

# **EARTHQUAKE MONITORING and TSUNAMI EARLY WARNING SYSTEM INDONESIA (InaTEWS)**

Tokyo, January 11-12, 2007

## **Meteorological and Geophysical Agency INDONESIA**



BMG



DEPDAGRI



DEPLU



ESDM



KESRA



KOMINFO



BAPPENAS



BPPT



BAKOSURTANAL



LAPAN



LIPI



DKP



KLH



ITB

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# I. Task and Function

## Mission

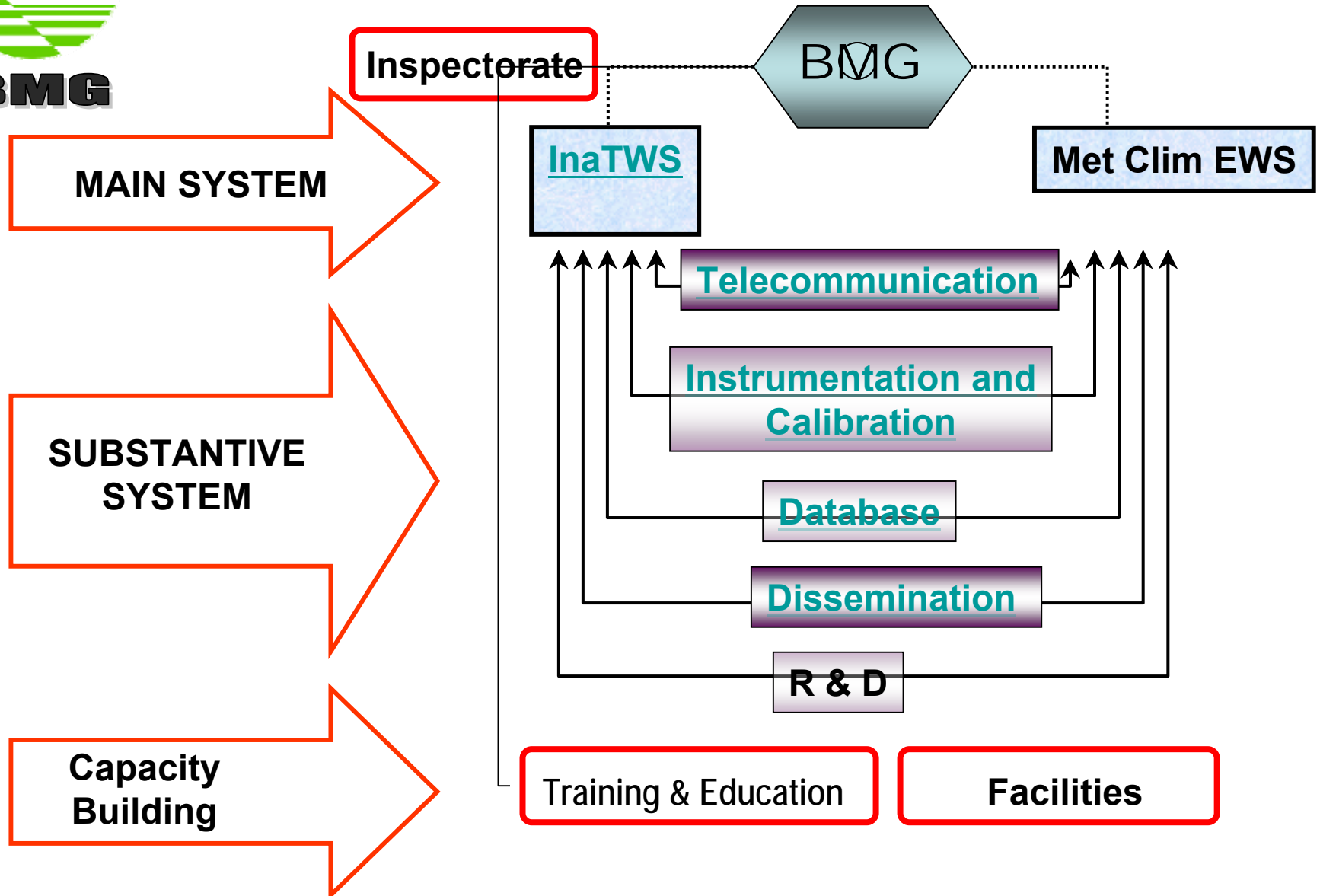
- “Providing accurate, prompt, and qualified services for the protection of citizen lives and properties from Natural Disaster”.*
- ➔ *As the Reference Institution for Customer- Oriented Meteorological Service in the Tropical Region*

## Task - Function

- Policy formulation for standard operational procedures in the fields of met - clim - geoph.
- Implementation of met - clim - geoph observation, data collection - processing - analysis, and research into Indonesian weather, climate and geophysics to provide Meteorological, Climatological and Geophysical Services to all sectors
- Mandatory in the operational of meteorology, climatology and geophysics.
- Fulfillment of Indonesian's obligation under the convention of WMO (World Meteorological Organization)

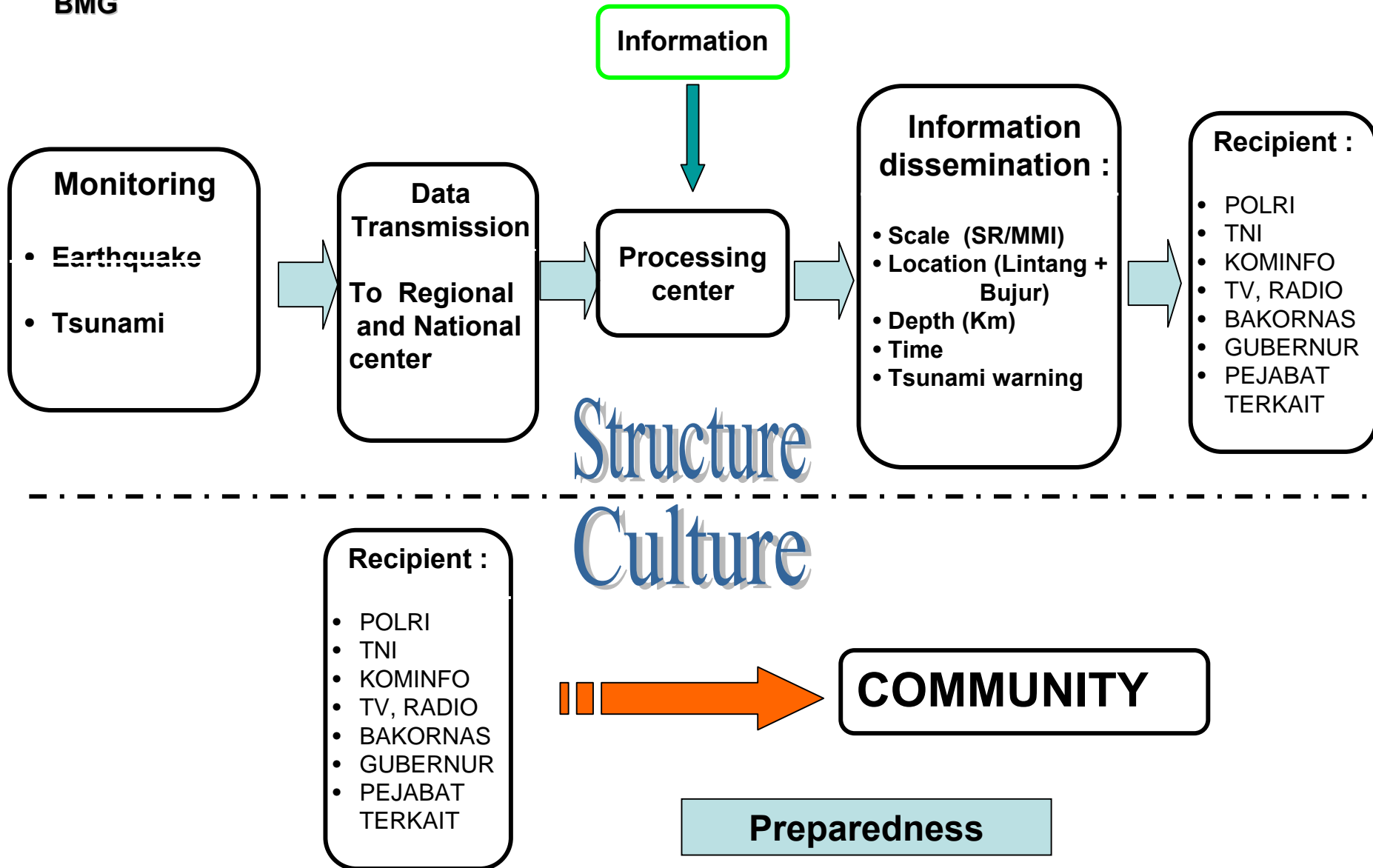


# PRIMARY PROGRAM OF BMG





# Scenario





## Priority of BMG program to develop TWC

- Develop monitoring tools, equipment, models, support systems
- Construct new building in National TWC and Regional TWC
- Integration of all parameter of observations for TWC
- Develop Standard operational Procedures in BMG
- Socialization of BMG product to all institutions national, local government, and universities
- Develop interfacing tools to disseminate information and warning
- Develop interaction and the appropriate SOP in the local government level to respond information and Warning from BMG
- Conduct the training and improve Human Resources
- Conduct coordination meeting with donors countries regularly
- Develop network of observation as well as information dissemination to ASEAN, Indian Ocean and Pacific region

