The Application of SpaceTechnology on Establishment of Indonesia's Tsunami Early Warning System

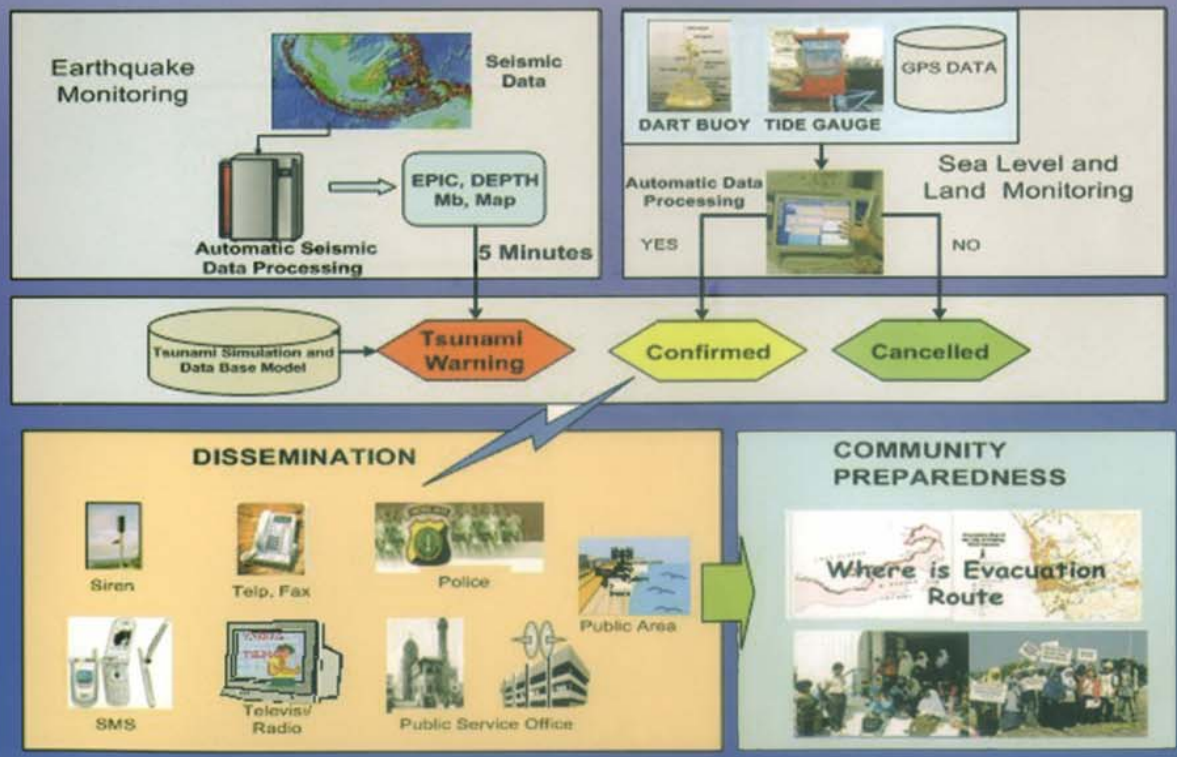
Presented By

Delegation of Indonesia

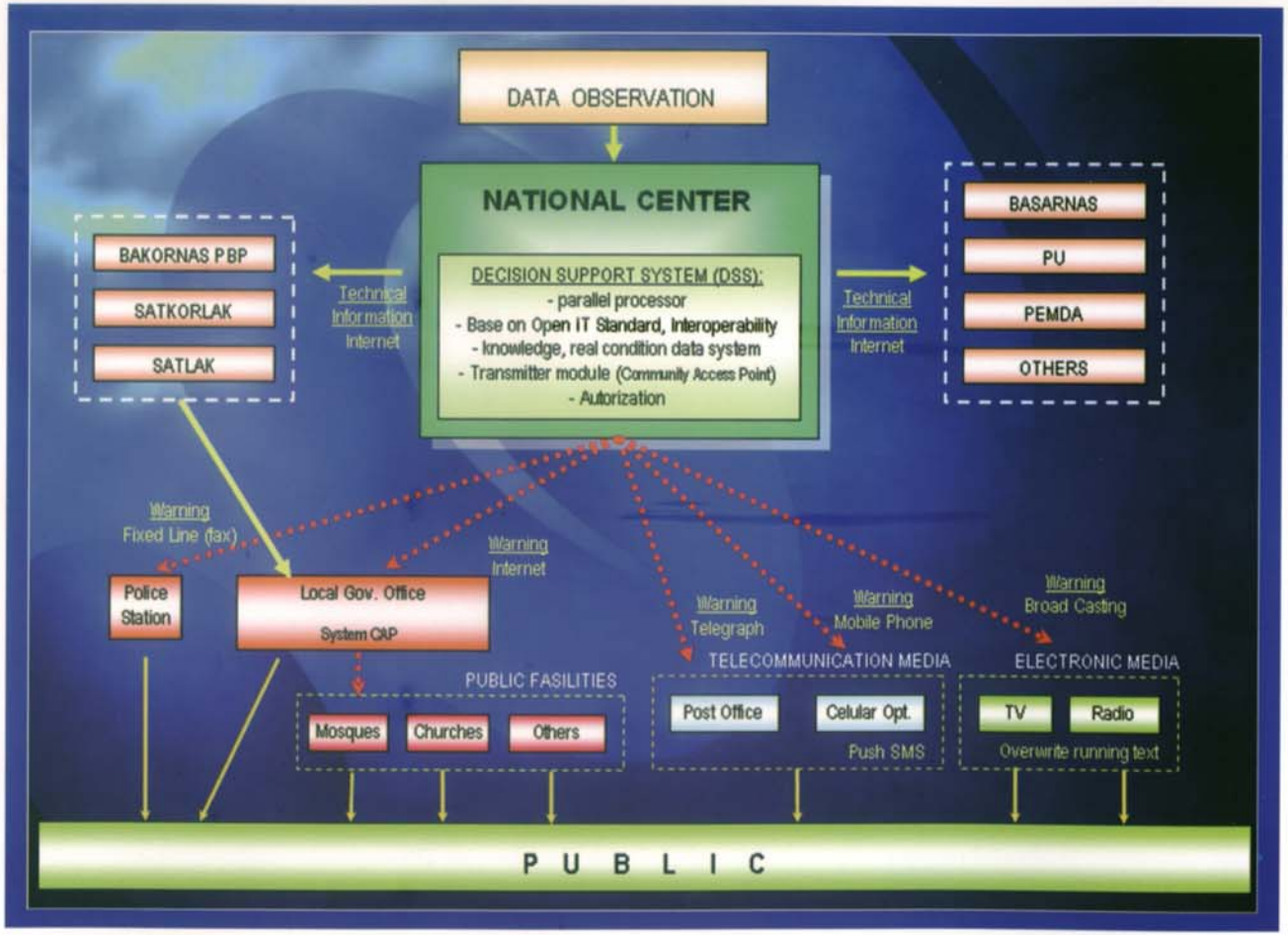
GRAND SCENARIO SISTEM PERINGATAN DINI TSUNAMI
TSUNAMI EARLY WARNING SYSTEM GRAND SCENARIO

TEWS di Indonesia didesain dengan target dalam waktu lima menit setelah gempa terjadi peringatan tsunami (Tsunami warning) sudah bisa diinformasikan. Komponen TEWS antara lain Observasi (Earthquake monitoring - Sea Level Monitoring), Integrasi dan Diseminasi Informasi, serta Kesiapsiagaan Masyarakat.

TEWS in Indonesia is designed to send the warning within 5 minutes after the earthquake. TEWS consist of several components that are Observatio (Earthquake - Sea Level Monitoring), Integration and Dissemination information , and Community Preparedness.



