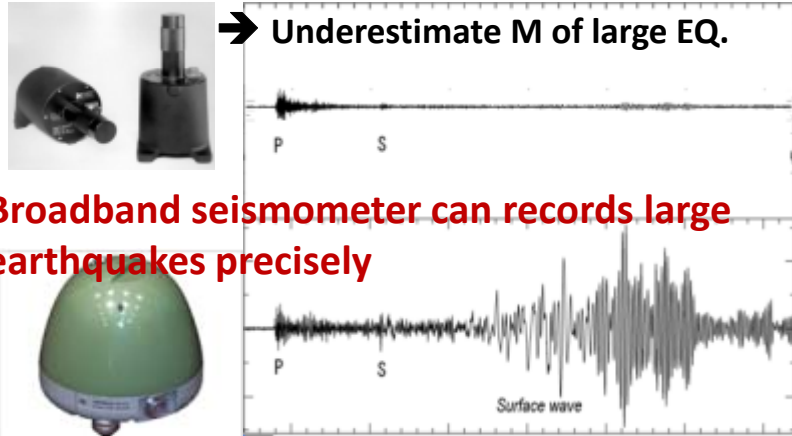
Signing of  
PHIVOLCS-NIED MoU



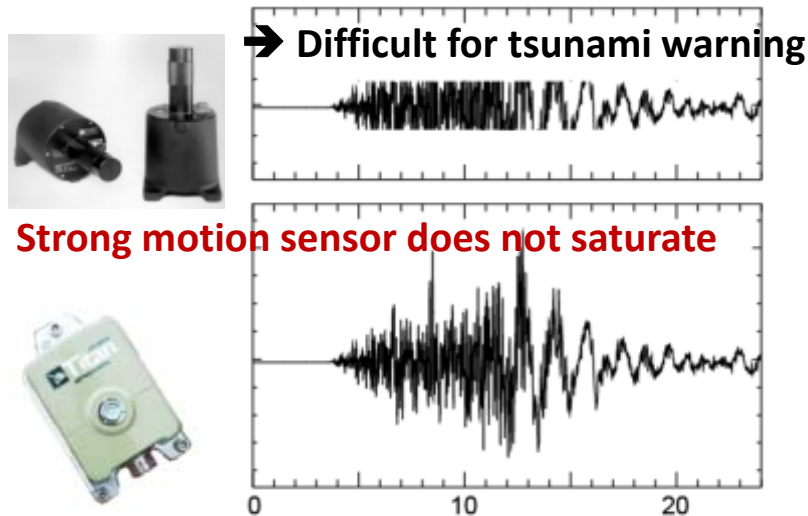
# 1. Real-time earthquake monitoring

## 1.1 Advanced earthquake source determination system

SP sensor is sensitive only to short period ground motions

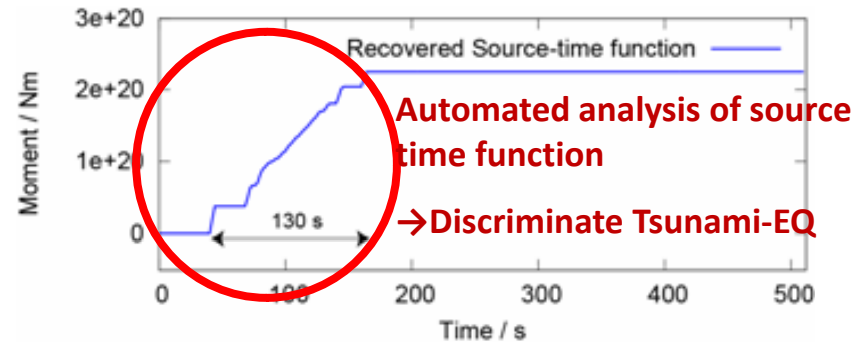
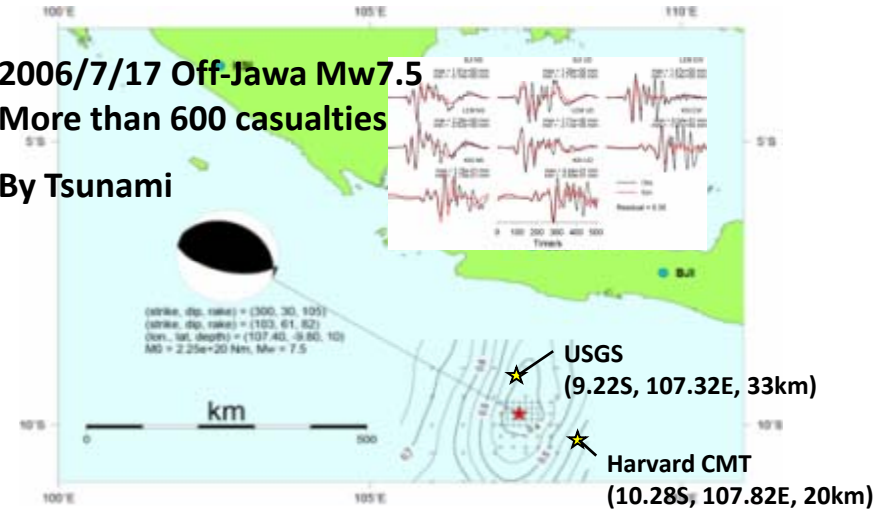


SP sensor saturates by large earthquake



## SWIFT source inversion by NIED

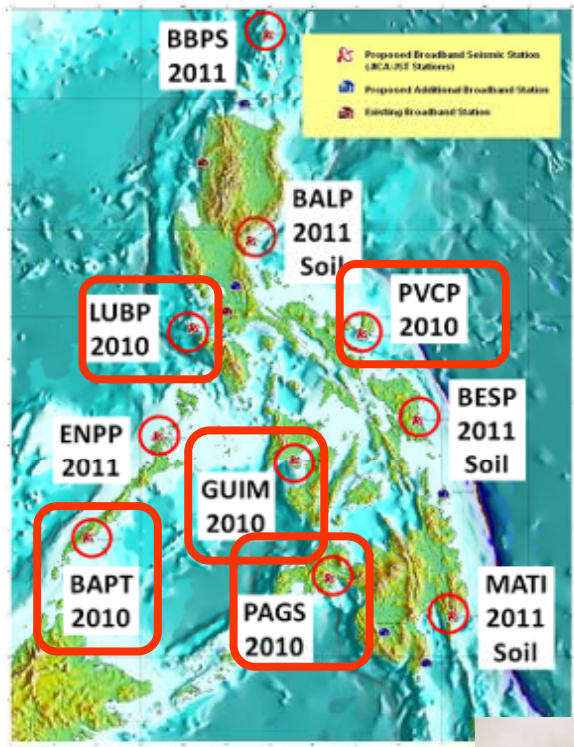
2006/7/17 Off-Jawa Mw7.5  
More than 600 casualties  
By Tsunami