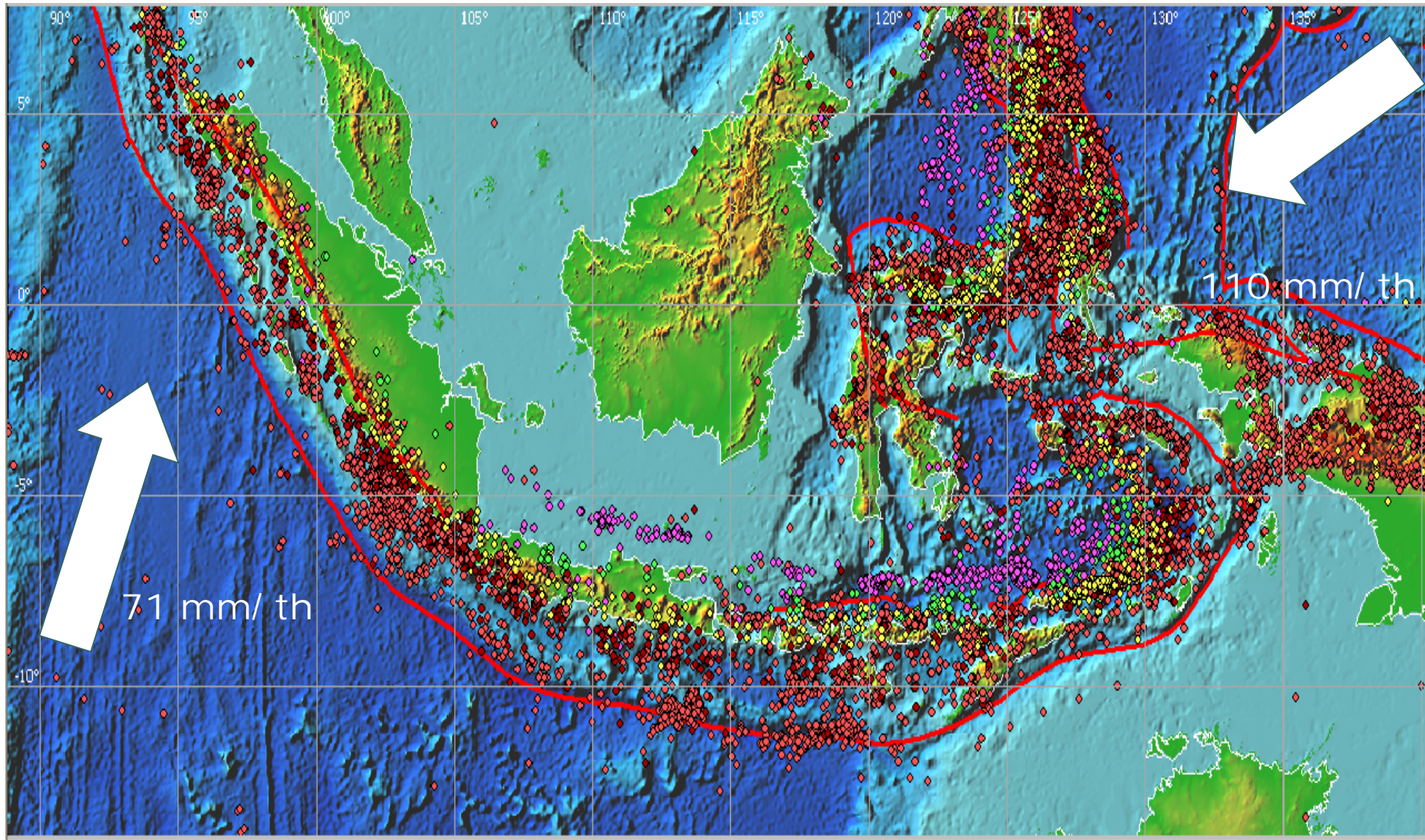


# International collaboration in developing Tsunami Warning System in Indonesia

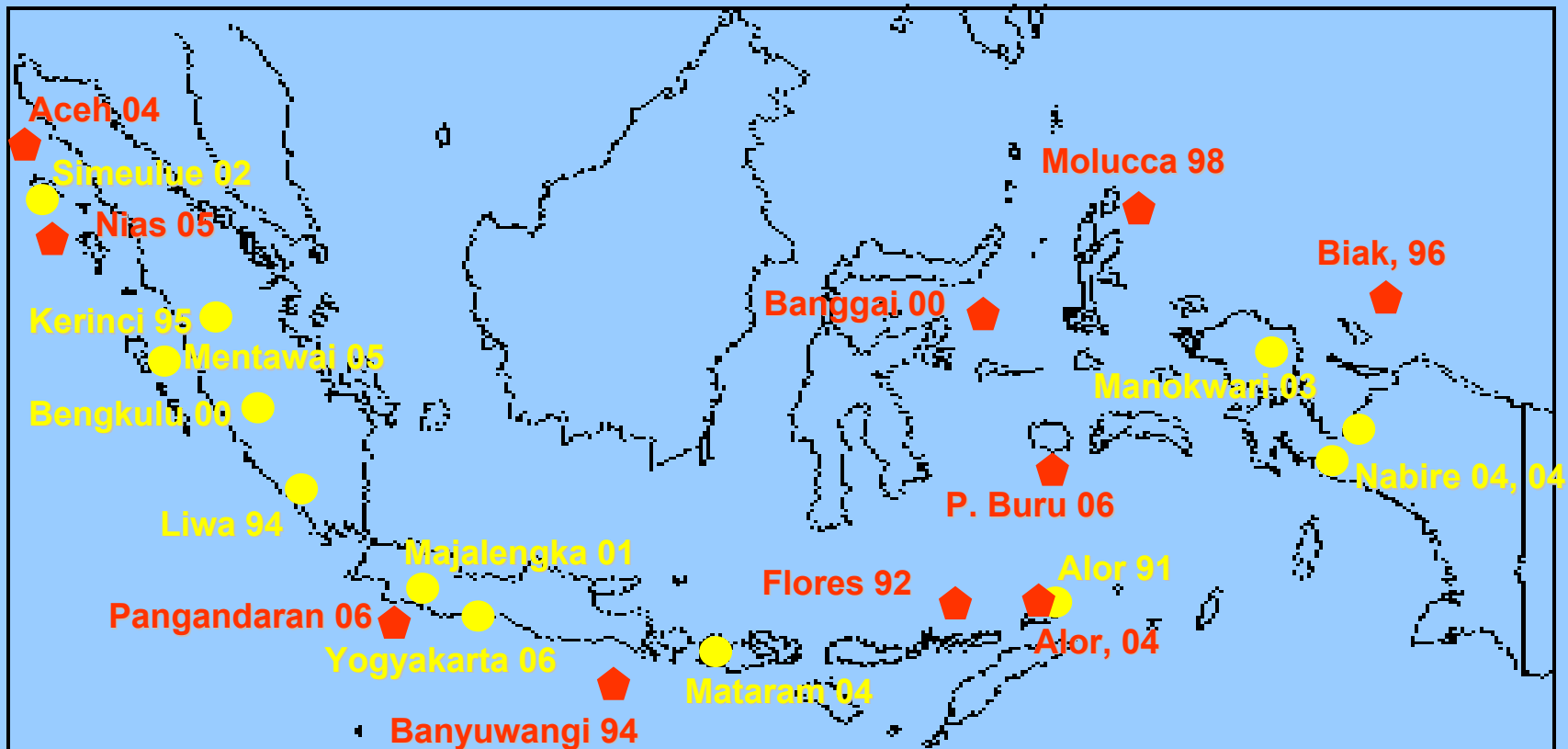
- Germany; GFZ, GTZ, DLR
- Japan; NIED, JAMSTEC, JMA, JICA
- China; CEA
- USA; US-IOTWS, NOAA, CALTECH, USGS, PTWC, ITIC,
- French; CEA
- ASEAN Countries; AEIC, ASEAN Earthquake Information Center
- Countries in Indian Ocean (IOTWS) and Pacific (PTWS) region
- UN; UNESCO, UNDP, UNU
- CTBTO, IRIS



# Earthquake distribution in Indonesia



# Destructive Earthquake and TSUNAMI 1991 - 2006



Earthquake : 22 x  
Tsunami : 10 x

→ > 1 / year  
→ ~ Every 2 years

● EARTHQUAKE  
◆ EARTHQUAKE → TSUNAMI





# Components of Tsunami Early Warning System

1. Monitoring; produce data
2. Processing; produce information
3. Dissemination; communication
4. Preparedness; education, evacuation



# Components of Tsunami Warning System

Direction

Earthquake



Tsunami or not



Evacuation or not



less casualties

1. Monitoring  
2. Processing

3. Dissemination  
4. Preparedness

- BMG, the agency who monitor and release earthquake information and tsunami early warning
- **The first five minutes**; earthquake information and tsunami warning belong to BMG or BMG's responsibilities, **the next minutes** it becomes responsibilities of other institutions for people safety (*President of RI, July 2006*)
- BMG has a task to produce earthquake information and tsunami warning within five minutes after the earthquake
- Other institution's tasks; readiness, preparedness, emergency response for any possibility impact of earthquake and tsunami to reduce casualty in timely manner.