KOMPONEN TEWS : INTEGRASI DAN DISEMINASI INFORMASI.
TEWS COMPONENT : INTEGRATION AND DISSEMINATION INFORMATION

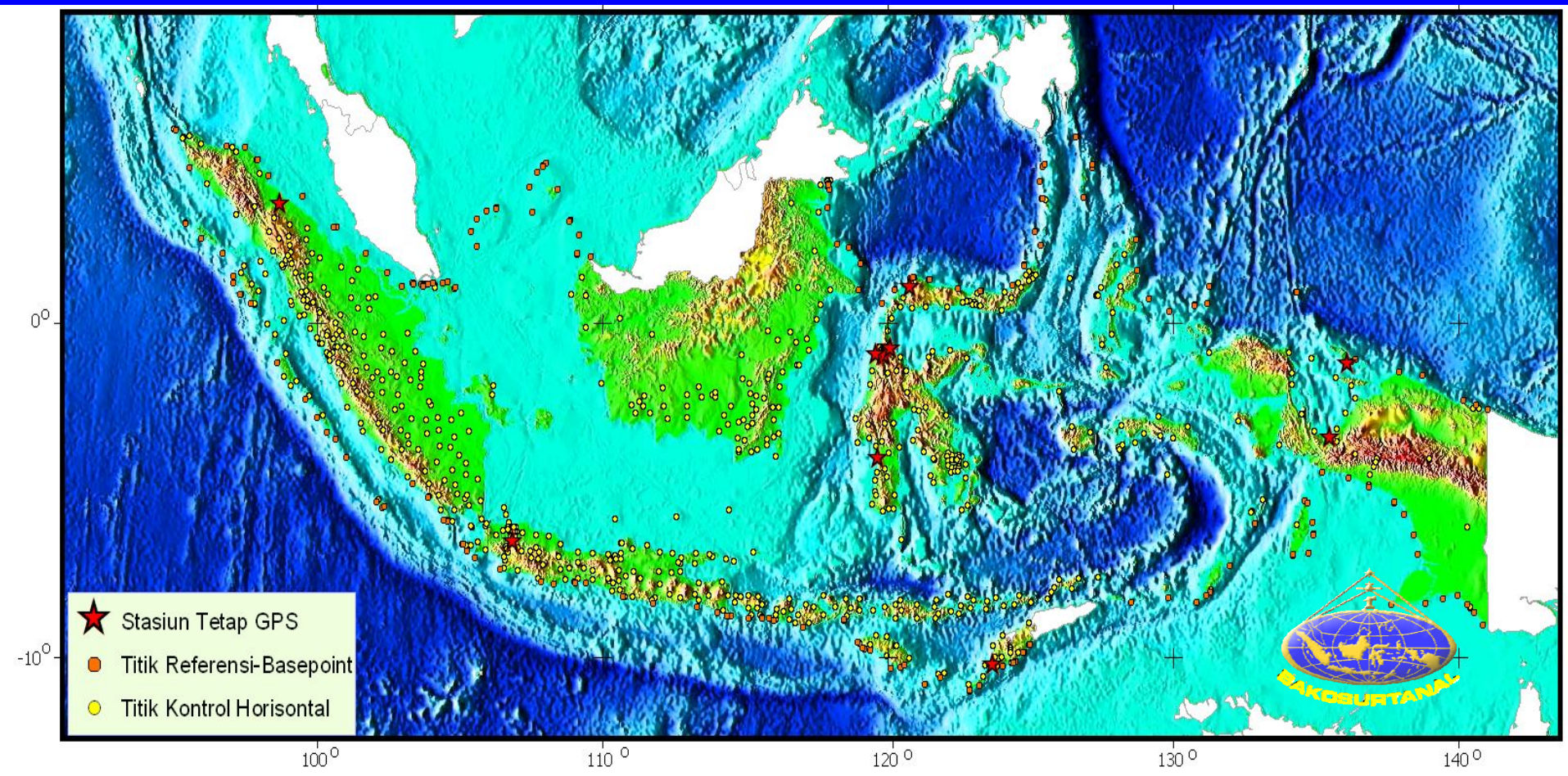


Space Technology to Support Real or Near Real Time Monitoring

- Program on an application of Global Navigation Satellite System for Geodynamic/crustal movement monitoring (Global Positioning System -GPS)4
- Program on Earthquake monitoring (data communication-ICT)
- Program on sea level and sea wave recordings (data communication-ICT)
- Program on monitoring and updating of Geospatial data (Remote Sensing for base and thematic mapping)

Program on Global Positioning System (GPS)
An application of Global Navigation Satellite System

The Indonesia Geodetic (GPS) Control Network
Status Year 2003



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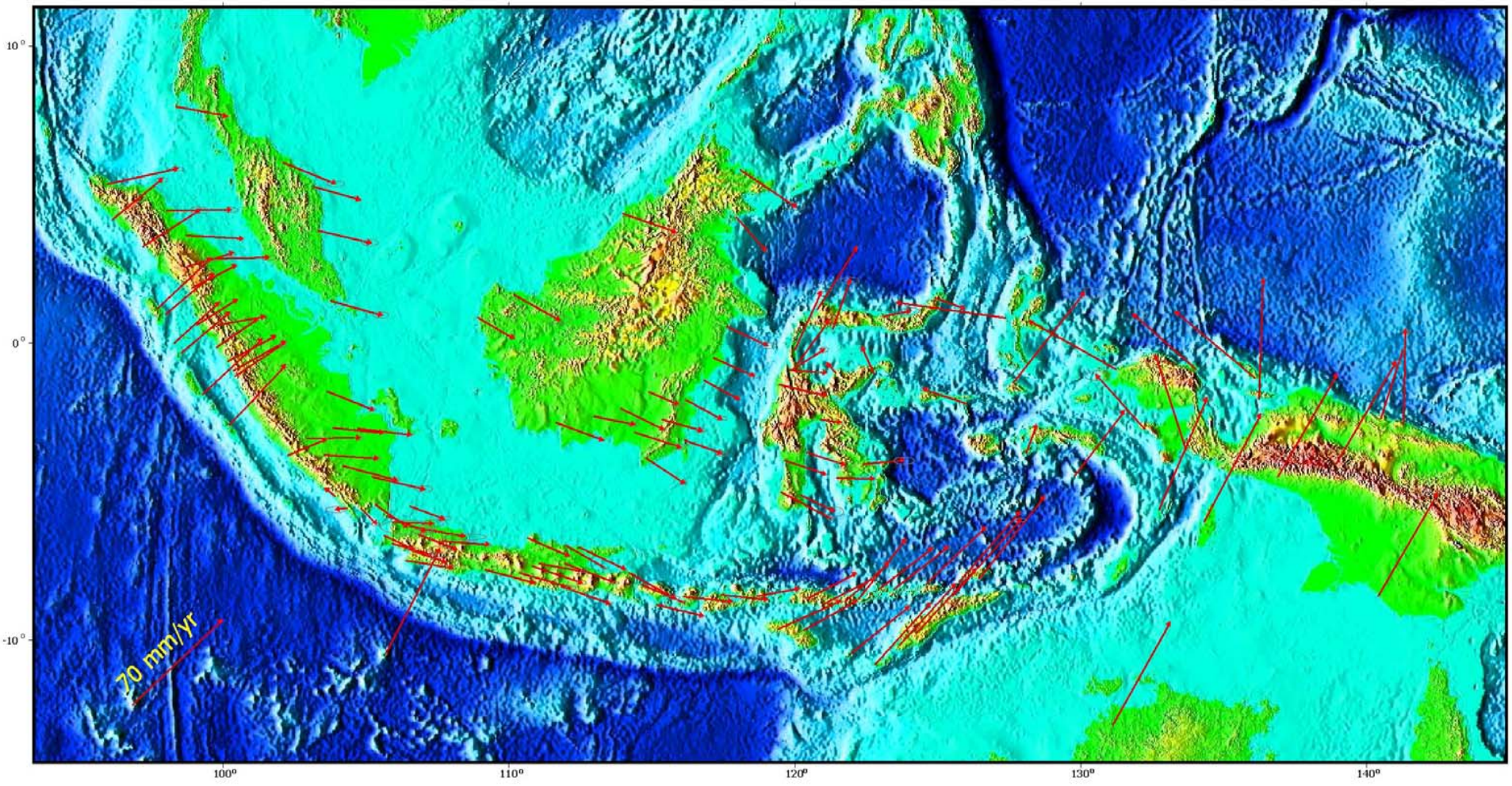
Present day horizontal plate motion in Indonesia In ITRF2000



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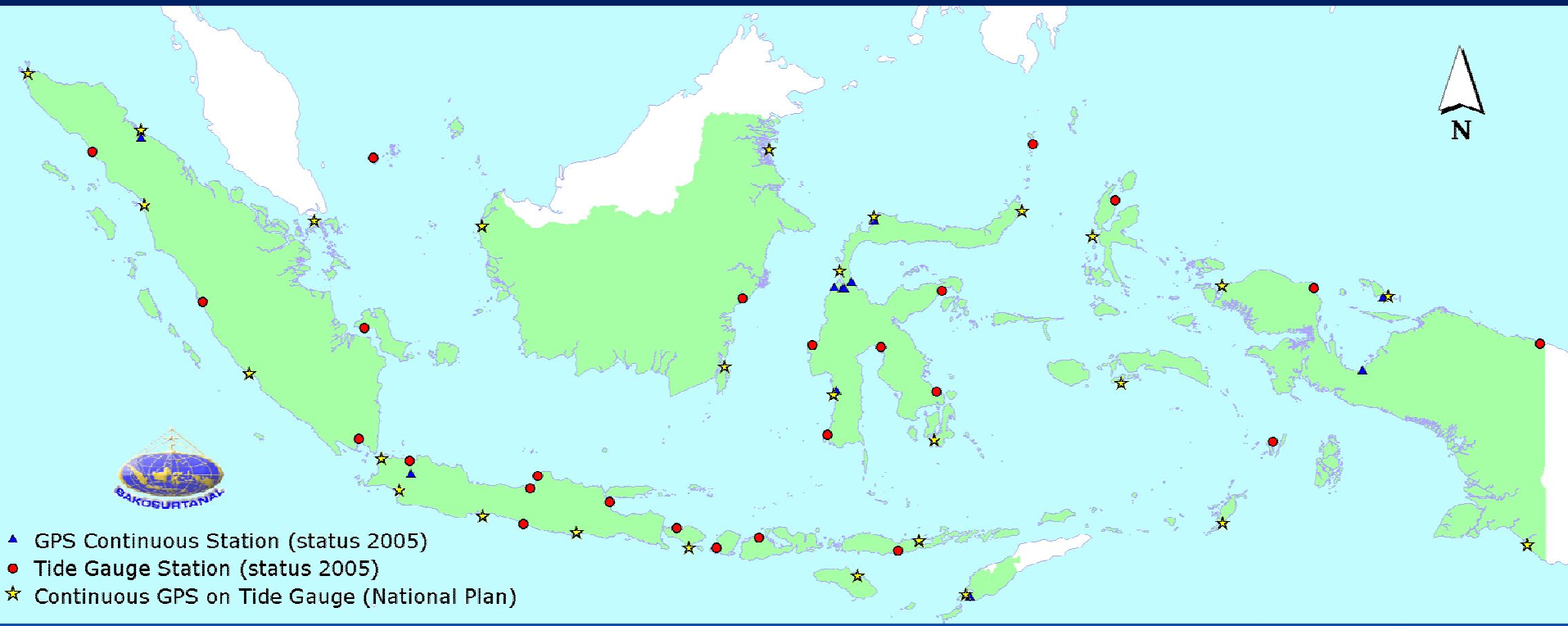
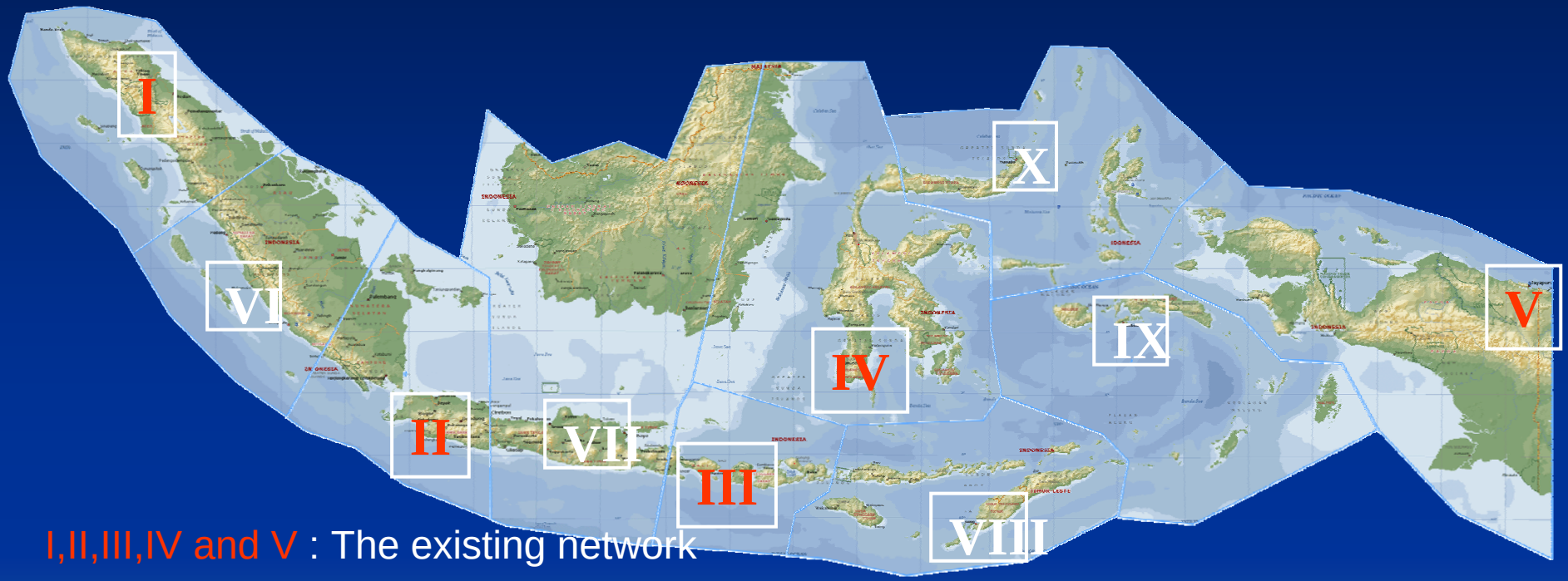
INDONESIAN PERMANENT GPS AND TIDE GAUGE STATIONS