More precise information of the source of large earthquakes

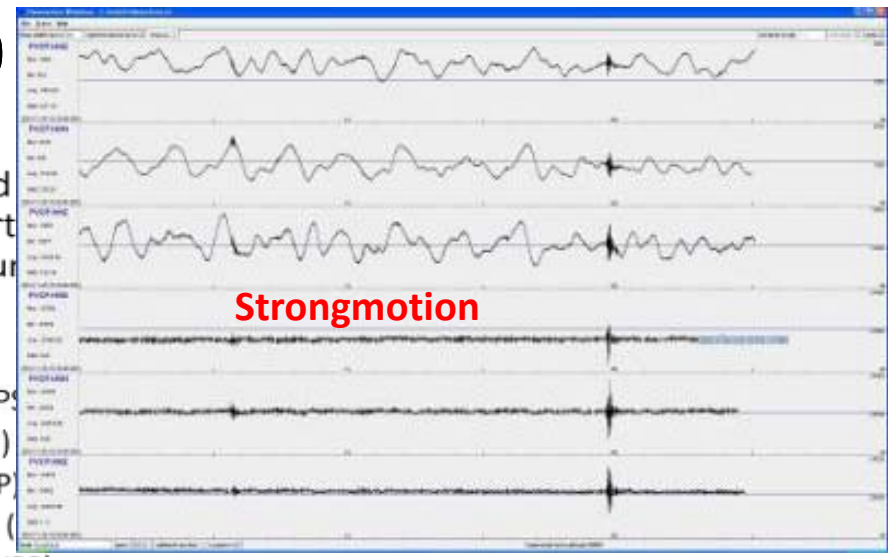
# Installation of broadband seismometers, Nov.-Dec., 2010

Broadband



Ten (10) Short-period stations to be converted to broadband stations under JICA/JST Project:

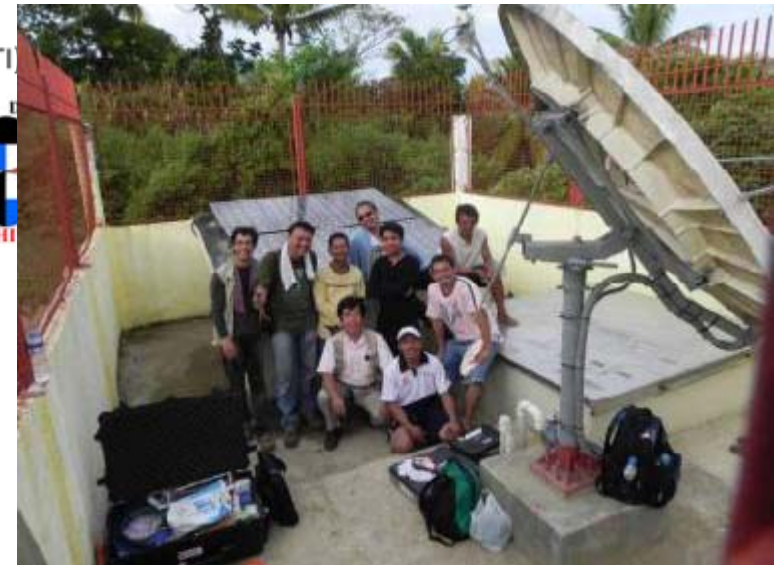
1. Basco, Batanes (BBPS)
2. Baler, Aurora (BALP)
3. Lubang Island (LUBP)
4. Virac, Catanduanes (PVCP)
5. El Nido, Palawan (ENPP)
6. Bataraza, Palawan (BAPT)
7. Guimaras Island (GUIM)
8. Borongan, Eastern Samar (BESP)
9. Pagadian (PAGZ)
10. Mati, Davao Oriental (MATI)



Strongmotion (Titan)



Broadband (T240)