# Distribution of tasks to develop Tsunami Early warning System in Indonesia

## OPERASIONAL

### Observation

#### 1. SEISMIC MONITORING(BMG)

- **SEISMOGRAPH**  
Proposed : 160  
Installed : 30 (2005)
- **ACCELEROGRAPH**  
Proposed : 500  
Installed : 20 (2005)

#### 2. SEA MONITORING

- Tide Gauge (Bakosurtanal)
- GPS – Buoys (BPPT)

#### 3. CRUSTAL DEFORMATION

- GPS (Bakosurtanal)
- EO (LAPAN)

### Processing (BMG)

#### 1. REAL TIME AUTOMATIC PROCESSING :

- Earthquake Location ,  
Time and Magnitude

#### 2. INTERACTIVE PROCESSING

- Tsunami Generated ?
- Issue Tsunami Warning ?
- Cancel the Warning, All clear notification

#### 3. DATA BASE

- Historical Tsunami
- Pre Calculated Tsunami

### Alert Dissemination

Eq. Information

**Tsunami Warning**

**BMG**

- Situation Center
- Control system for dissemination

### Mitigation, Rehabilitation Emergency Response

**BAKORNAS PBP**

- Situation Center
- Control system for dissemination

- Communication
- Public Works
- Social affairs
- Health
- Interior Affair
- Local Gov.
- Red Cross
- Media

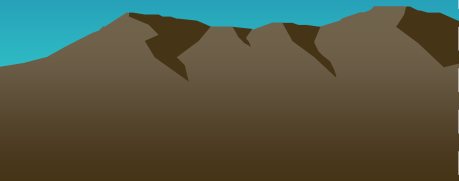
## Capacity Building

### Research and Development

Modelling, R&D, Modules for Public Awareness and Preparedness (RISTEK, Universities, Research Institutes)

### H R D

Formal Education, Training, Public Education, Simulation (RISTEK, Min. Education, BAKORNAS, LIPI, loc Gov)

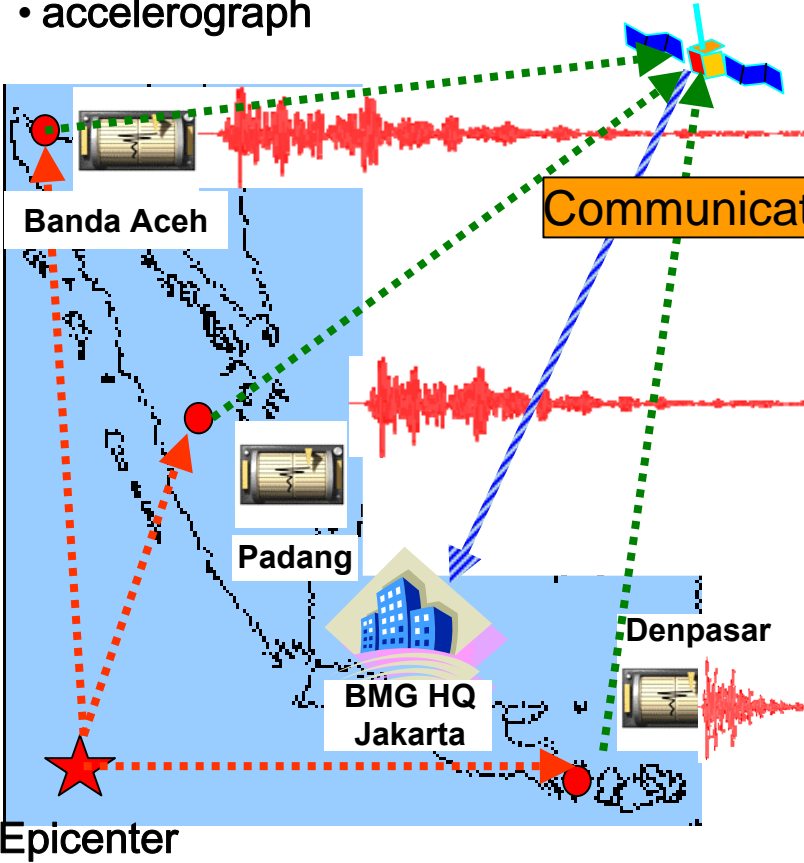




# END TO half-END CONCEPT OF Indonesian TEWS (InaTEWS)

## OBSERVATION

- Seismograph
- accelerograph



- Tide Gauge
- Buoy/OBU
- GPS LAND STATION
- Earth Observation

## PROCESSING



*Earthquake Information*

- Time
- Location
- Magnitude

1

Decision support

*Earthquake information or Tsunami Warning*

Manual Verification

2

SMS  
5 in 1  
Phone  
Web  
Email

3

Control System  
Of Situation  
Center

## DISSEMINATION

Evacuate  
Watch  
Advisory  
Cancellation



Siren



Speaker



Phone/fax



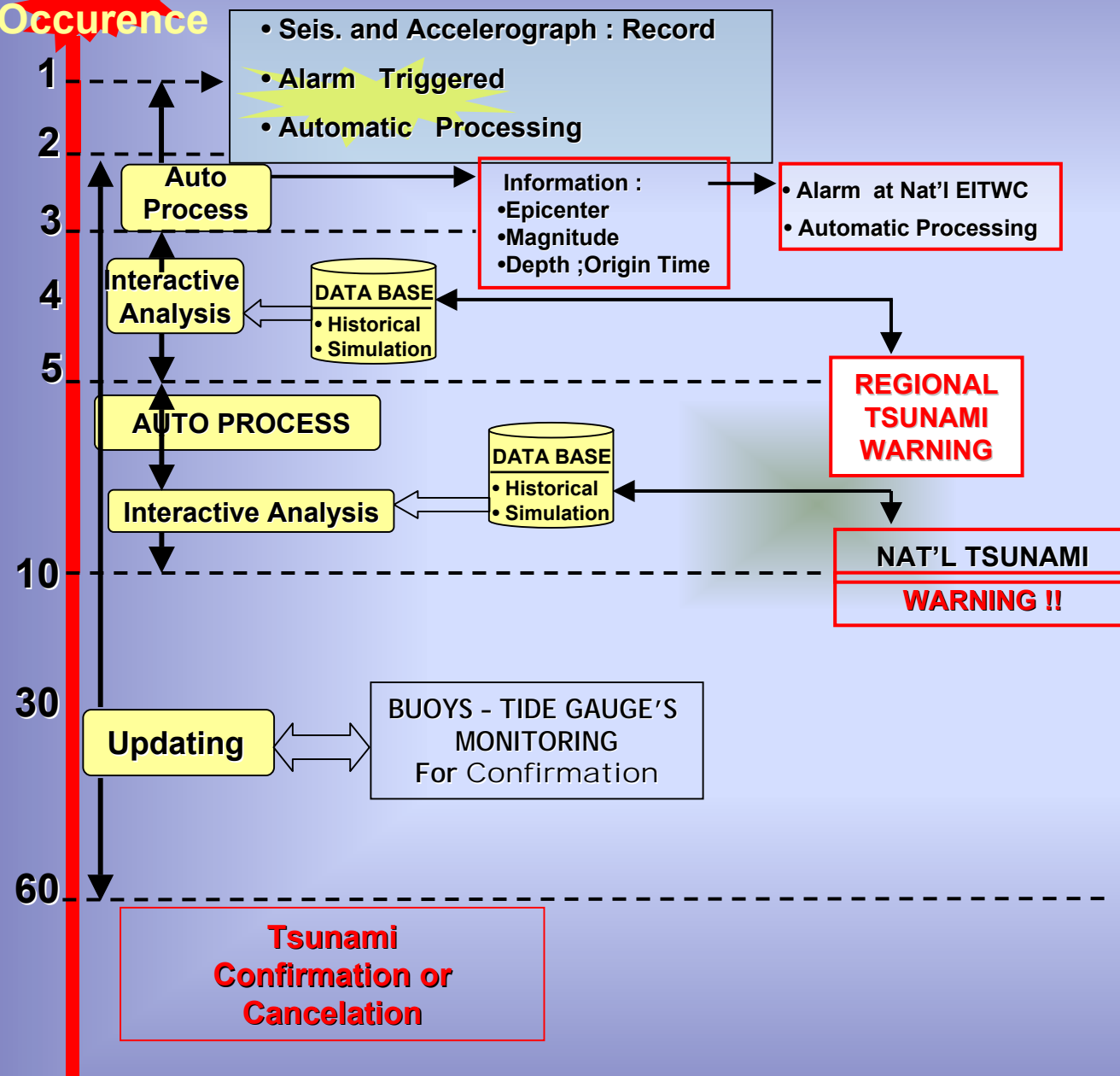
SMS



Control System  
Of Situation  
Center

Communication

# Earthquake Occurrence Time (in Minutes) Required for Processing Warning Information



Processing Time Frame (Minute 1 - Minute 10)

Minute 1: Signal recorded at  $\geq 5$  Stations

Minute 2: Processing

Minute 3: EQ Parameters (Origin Time; Epicenter; Depth; Magnitude)