Program on Earthquake Monitoring System

BMG

EXISTING SEISMIC NETWORK and Grand Design Network for Earthquake Monitoring



I,II,III,IV and V : The existing network

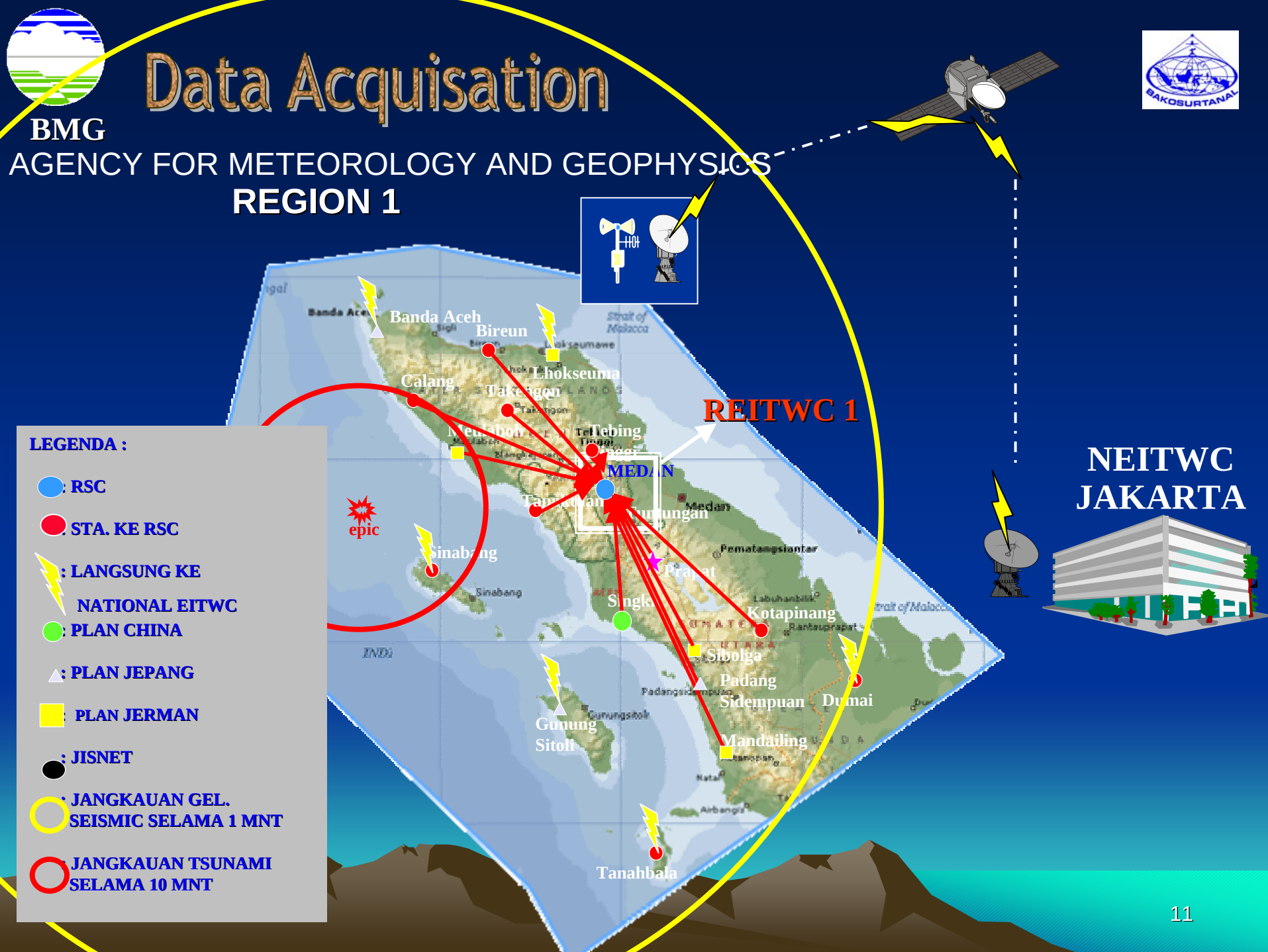
Designed for 160 seismographs network, supported by Germany,China,Japan and CTBTO

Data Acquisation

BMG

AGENCY FOR METEOROLOGY AND GEOPHYSICS

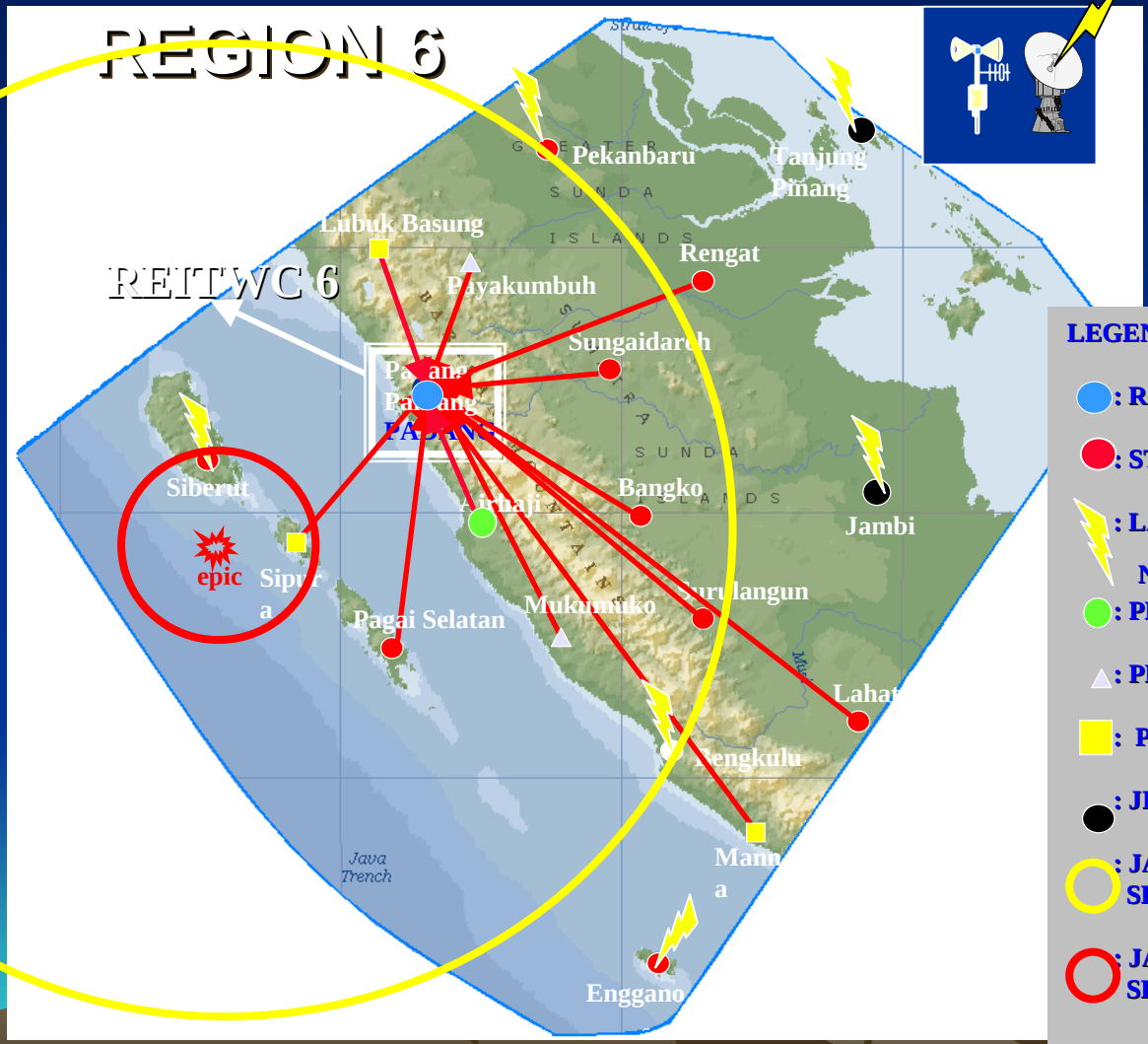
REGION 1



Data Acquisation

BMG

AGENCY FOR METEOROLOGY AND GEOPHYSICS



LEGENDA :