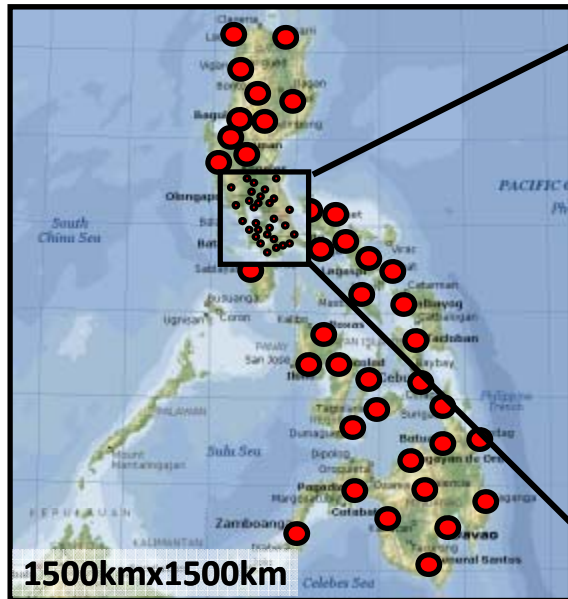


The Team in Virac

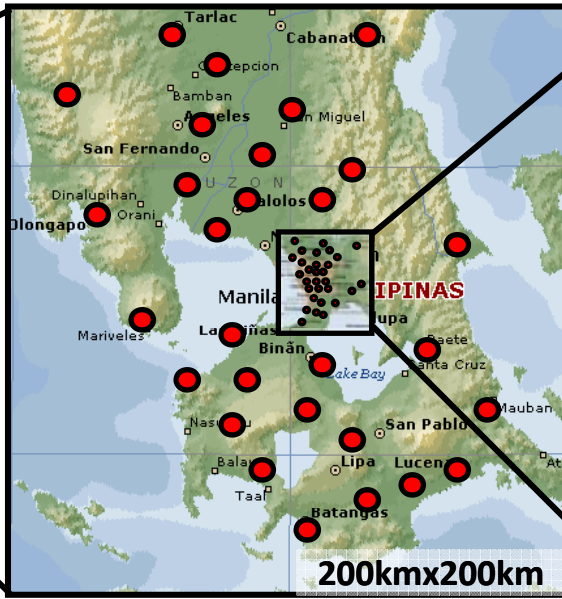


# Rapid Earthquake Intensity Notification System

100 Locations at Local Government Building/PHIVOLCS obs.



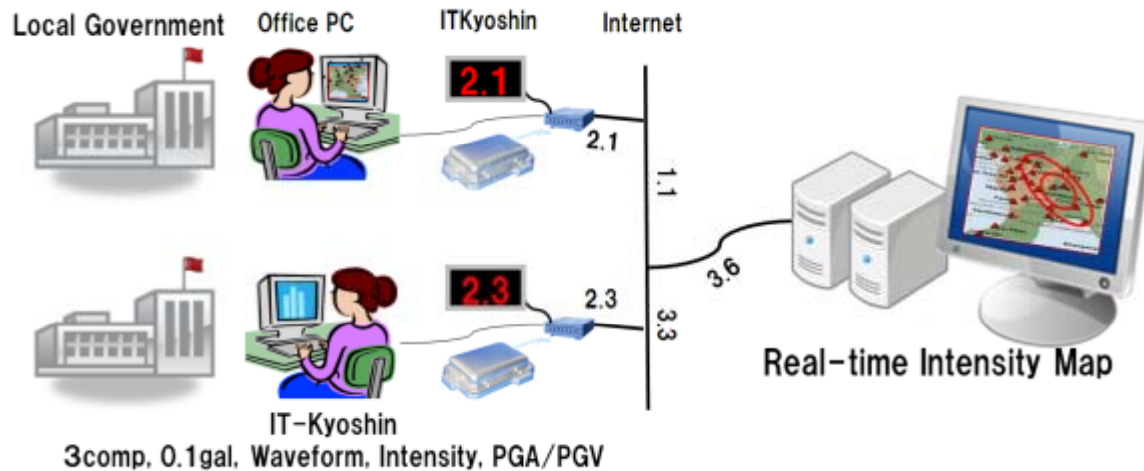
40 nationwide as the 2<sup>nd</sup> experiment



30 in Luzon as the 2<sup>nd</sup> experiment



30 in Manila as the 1<sup>st</sup> experiment



Marikina City Government

# Test run in PHIVOLCS

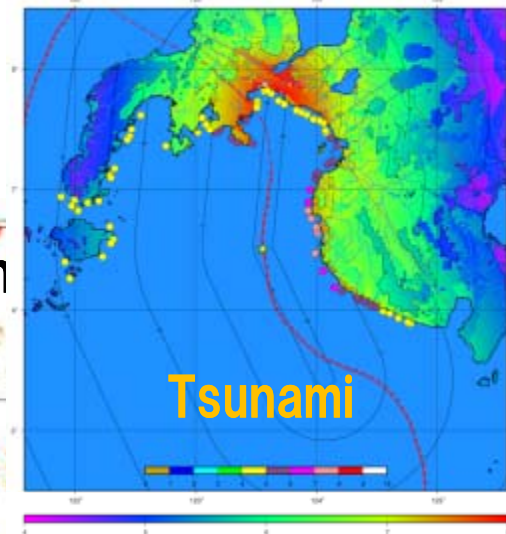
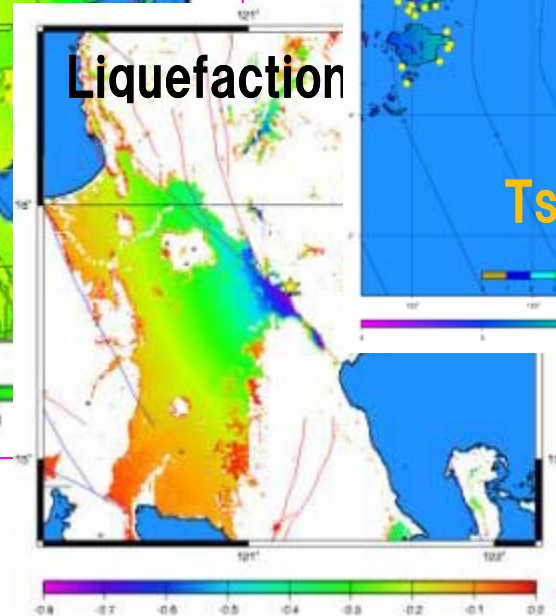
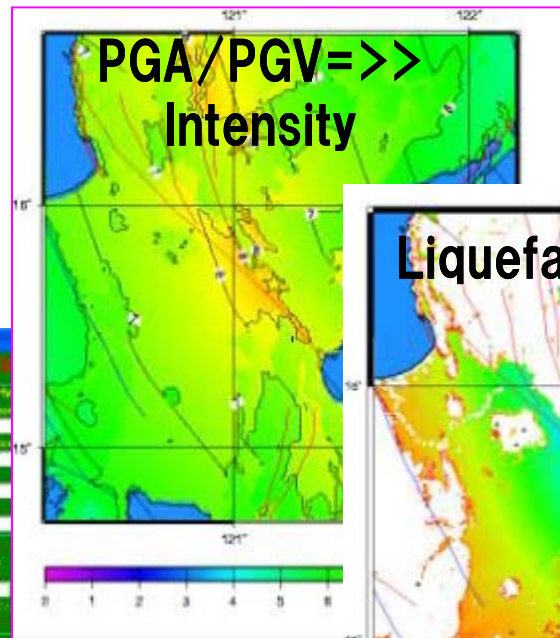


# Rapid Damage Estimate: Utilization and enhancement of REDAS

REDAS (Rapid Earthquake Damage Assessment System)