Minute 4: - Database is activated  
- Interactive Analysis

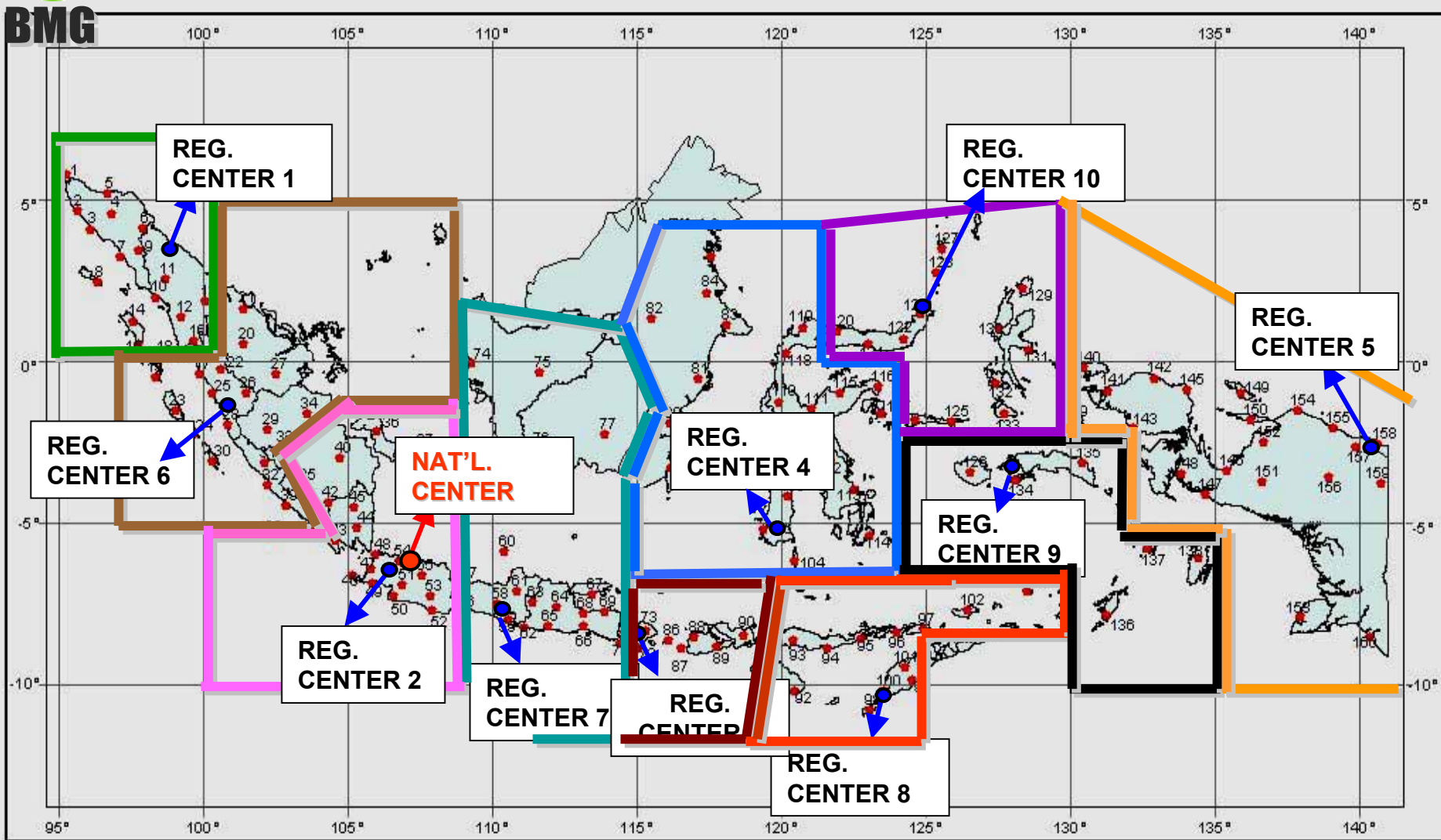
Minute 5: Warning !!

Minute 10: Warning From Nat'l Center to Wider Region/ International





# Indonesia Earthquake Information and Tsunami Warning Center (InaTWS end of 2008)



**Existing  
2006**

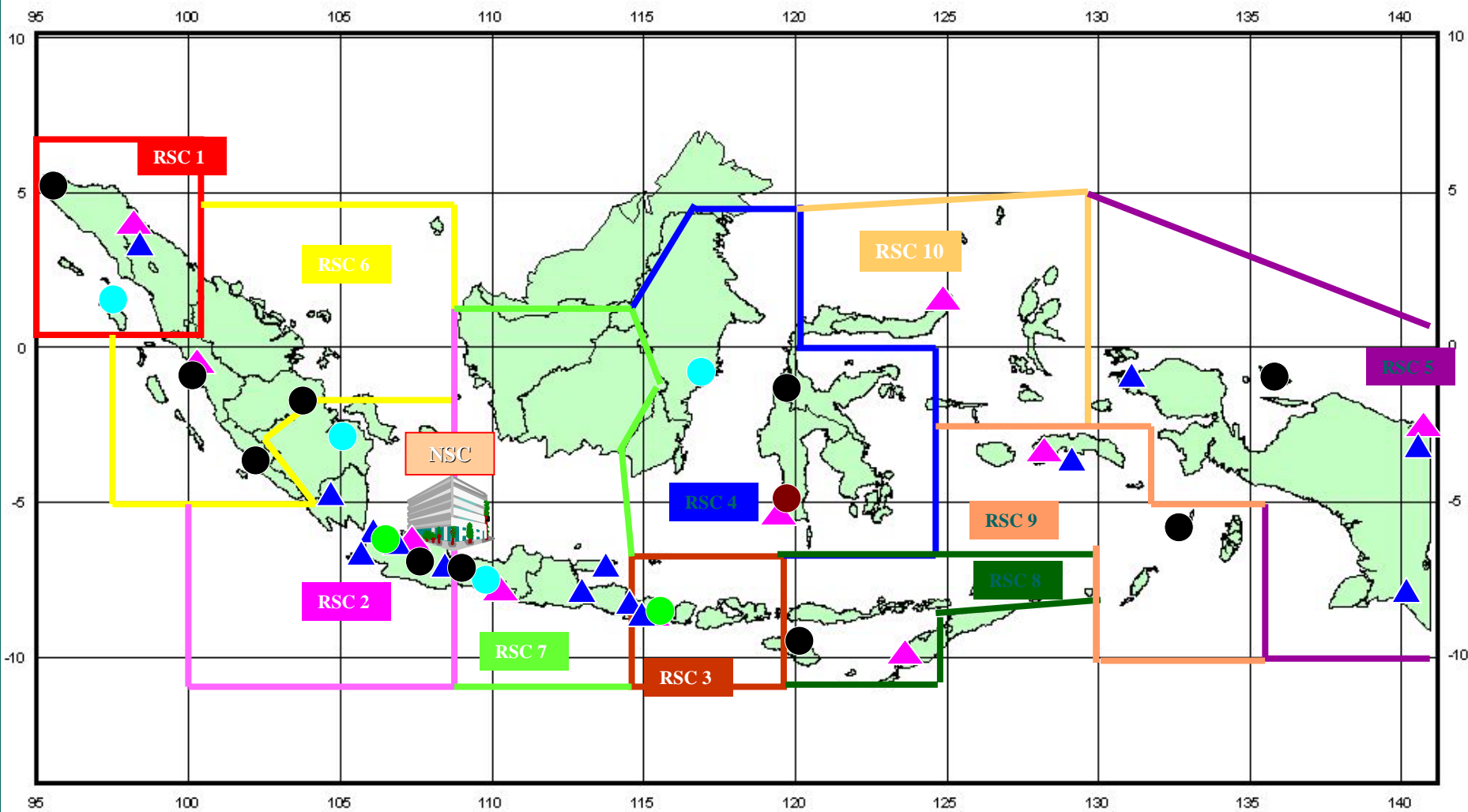
- 30 Seismic real time Sensor
- Processing Time  $\pm$  10 minutes

**Target  
2006-2008**

- 160 Seismic Sensors-500 Accelerograph
- Distance between sensors  $\pm$  100 km
- 10 RC and 1 NC
- Processing Time  $\pm$  5 minutes