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- : JISNET
- : JANGKAUAN GEL. SEISMIC SELAMA 1 MNT
- : JANGKAUAN TSUNAMI SELAMA 10 MNT

NEITWC JAKARTA

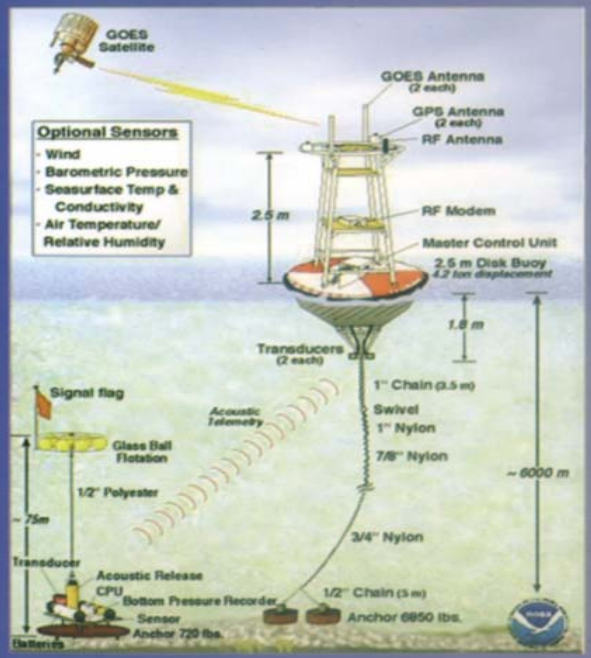
Program on Sea Level and Wave Monitoring

KOMPONEN TEWS : OBSERVASI

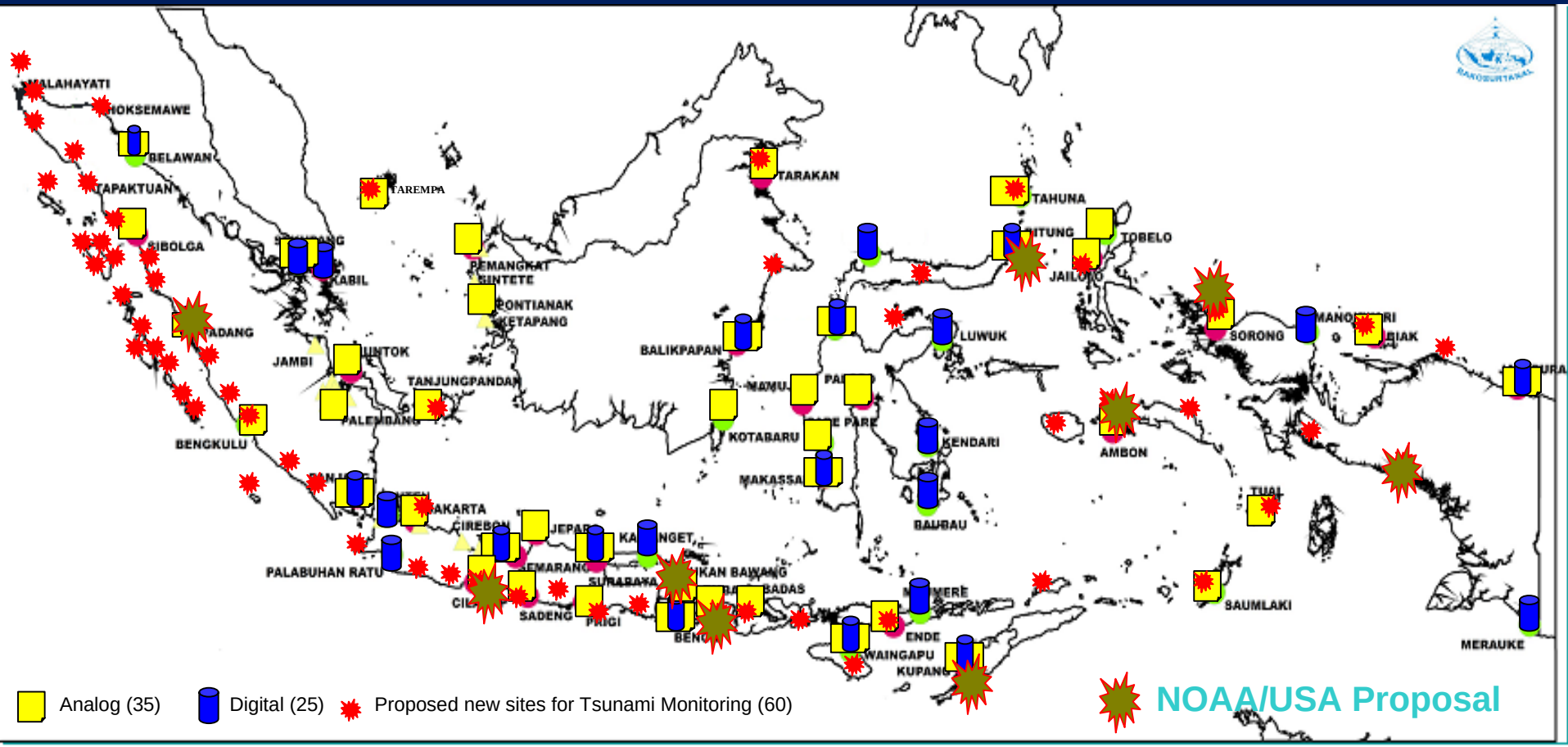
SEA LEVEL MONITORING

Pemantauan muka air laut diperlukan dalam TEWS untuk konfirmasi terjadi tidaknya tsunami.

Sea level monitoring is needed to confirm whether the tsunami will occur or not.



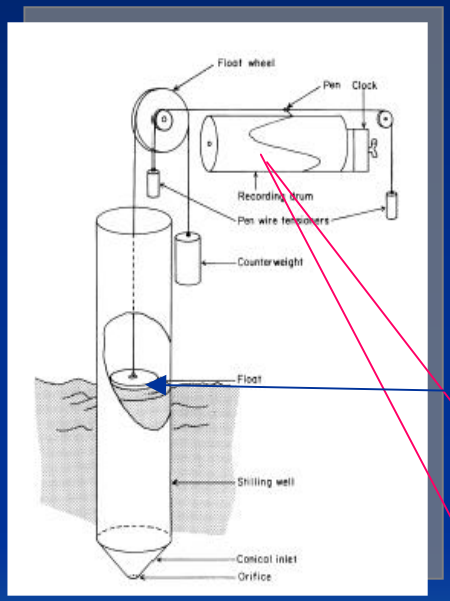
Proposed Additional Stations for TEWS



Designed for detecting both long and short distant tsunamis

Sample of Tide Gauge Station

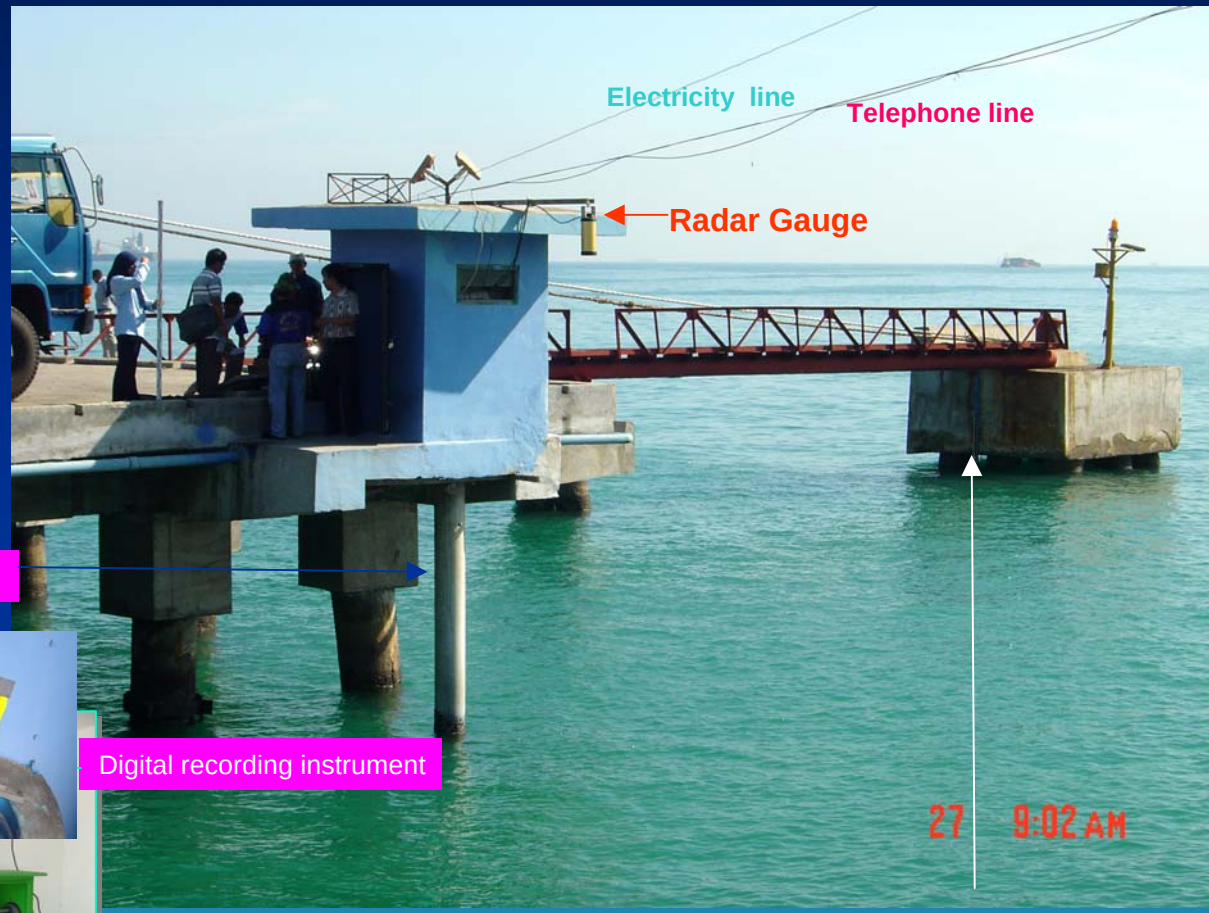
Banten (Sunda Strait)