Developed by PHIVOLCS (2002-)

- Hazard estimation (Ground motion, Liquefaction, Landslide, Tsunami)
- Promotion of utilization is ongoing by PHIVOLCS
- **Enhance REDAS to Real-time REDAS by PHIVOLCS in this project**



## 2. Evaluation of earthquake generation potential

### Mindanao

Frequent occurrence of large earthquakes  
⇒ Need to evaluate the potential

Currently

### Inland Earthquake

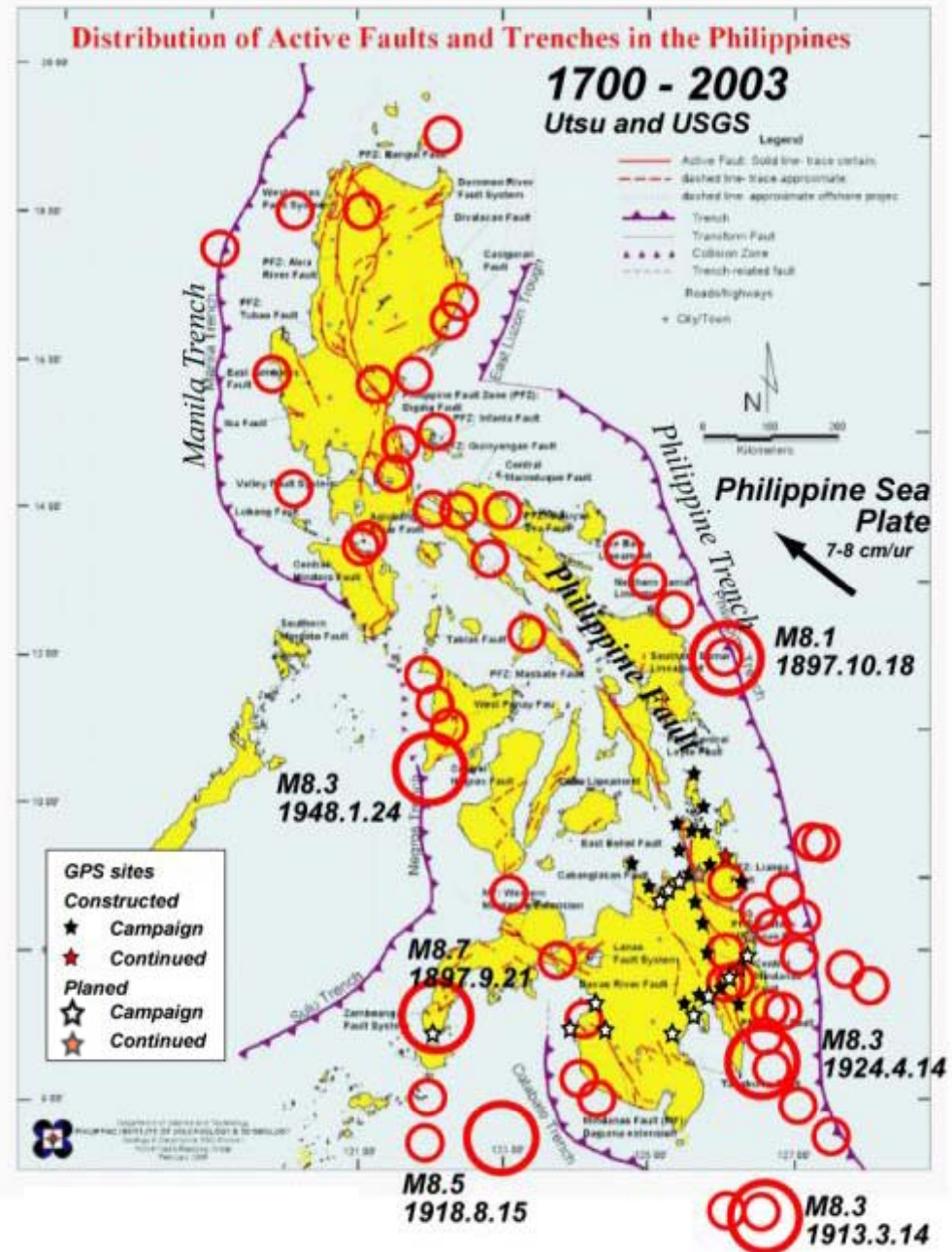
Philippin Fault in Mindanao

- Fault-generated topography
- Quiescence

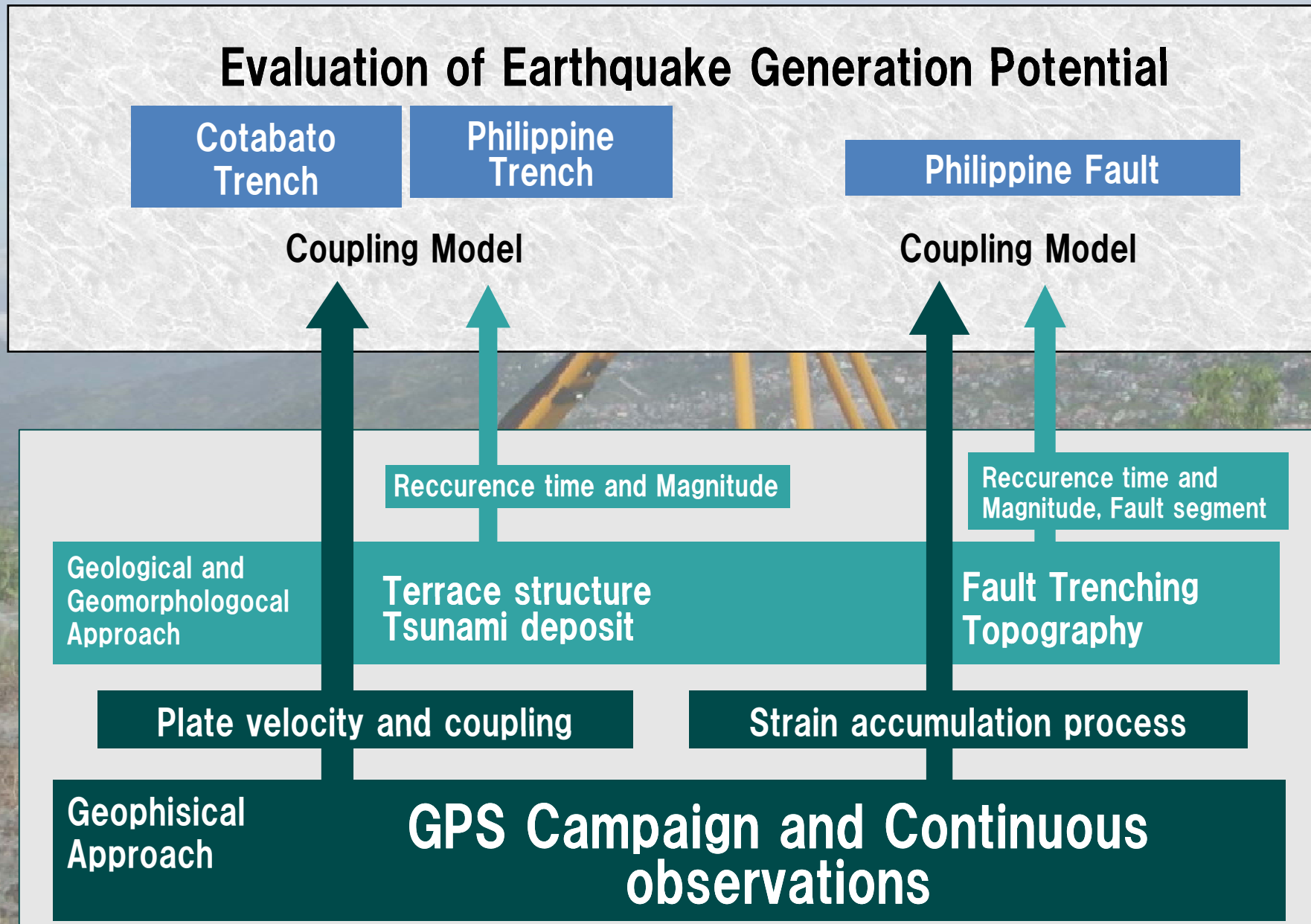