# BROADBAND SEISMIC STATIONS NETWORK INSTALLED 2005

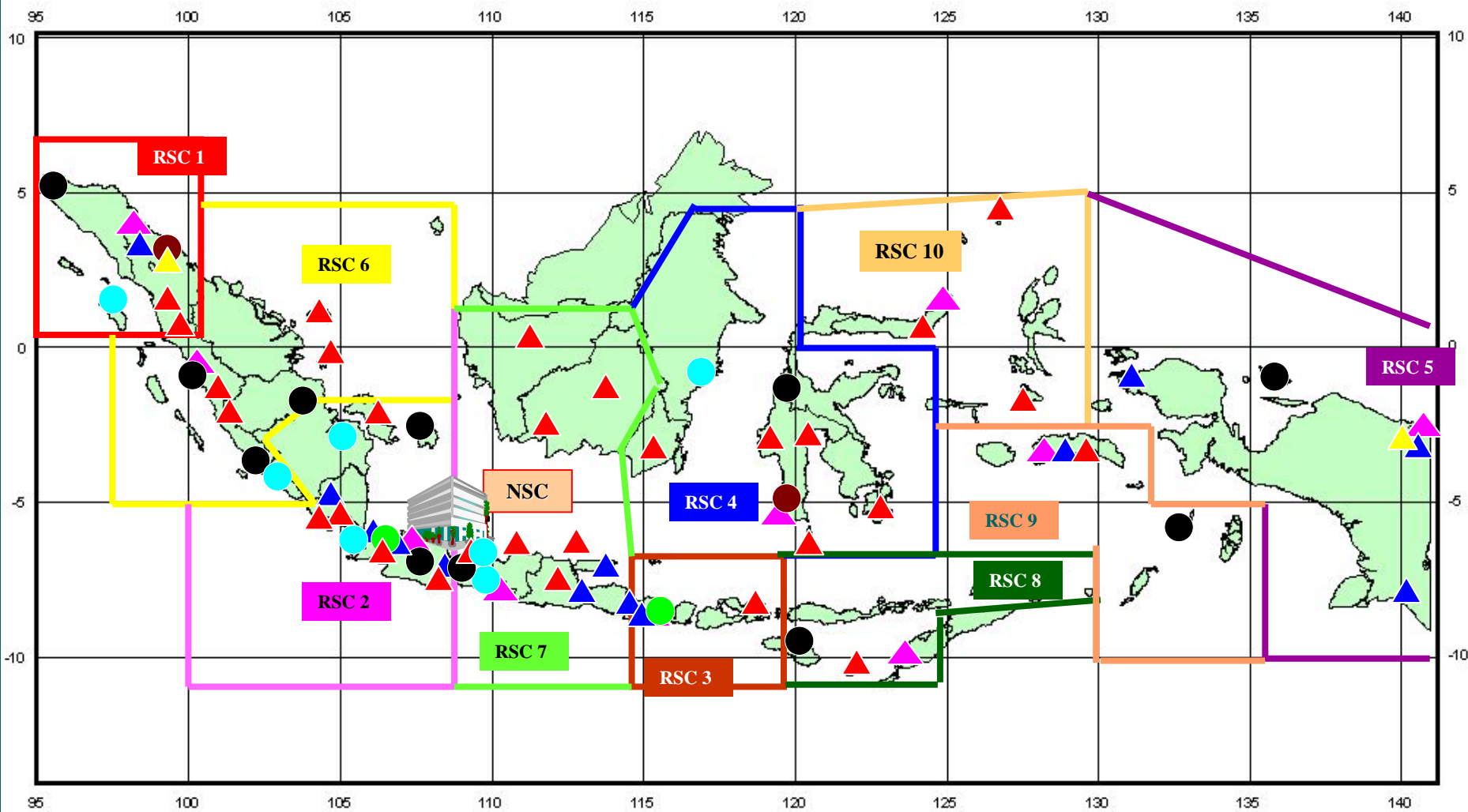


- Japan (10)
- German (4)
- CTBTO (1)
- ▲ Regional Centre (10)
- ▲ BMG (14)
- China (2)
- ▲ BMG (30), '06

RSC = Regional Seismic Center  
NSC = National Seismic Center

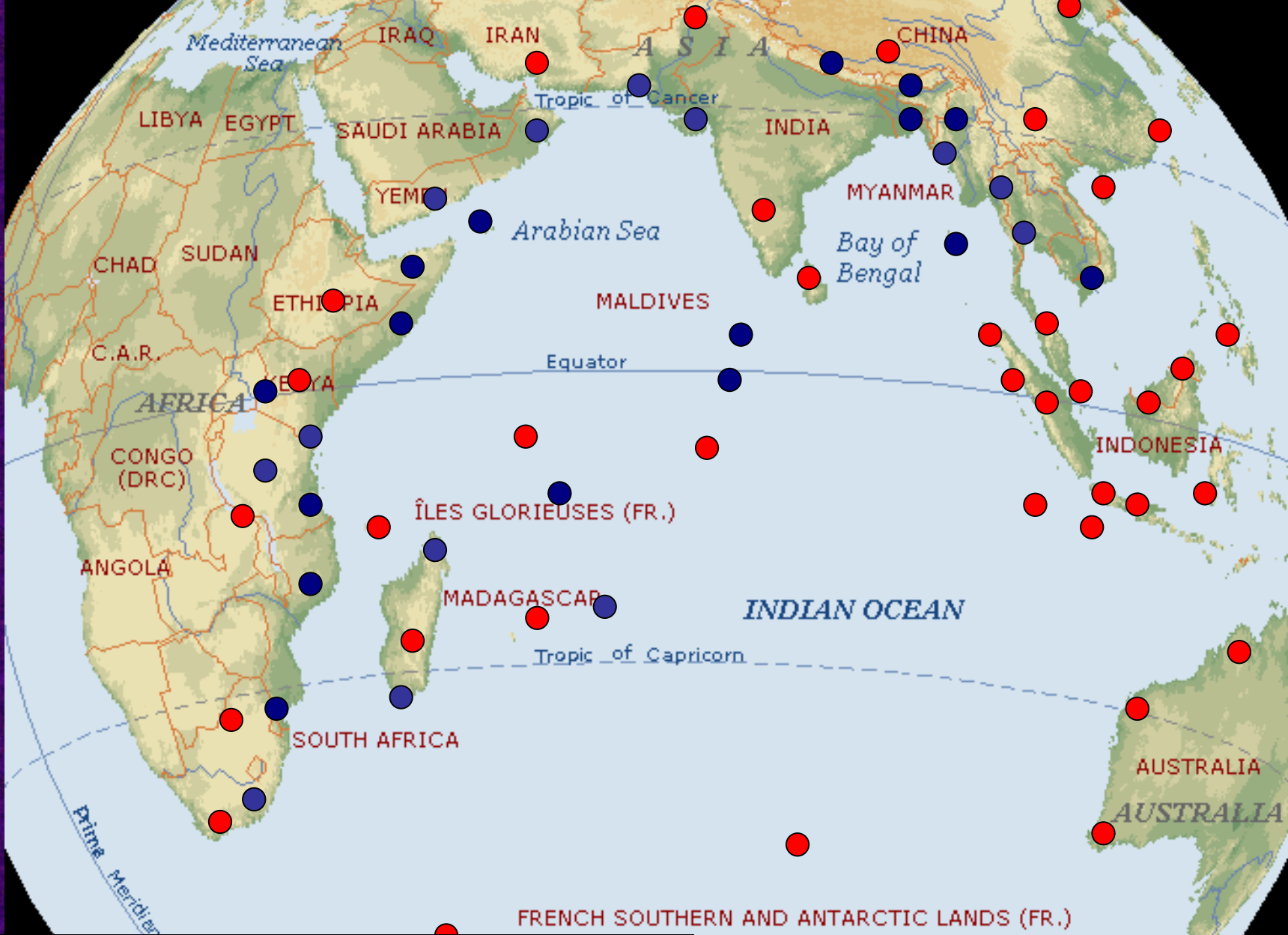


# BROADBAND SEISMIC STATIONS NETWORK INSTALLED 2006



- |               |              |                 |                        |                               |
|---------------|--------------|-----------------|------------------------|-------------------------------|
| ● Japan (11)  | ● German (4) | ● CTBTO (1)     | ▲ Regional Centre (10) | RSC = Regional Seismic Center |
| ▲ BMG (14)'05 | ● China (2)  | ▲ BMG (30), '06 | ▲ JAMSTEC              | NSC = National Seismic Center |