Stilling well

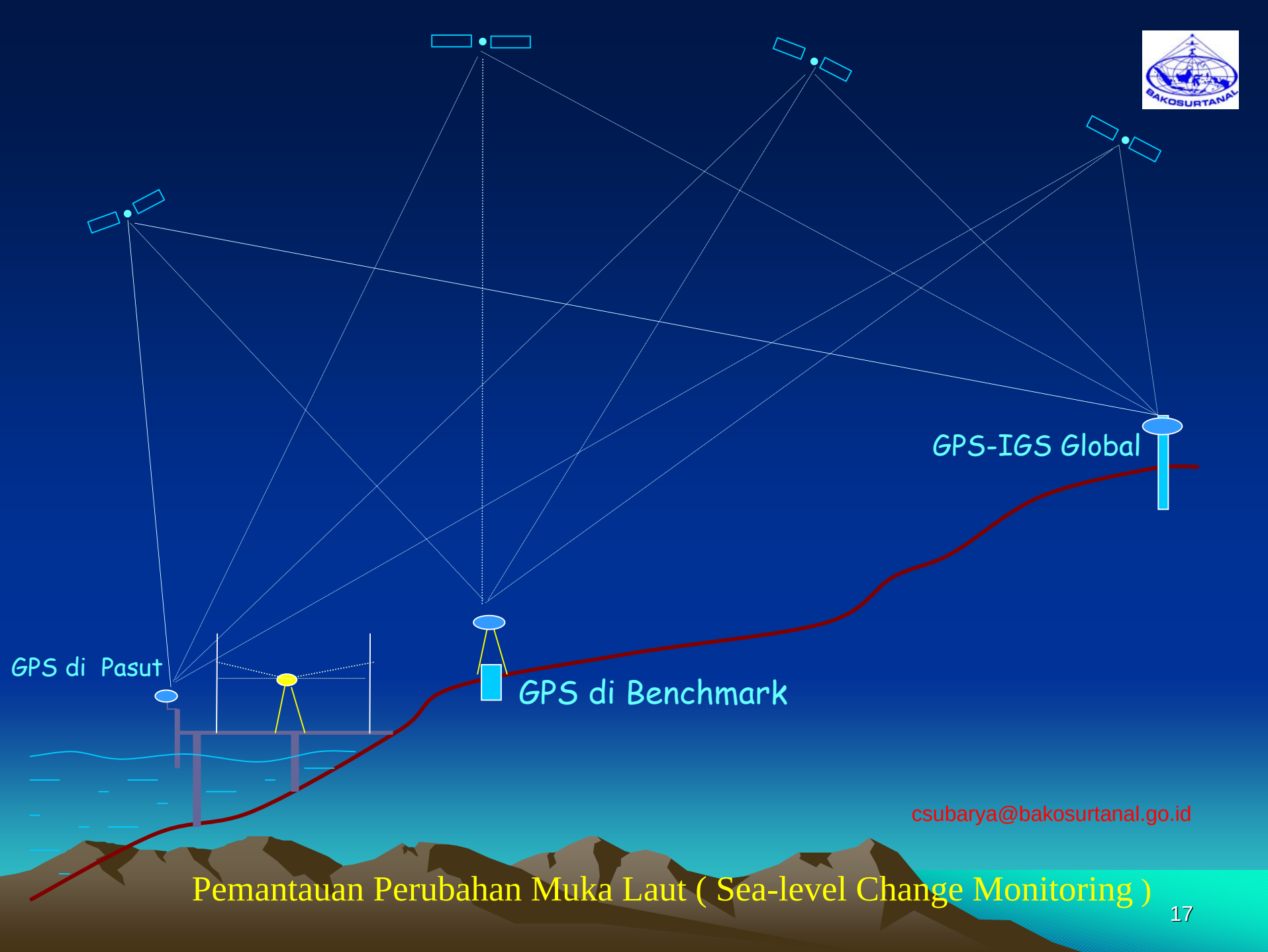
Digital recording instrument

Graphical recording instrument



Tide Staff

- Radar gauge is donated by OTT German and Trisari
- Installed on August 27, 2005



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Pemantauan Perubahan Muka Laut (Sea-level Change Monitoring)

Number of instruments required

- Based on GLOSS/IOC technical requirements
- New stations (60), each equipped with both pressure & radar gauges
- Up grade for the existing analogue stations (40 pressure gauges)
- Back up for the existing digital stations (25 pressure gauges)
- Real time data communication (60 Vsat or GTS)

Implementation in 2005

- Cooperation with NOAA/UHSLC and GLOSS/IOC
  - 22 April 2005, installed one station in Sibolga
  - Expected on September 2005: i) Padang, ii) Sabang, iii) Benoa (Bali)
- Cooperation with Germany
  - Possible 20 stations along the coastline of Indian Ocean; some would be installed before Dec 2005

Program on Geospatial Data

Topographic Mapping Coverage
At scale 1:10.000 & 1:5.000
Norwegia dan Australia (AusAID) Funding

NORWAY
(Grant)
Using Digital Camera

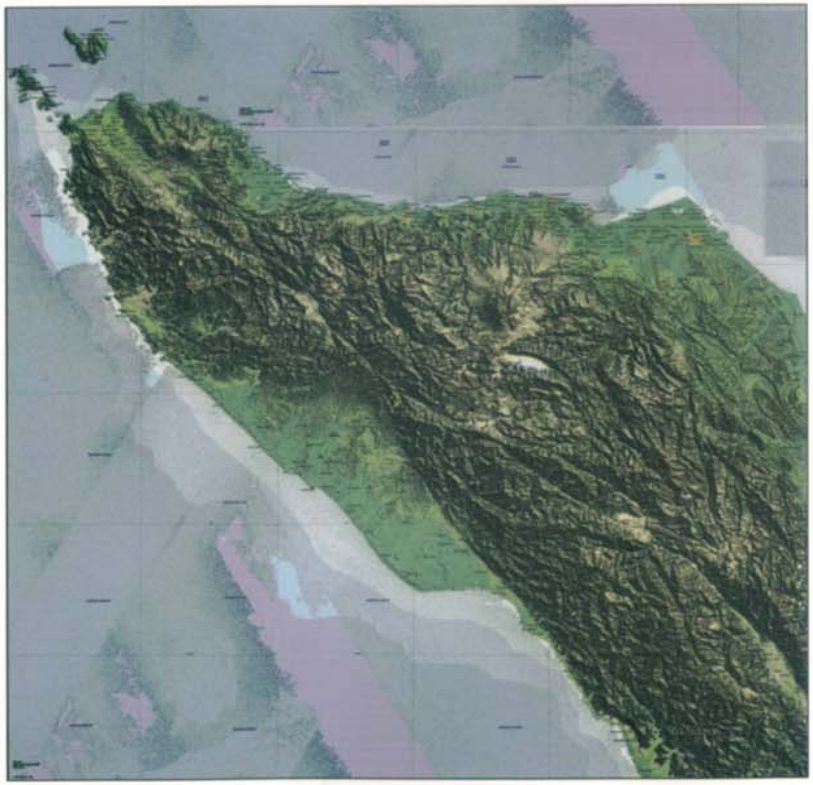
AUSTRALIA (Grant)
Using Interferometric Synthetic Apperture Radar (IFSAR)