### Subduction earthquakes

Philippine Trench, Cotabato Trench

- Large events in the past
- No large events in recent years



## 2. Evaluation of earthquake generation potential



# GPS Campaign Observations March 2010



# 3. Integrated real-time volcano monitoring

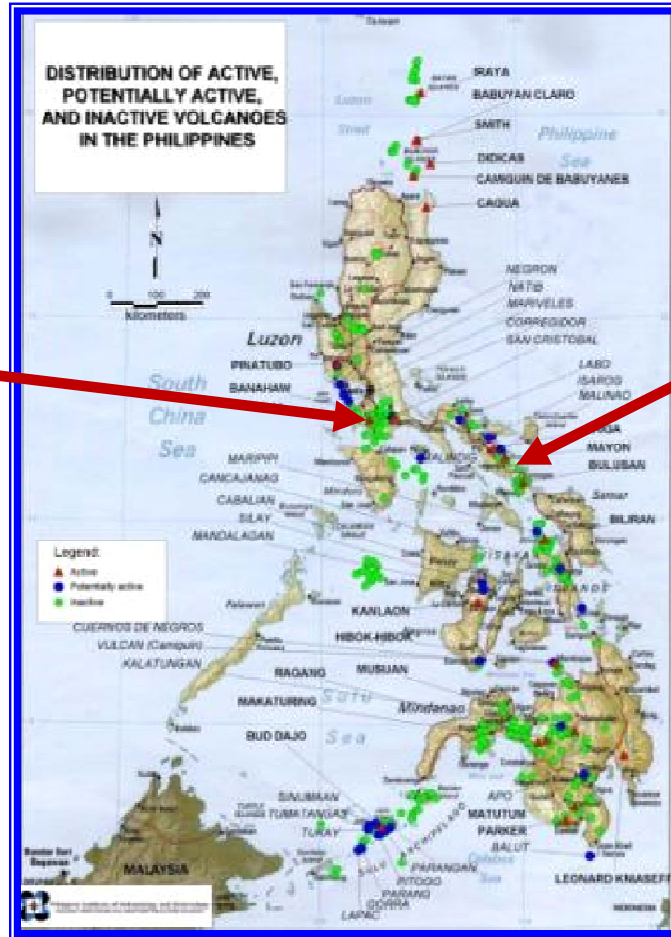
## Activities in the past

### Taal



Erupting every 10–20 years, but no eruption since 1977.

Ready to erupt.



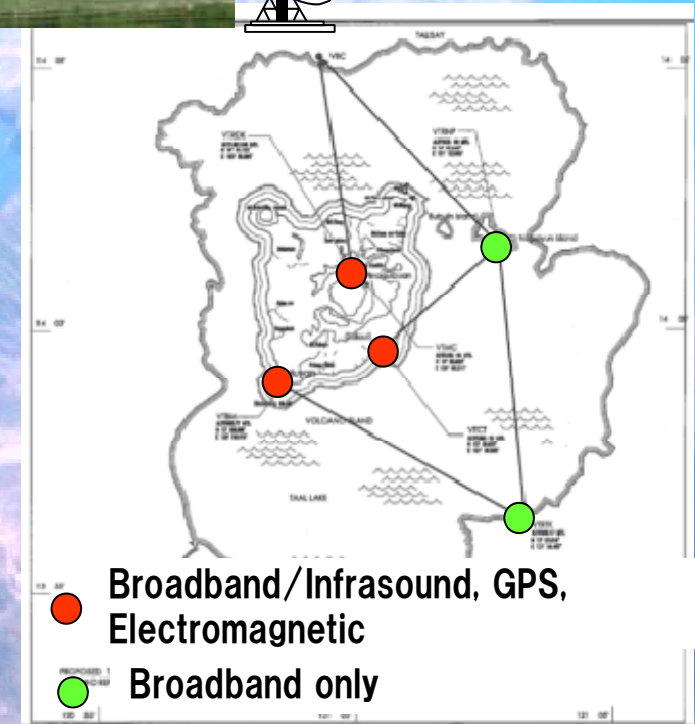
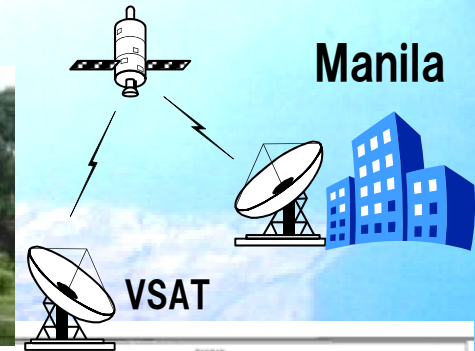
### Mayon