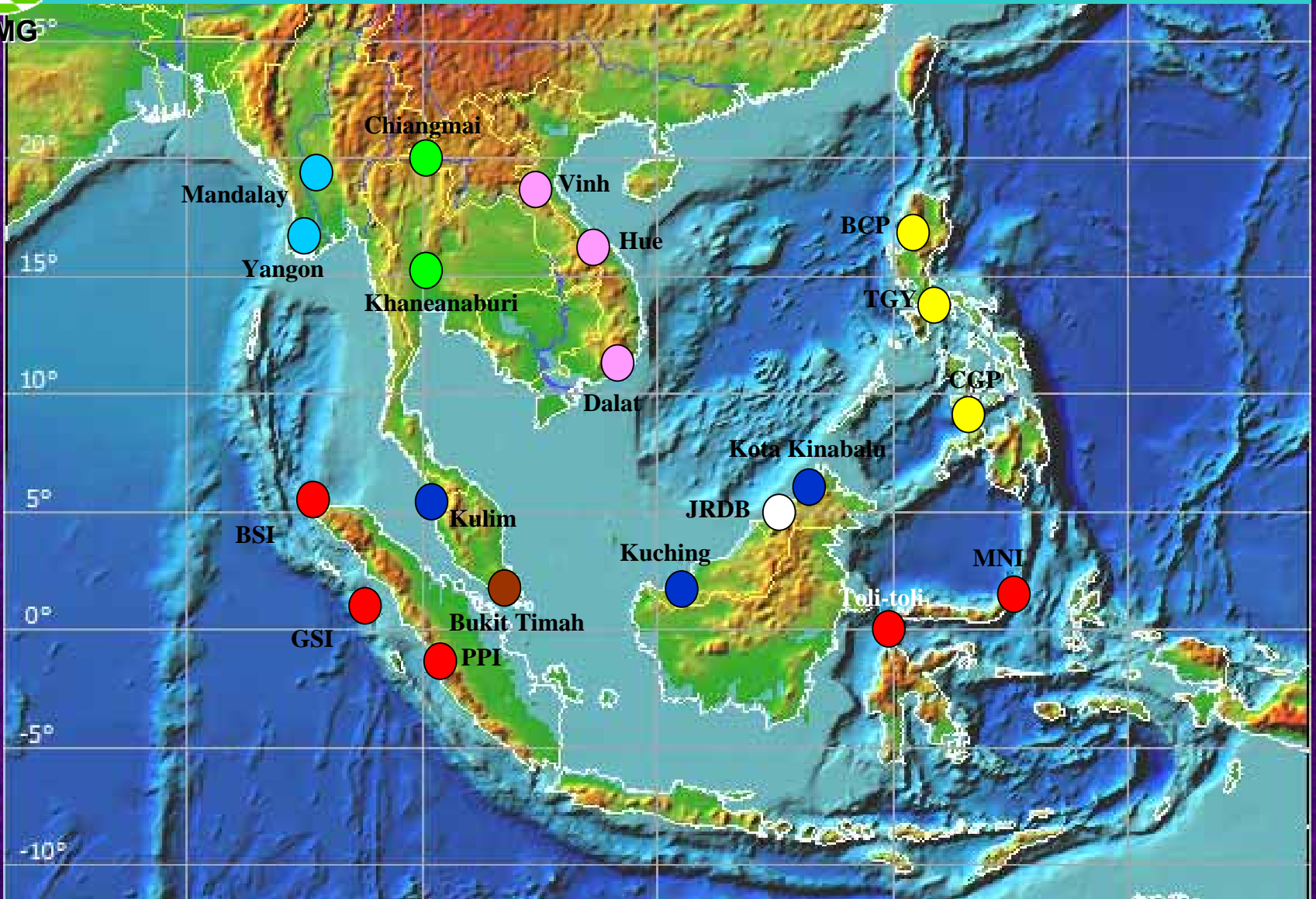


**Core Seismic stations  
to be shared among the members/international  
After ICG meeting in Hyderabad 2005**

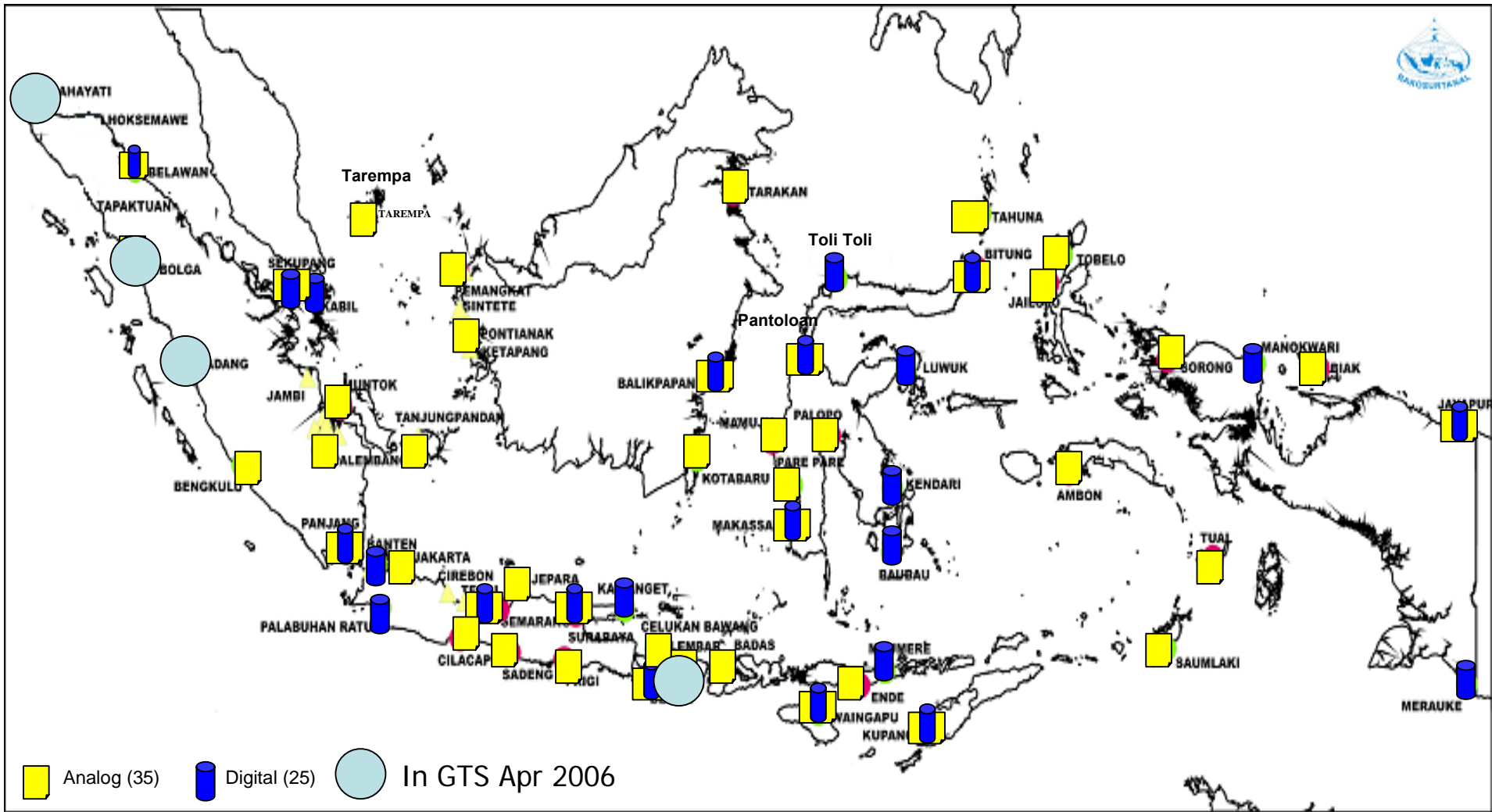


# Seismic stations for ASEAN real time data exchange After task force meeting of SCMGM in Malaysia 2005

BMG

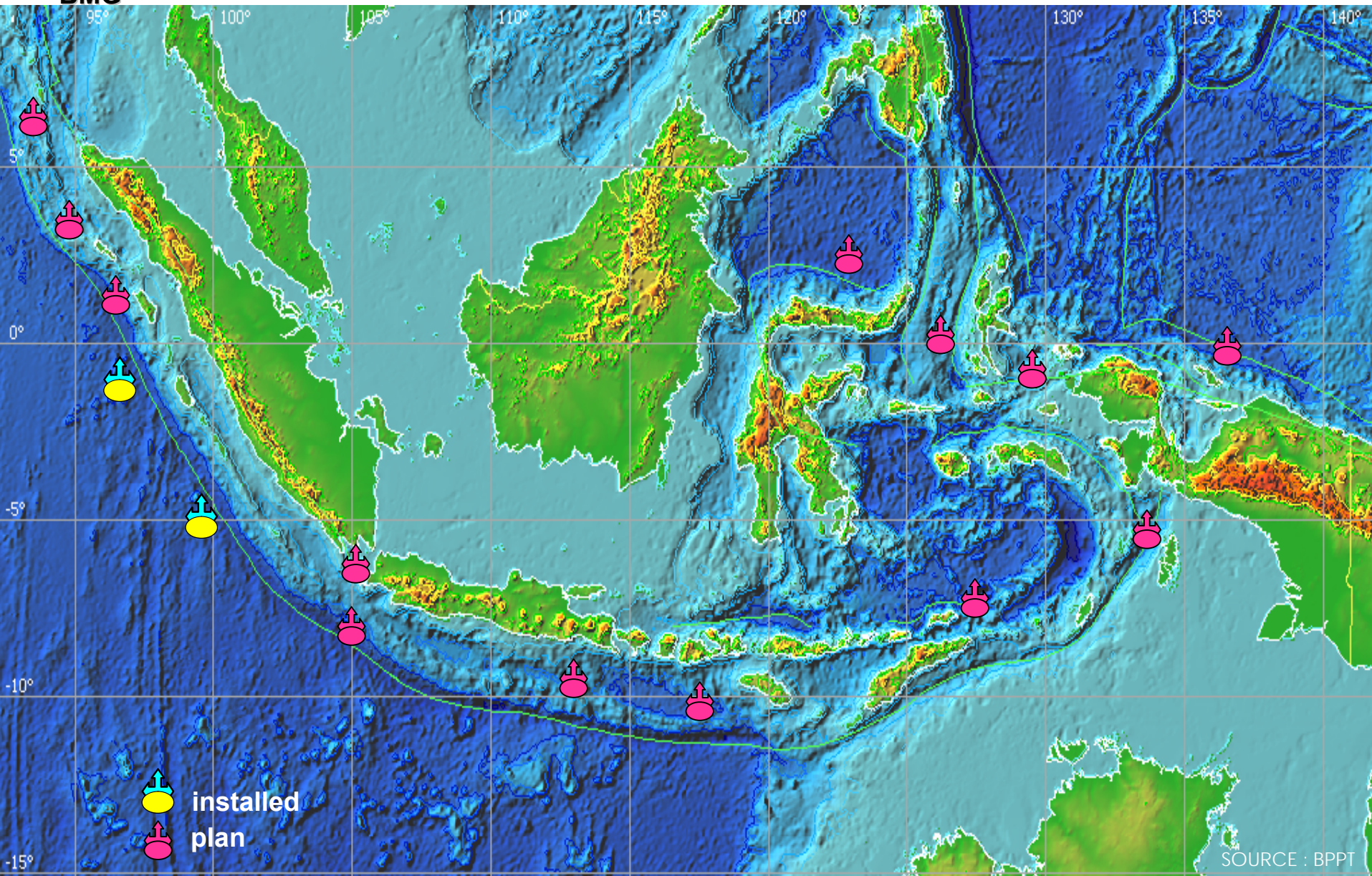



# Current Tide Gauges networks





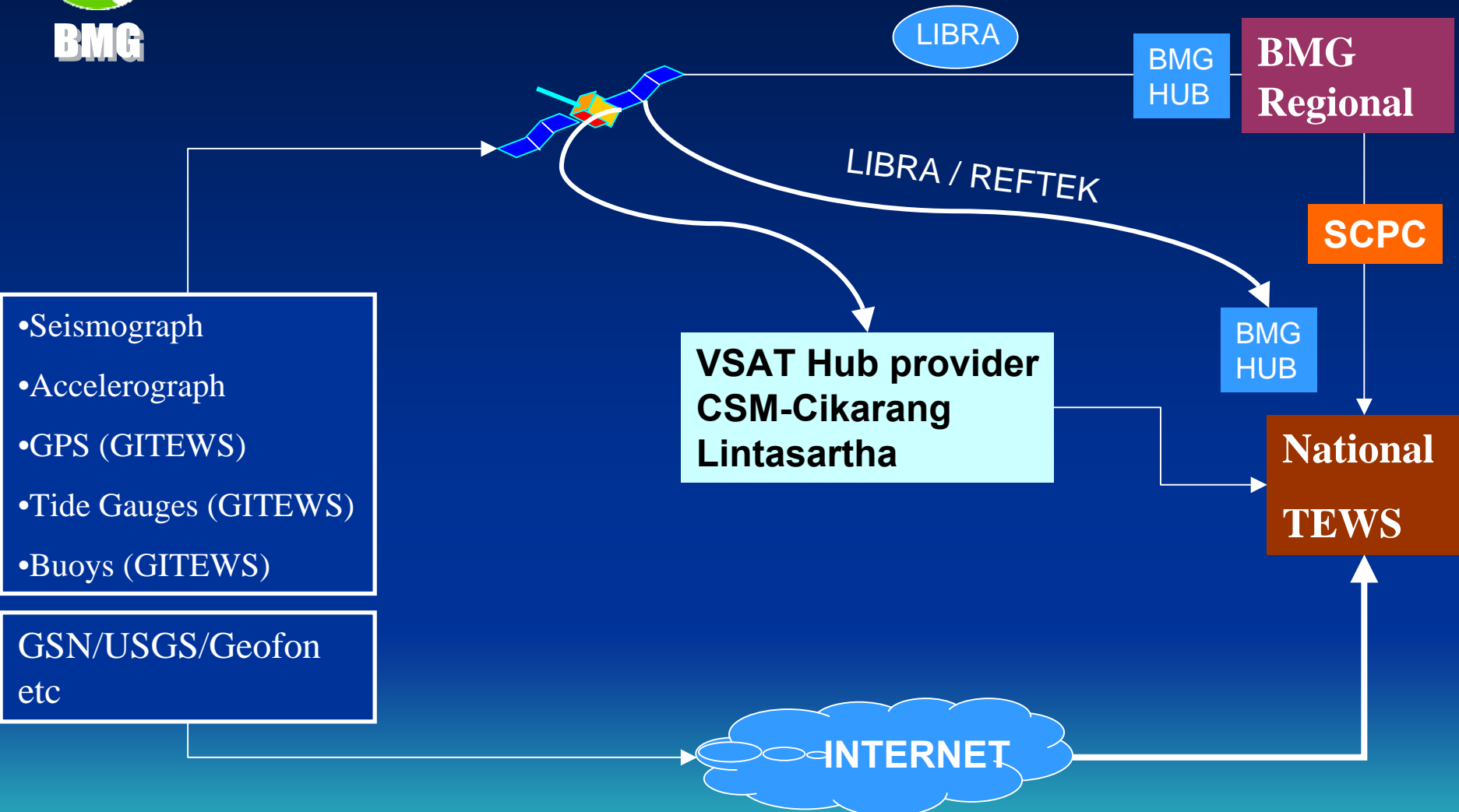
# DART BUOYS NETWORK



 installed  
 plan



# Communication System of Sensors stations

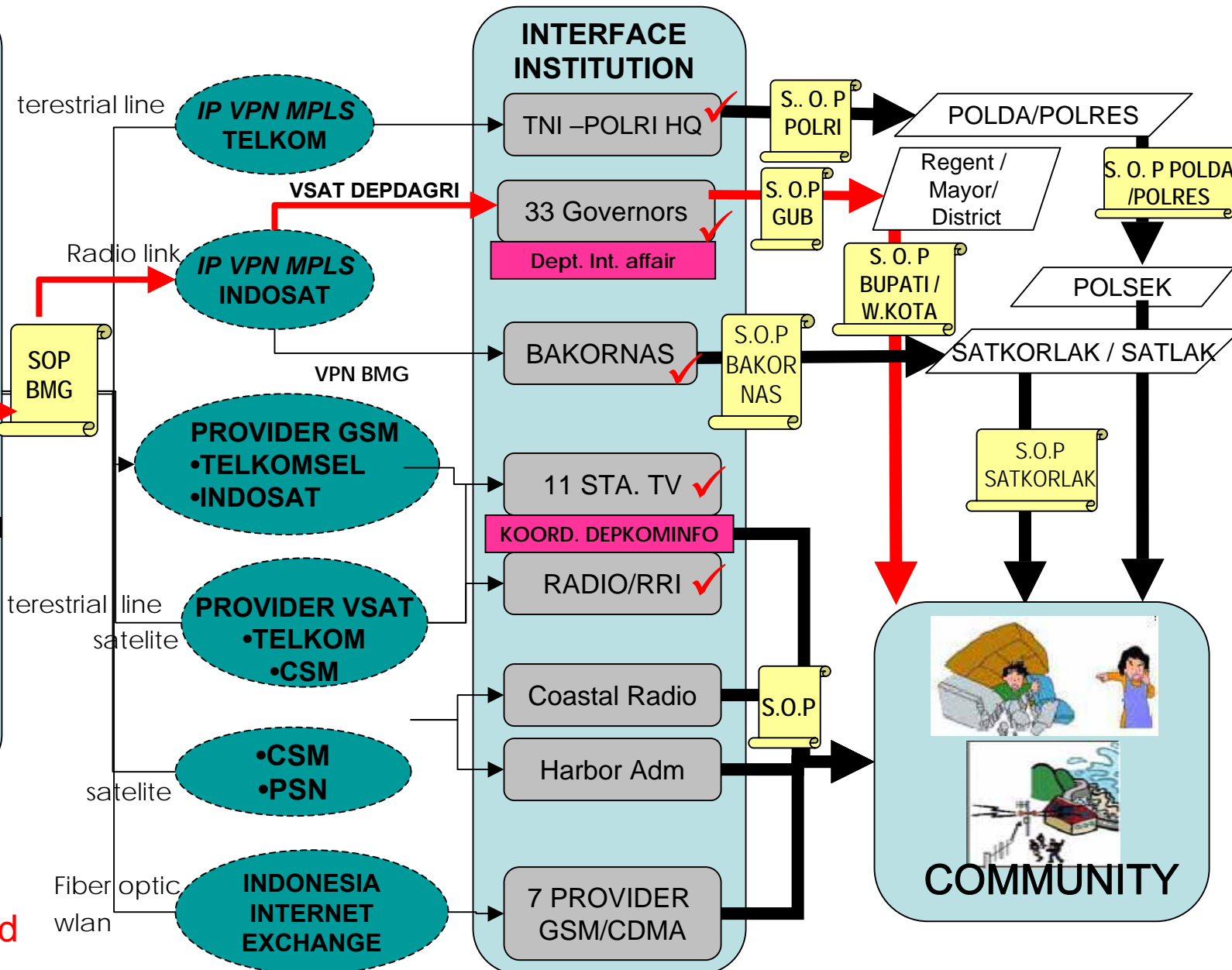


**SCPC; Single Channel Per Carrier- VSAT**

# Communication Network for INFORMATION DISSEMINATION

**BMG**

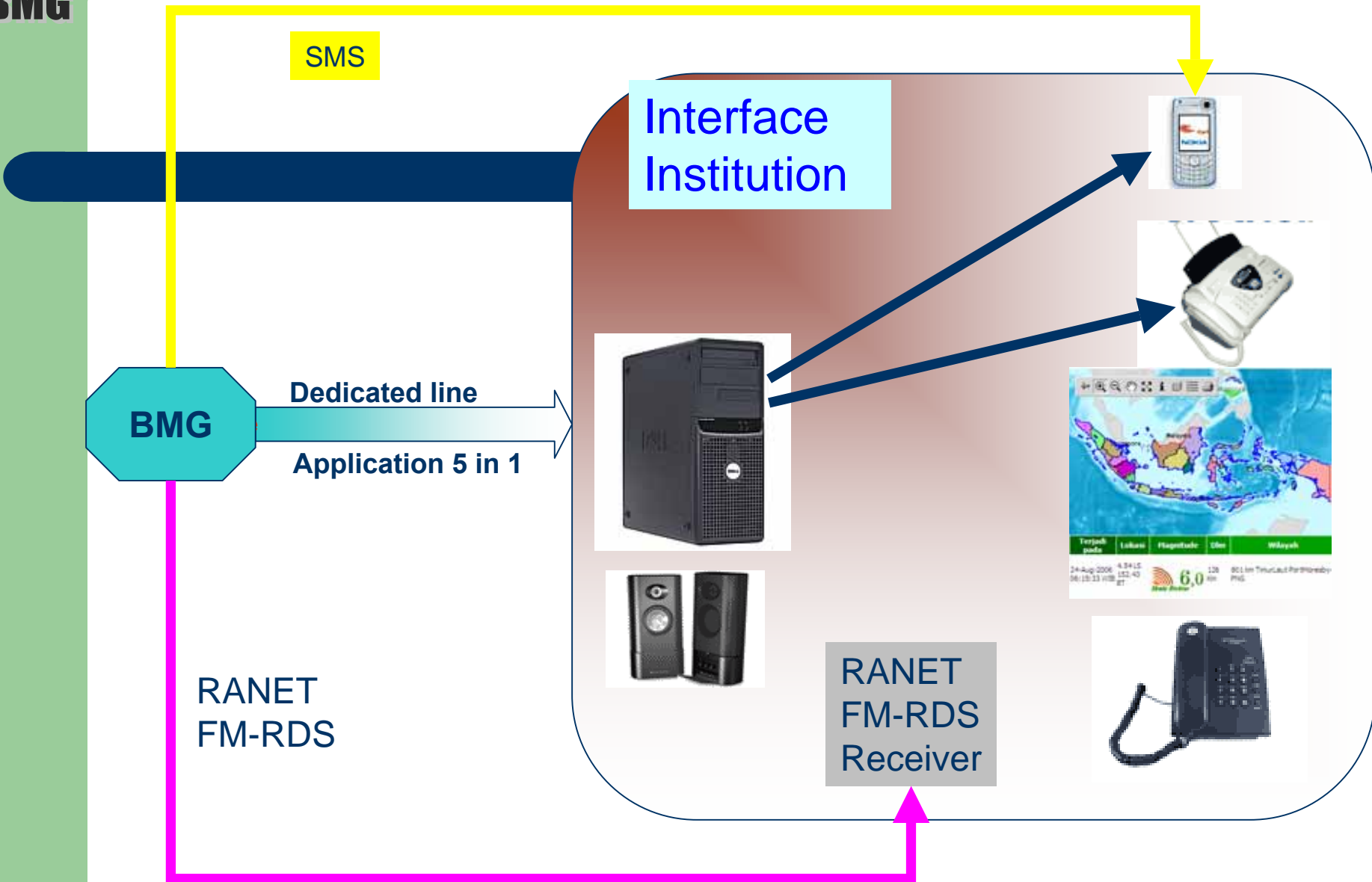
- SENSOR INSTALATION
- MONITORING
- PROCESSING
- ANALYSIS
- INFORMATION



✓ Established Sept 2006

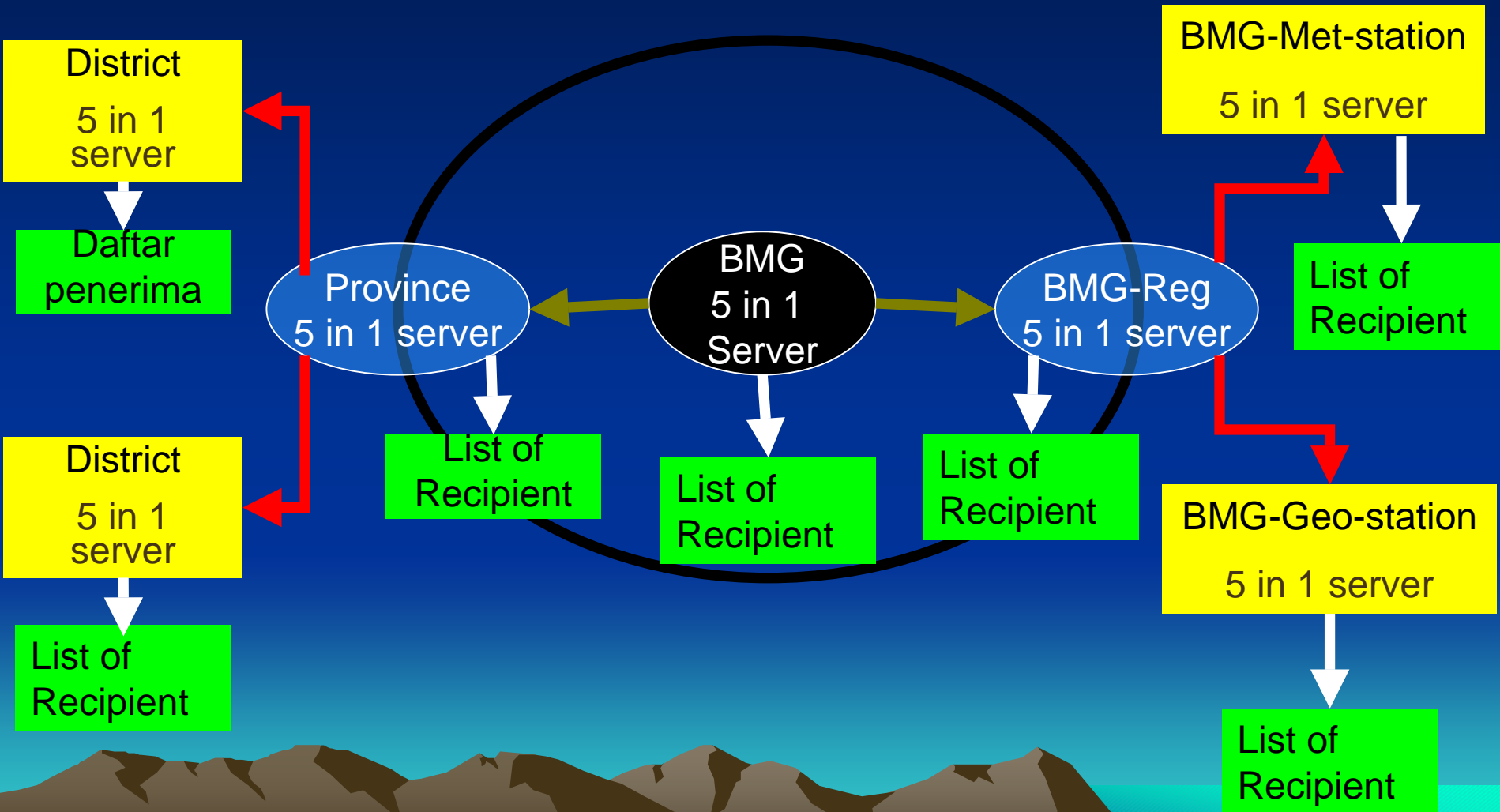


# INFORMATION Dissemination tools





# Clustering Information dissemination

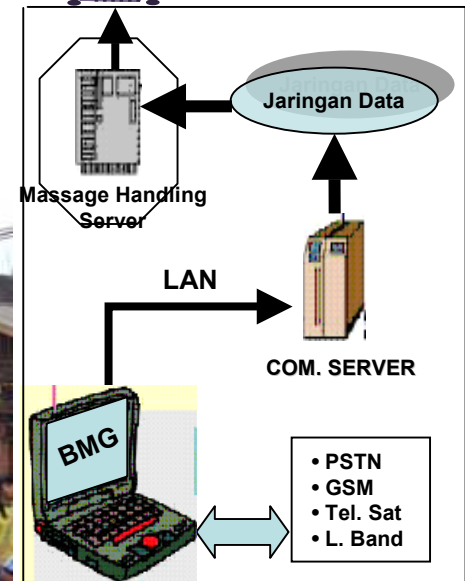