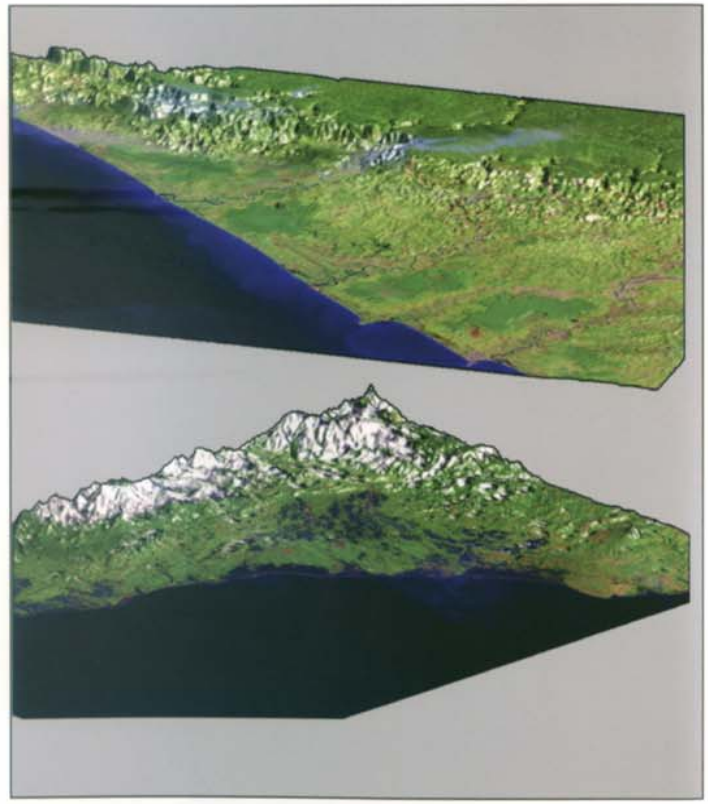
▲ GPS - Bakosurtanal

KAPASITAS PEMETAAN : PEMETAAN DENGAN CITRA SATELIT
MAPPING CAPACITY: SATELLITE IMAGE MAPPING

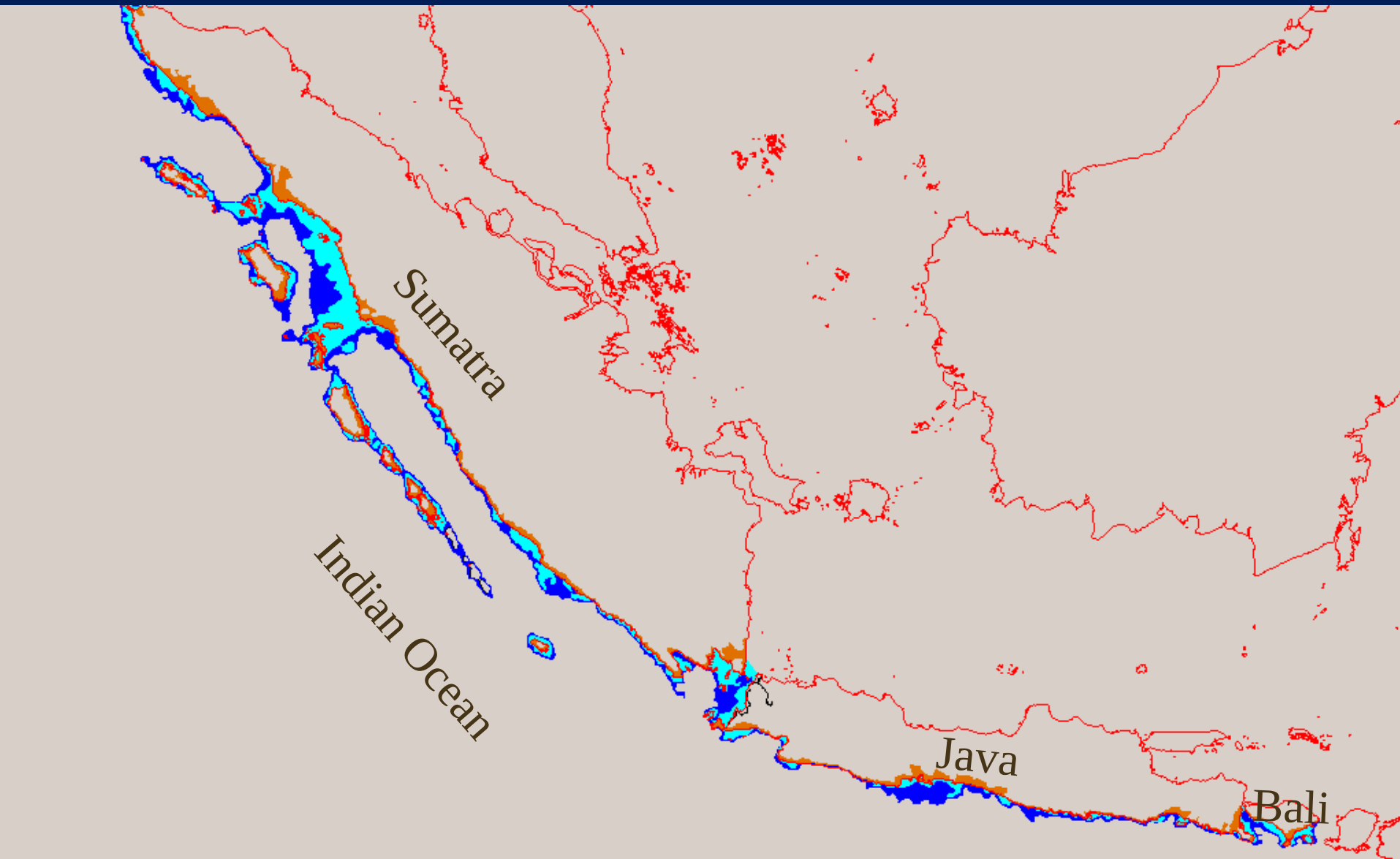
Pemetaan dengan citra Satelit sangat diperlukan dalam simulasi tsunami.

Satellite Image mapping is needed for tsunami simulation.





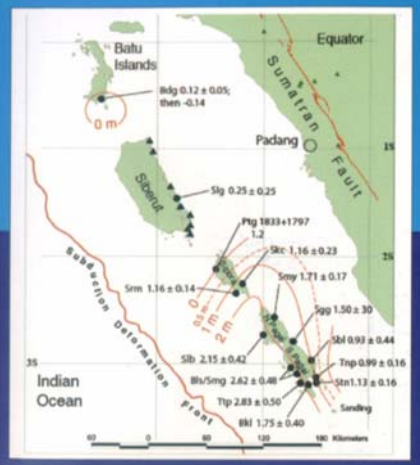
Survey Plan : Along West Sumatra-, South Java and South Bali Coasts

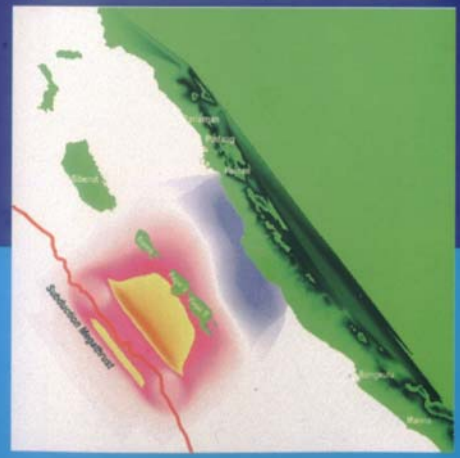


KAPASITAS PEMETAAN : PEMETAAN BATHIMETRI
MAPPING CAPACITY: BATHYMETRY MAPPING

Keberadaan peta bathimetri yang baik sangat diperlukan dalam simulasi tsunami dan penentuan DART-BUOY untuk monitoring gelombang Tsunami.

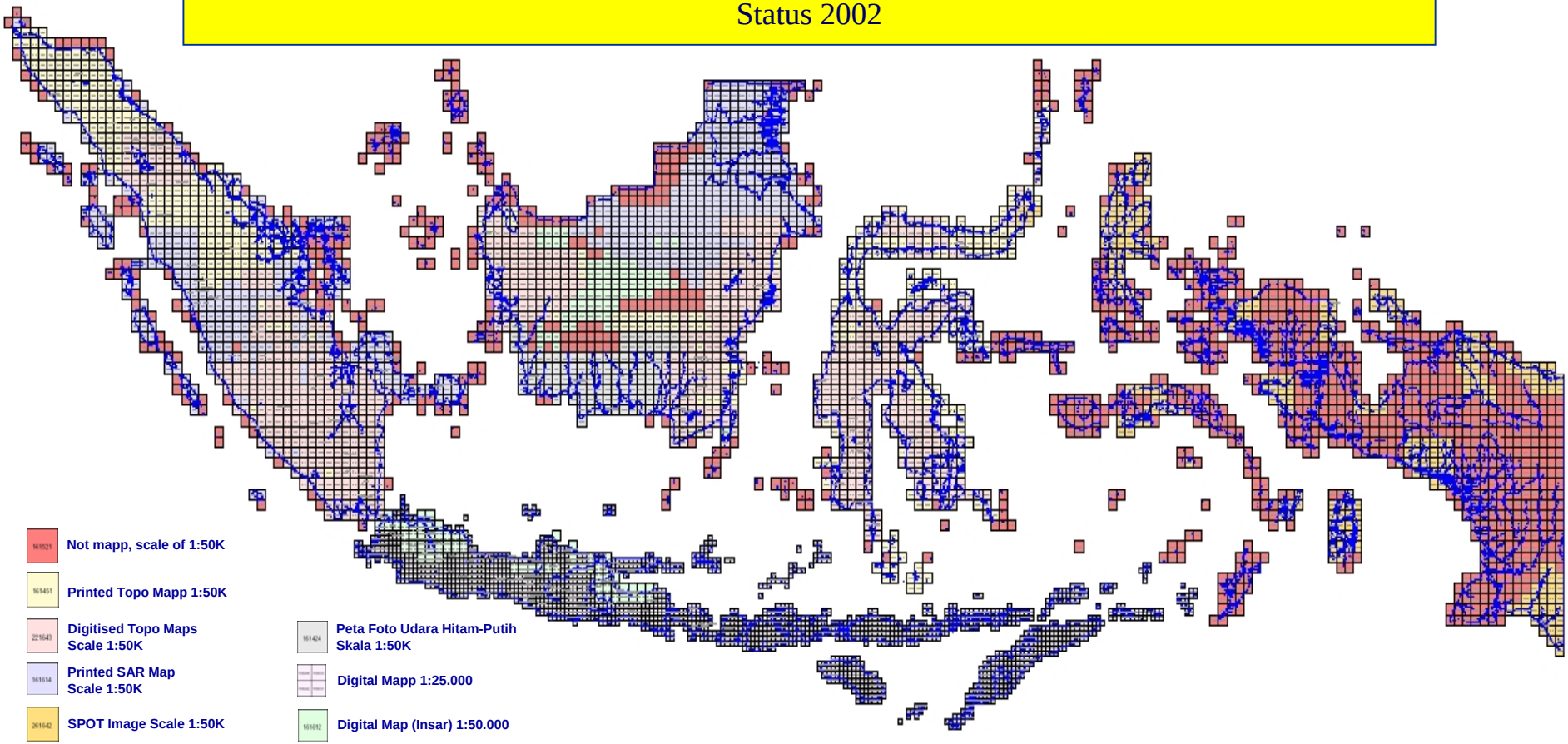
Good bathymetry mapping is needed for tsunami simulation and determine DART BUOY for monitoring tsunami waves