Continuous activities since 2003

# Taal volcano

- Broadband seismic monitoring of underground magma movements
- Infrasonic observation for detection and size estimation of eruptions
- GPS observations for estimation of deformation and pressure source
- Electromagnetic observations to monitor thermal structure
- CCD Live cam
- Satellite telemetry to Manila



**Installation of a system of comprehensive monitoring of the precursors**







# Installation of GPS and EM sensors in Taal



GPS



Fluxgate magnetometer



Data logger



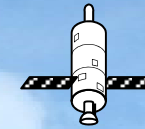
Data logger



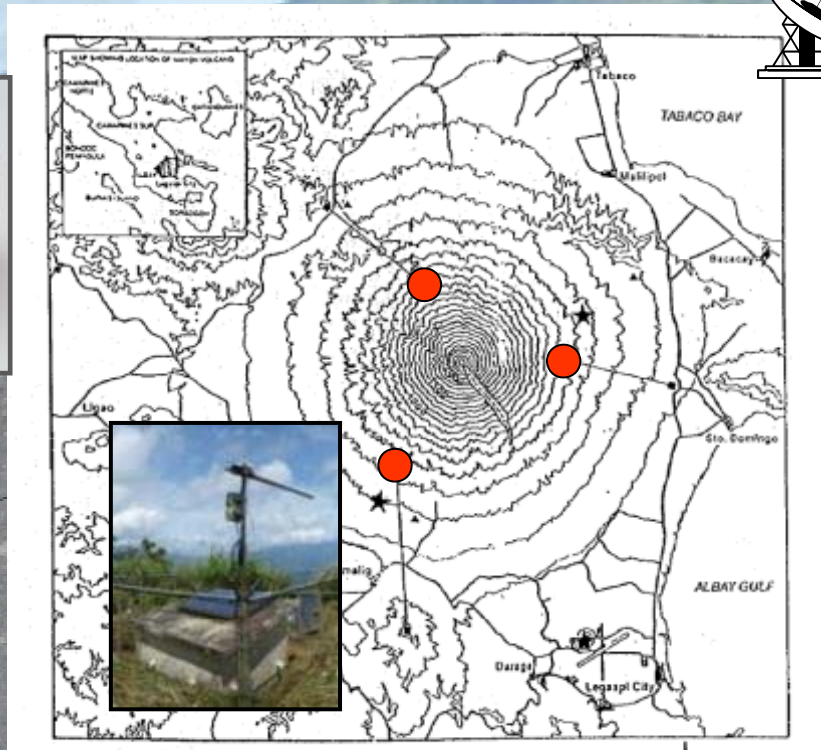
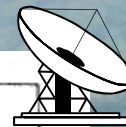
Overhauser magnetometer

# Mayon Volcano

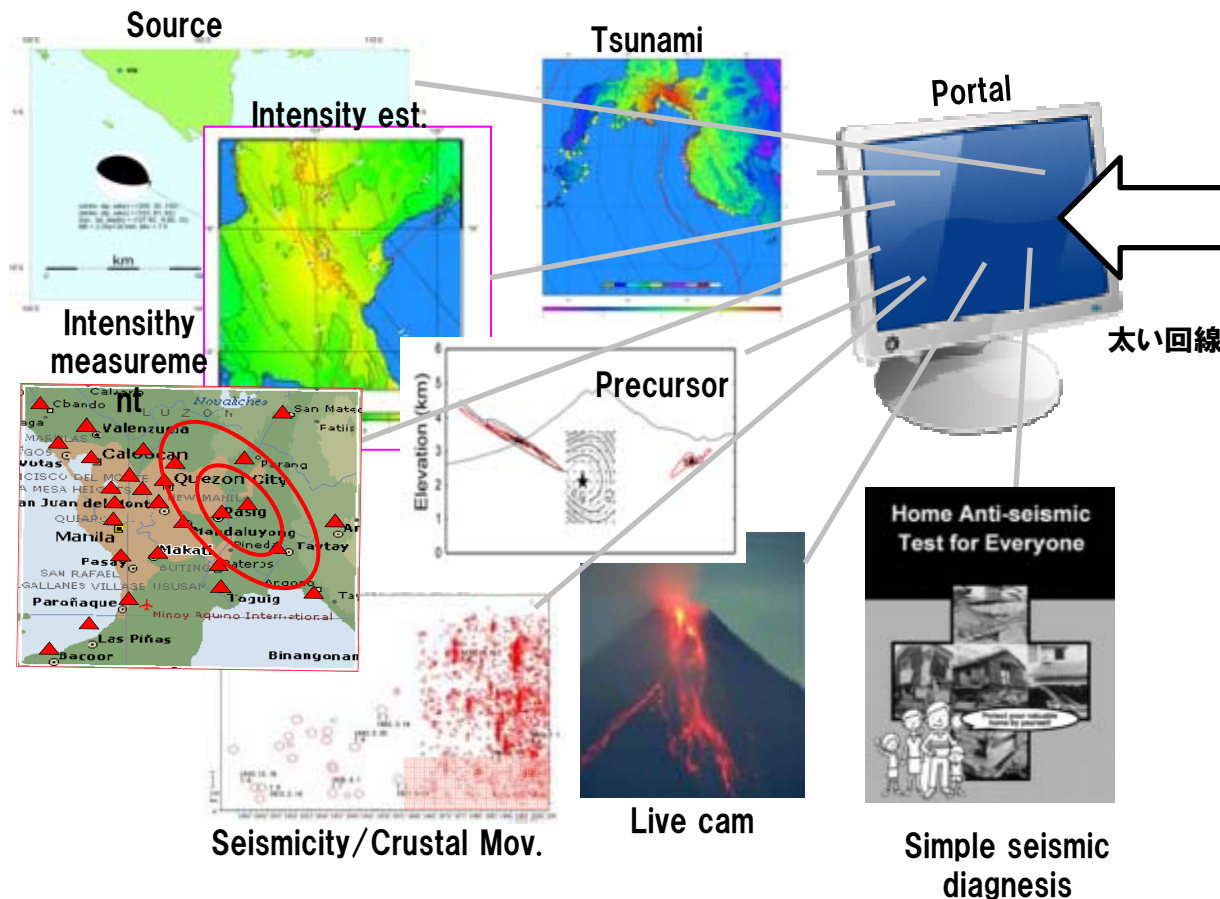
- Broadband seismic monitoring of underground magma movements
- Infrasound observation for detection and size estimation of eruptions
- CCD Live cam
- Satellite telemetry to Manila