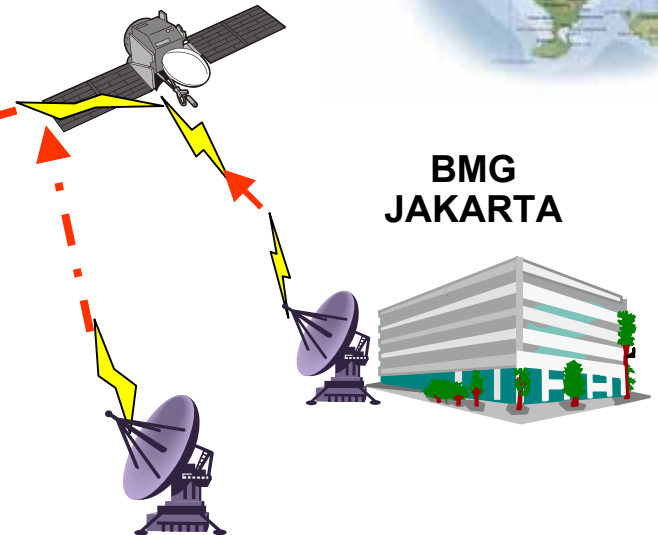




# SIREN NETWORK



Tsunami Drill



MEDAN  
PADANG  
DENPASAR



# Time Frame TWS

## 2006 - 2009

Tsunami Warning System	2006	2007	2008	2009
a. Monitoring System				
- BB Seismometer	40 unit	50 unit	40 unit	160 unit
- Accelerograph	40 unit	200 unit	250 unit	
b. Communication				
- Central Hub at Regional Center	2 unit	5 unit	3 unit	
- Remote Communications at Station/ Sensor Site	30 unit	50 unit	50 unit	
- Rent a Transponder	7KHz	1.2MHz	1.2MHz	
- VSAT-IP	12 sites	10 sites	10 sites	
- RANET and GSM in Municipality		450 sets	500 sets	
- RANET and GSM in Regional TWS and station		50 sets	50 sets	
c. Seismic Stations assessment		evaluation	relocate	relocate
d. National, regional and interfacing institution		SOP	SOP	SOP

# List activities in Capacity Building

- Training course to develop TWC of BMG in PTWC and JMA ,2006
- Training of seismic data acquisition for BMG and AEIC member, 2006
- Assessment of BMG capabilities by experts from ITIC, PTWC, JMA, IOC, USGS in 2006
- Join the training course of tsunami modeling in Malaysia and Belgium
- Training of seismology for BMG and MMD of Malaysia, by USGS, ITIC, JMA, IOC and IRIS, 2006
- Training in Seismology and tsunami by GFZ of Germany, 2007
- Task force meeting of SCMG (AEIC), 2007
- Training course for seismologist of AEIC, 2007





**BMG**

# Pictures of activities



**BMG new building for operation center**



**Socialization in University**



**Socialization in Local government**



**Preparation for Tsunami Drill with loc.gov**



# Conclusion

- Continue to develop networks to observe earthquake and tsunami and Infrastructure
- Integrate the parameters of observation to get a robust tsunami warning
- Develop tsunami forecasting to support type of warning messages
- Develop several models to support earthquake information
- Increase the capacity of human resources
- Develop SOP in BMG and SOP for local gov



BMG

**THANK YOU**

**ARIGATO**

**Terima kasih**

**FOR YOUR ATTENTION**