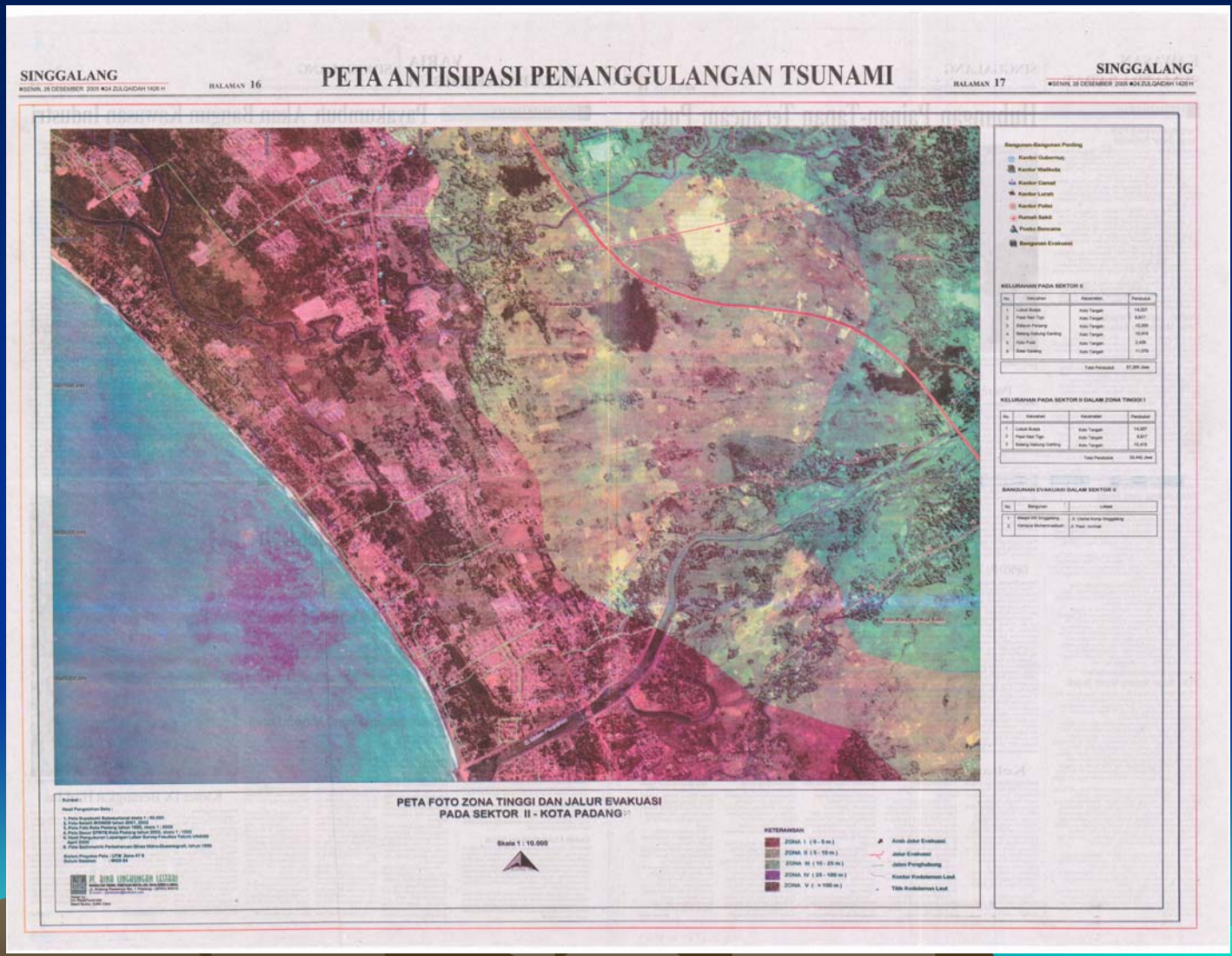


Topographic Map Index, Scale 1:50K

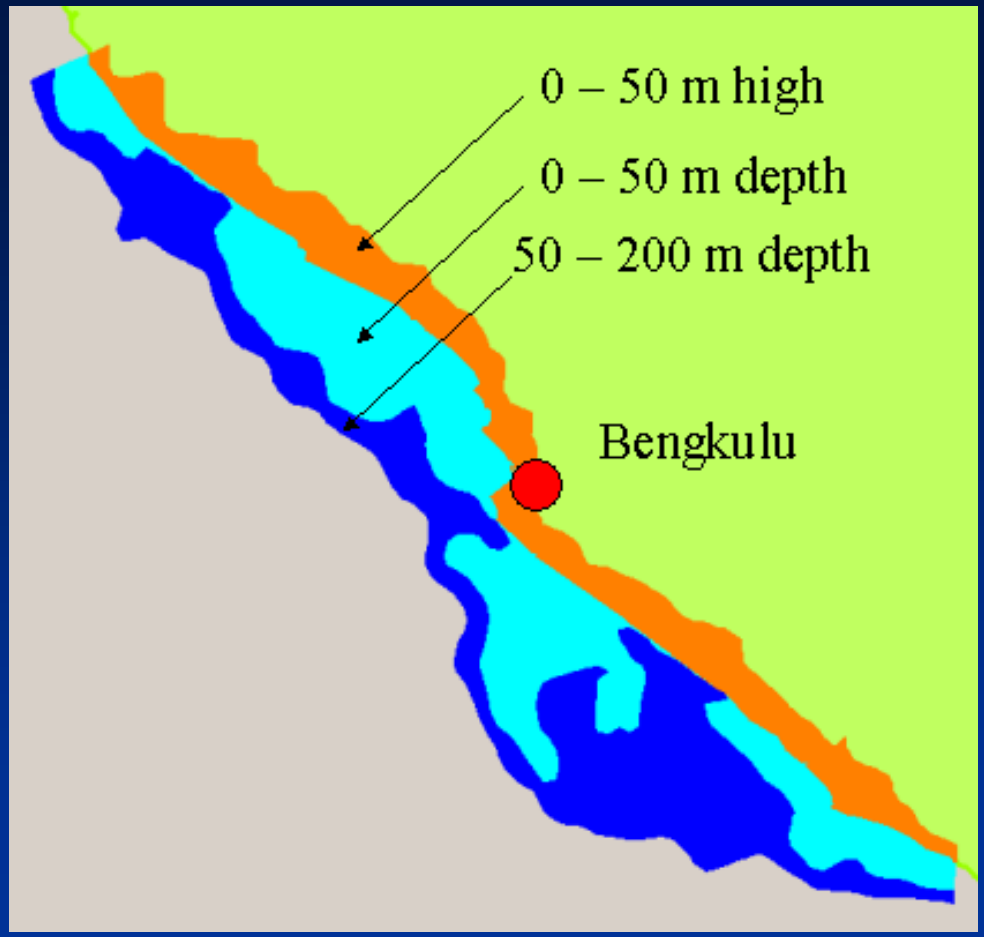
Status 2002



An example of inundation map resulted from Remote sensing images



One of The 2nd Priority Areas to be Surveyed , West Sumatera Coast



Survey Plan : Bengkulu and Its Surroundings

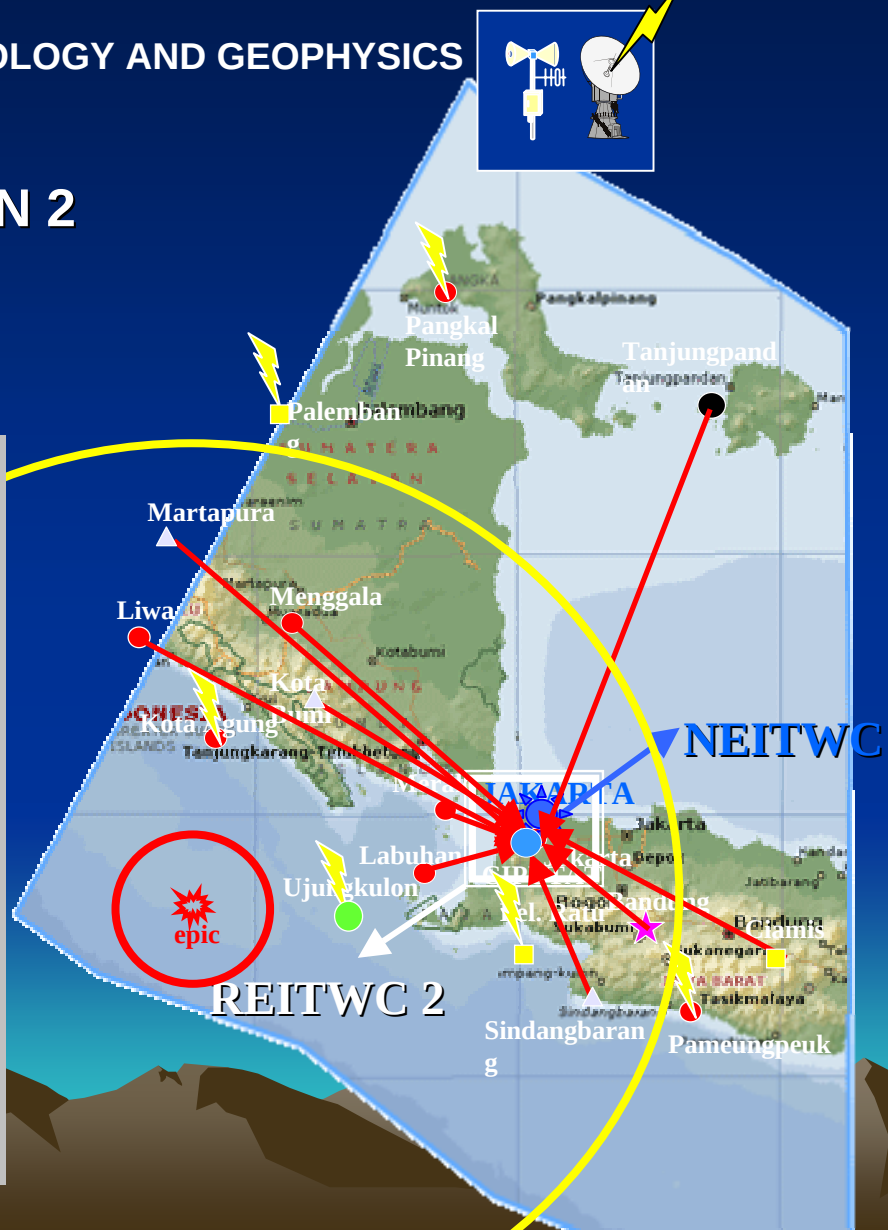
Data Acquisation

BMG

AGENCY FOR METEOROLOGY AND GEOPHYSICS

BAKOSURTANAL

REGION 2