Manila



# 4.1 Development of disaster mitigation information portal site



Provide a gateway to earthquake and volcano information to everyone

+ PHIVOLCS' s internal information sharing

# Survey of non-engineered houses for Developing Seismic Diagnosis for Everyone



Panpanga



Panpanga



Mindanao



Makati



Marikina



Mindanao

**February , 2011, in Tsukuba Japan**  
**Full-scale shaking table experiment of**  
**Philippine CHB masonry houses**

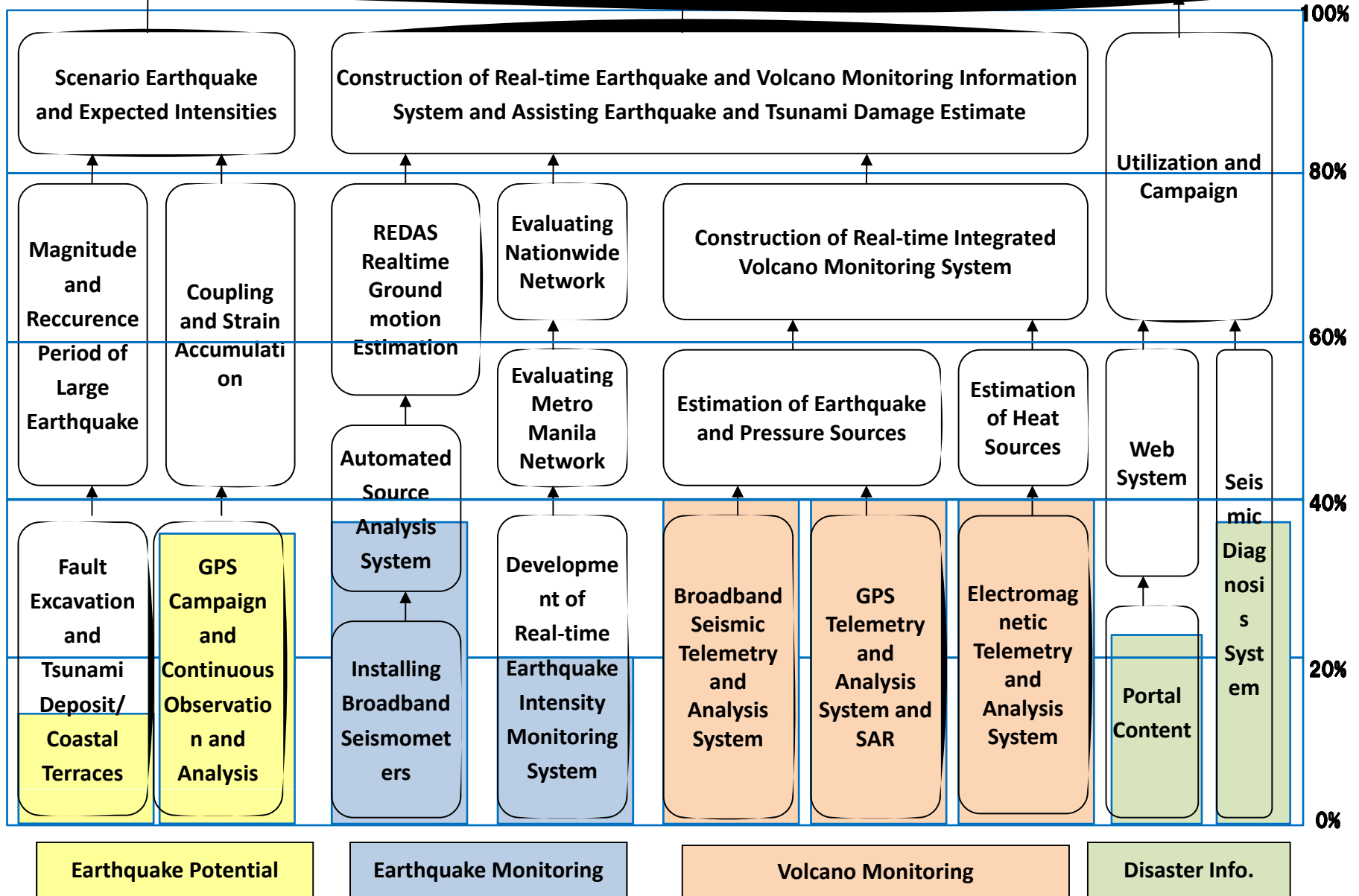


# Promotion of utilization of the portal site

**Holding Seminars for  
NDCC members  
Local government  
Communities**



# Construction of Web portal of Earthquake and Volcano Disaster Information as Scientific Basis of Disaster Reduction Polity of the Philippines





# After March 11, 2011 Great East Japan Earthquake

## Strengthening of Tsunami Component

Seismic and Sea Level  
Monitoring  
**(1) Sea Level  
Monitoring**

Forecasting and  
Dissemination  
**(2) JMA's advisor**

People's Awareness, Evacuation Plan and Drill  
**(3) Video Interviews of Phillippino Victims**

Sea Walls, Evacuation Buildings

# Video Interviews with Filipino victims of the Great East Japan Earthquake



# Strengthening PIVOLCS's Tsunami Forecasting and Decision Making System with JMA's Advisory



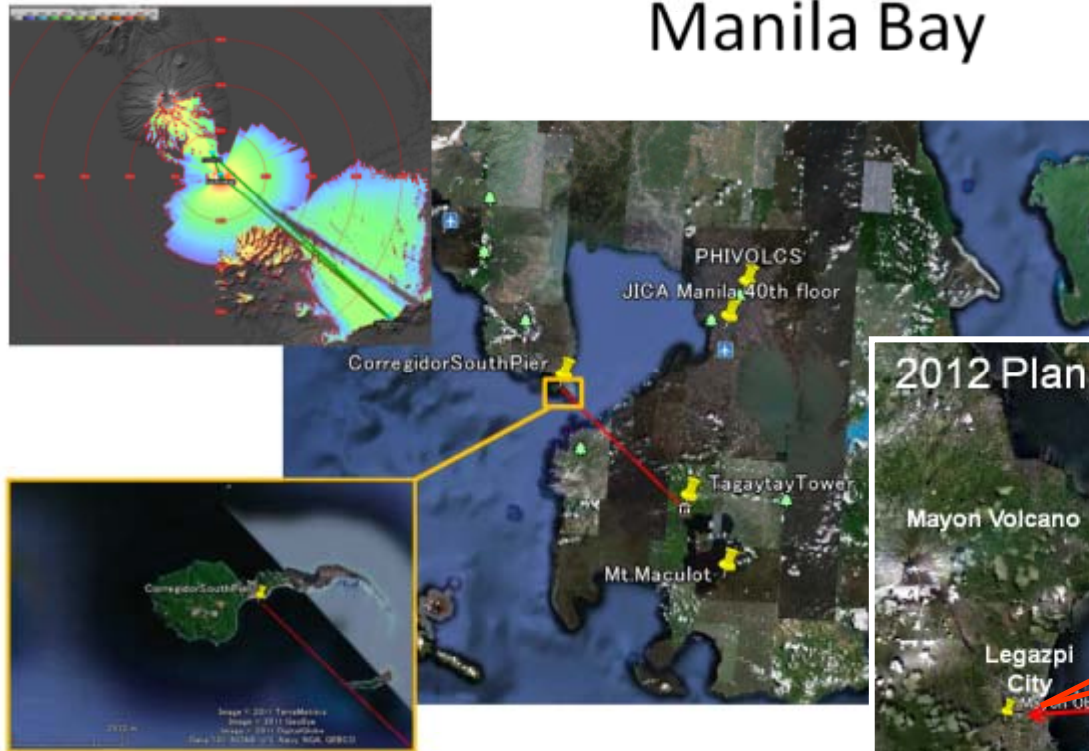
**JMA**

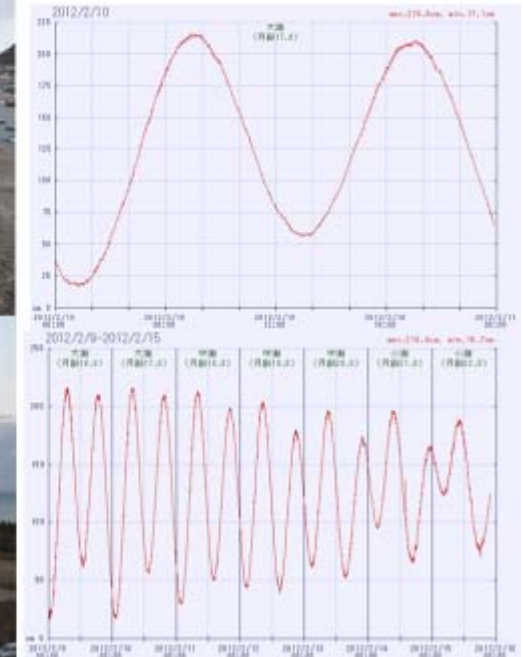
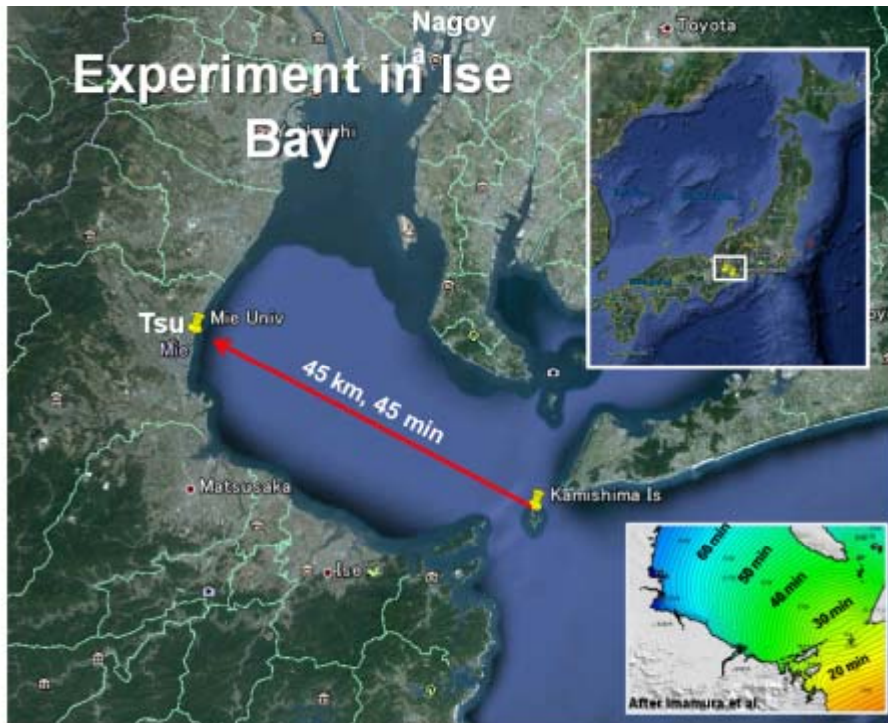


**PIVOLCS**

# Sea Level Monitoring for the Last Minutes Tsunami Warning for Cities in Bay Areas

## Manila Bay





### Sea-level monitoring at sand beach



**Thank you very much**