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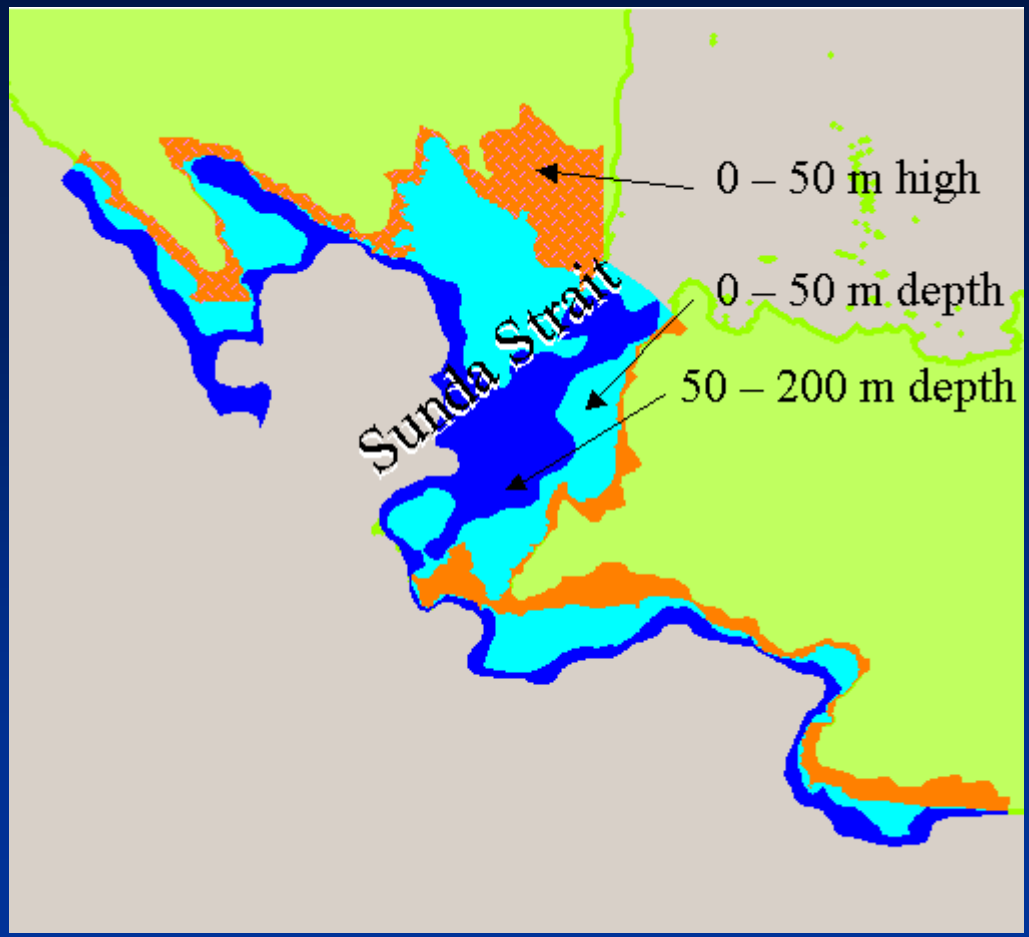
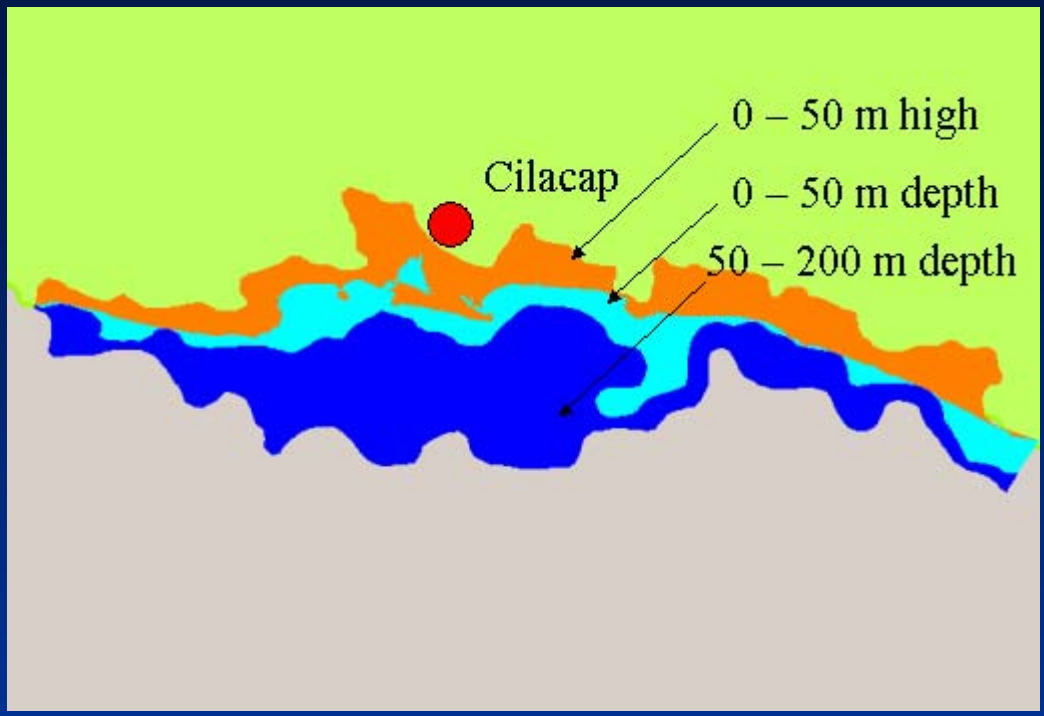
NEITWC

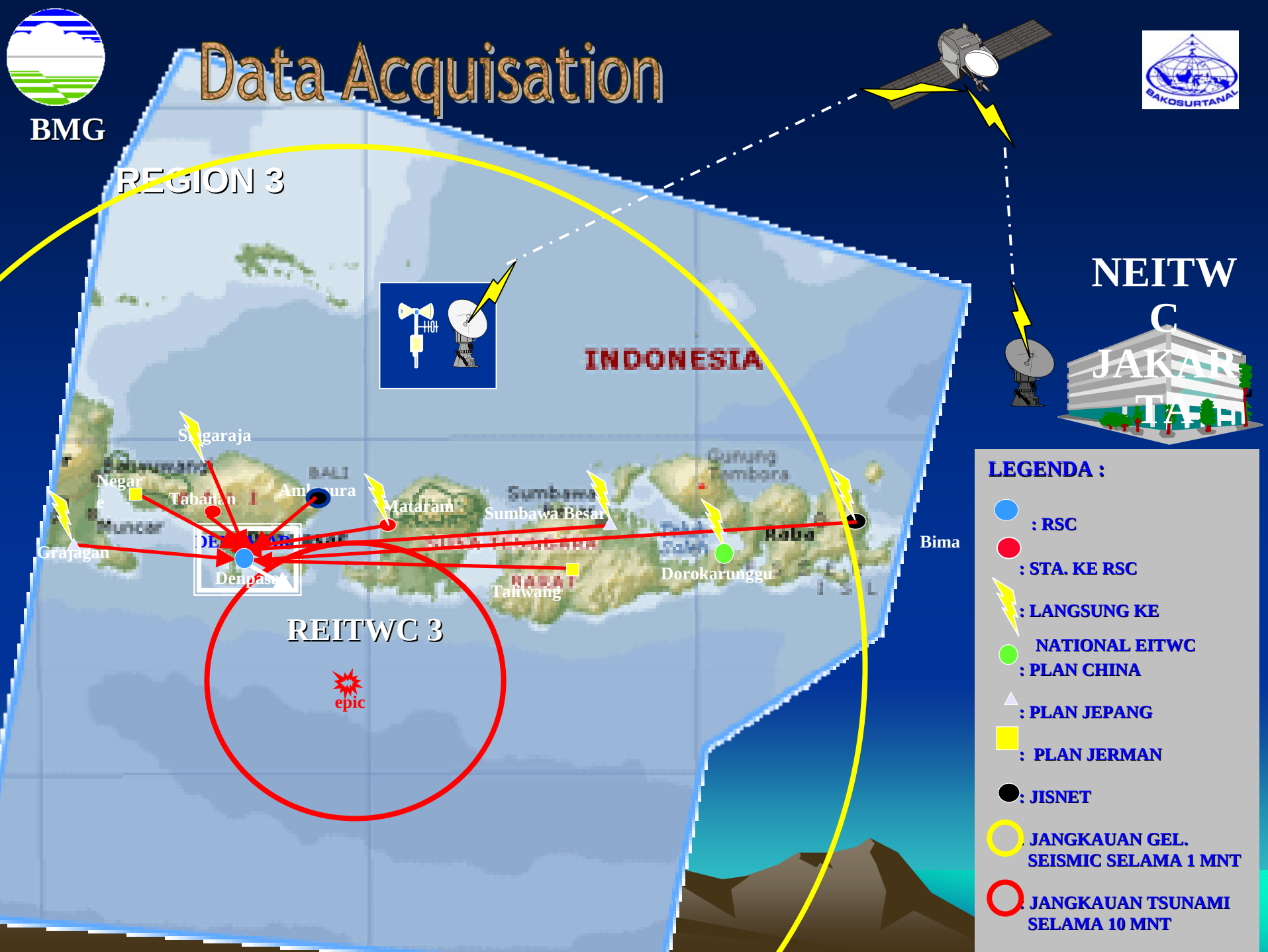
JAKARTA



Survey Plan : Sunda Strait and Its Surroundings



Survey Plan : Cilcacap and Its Surroundings


BMG
Data Acquisation
REGION 3
INDONESIA
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LEGENDA :
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: LANGSUNG KE NATIONAL EITWC
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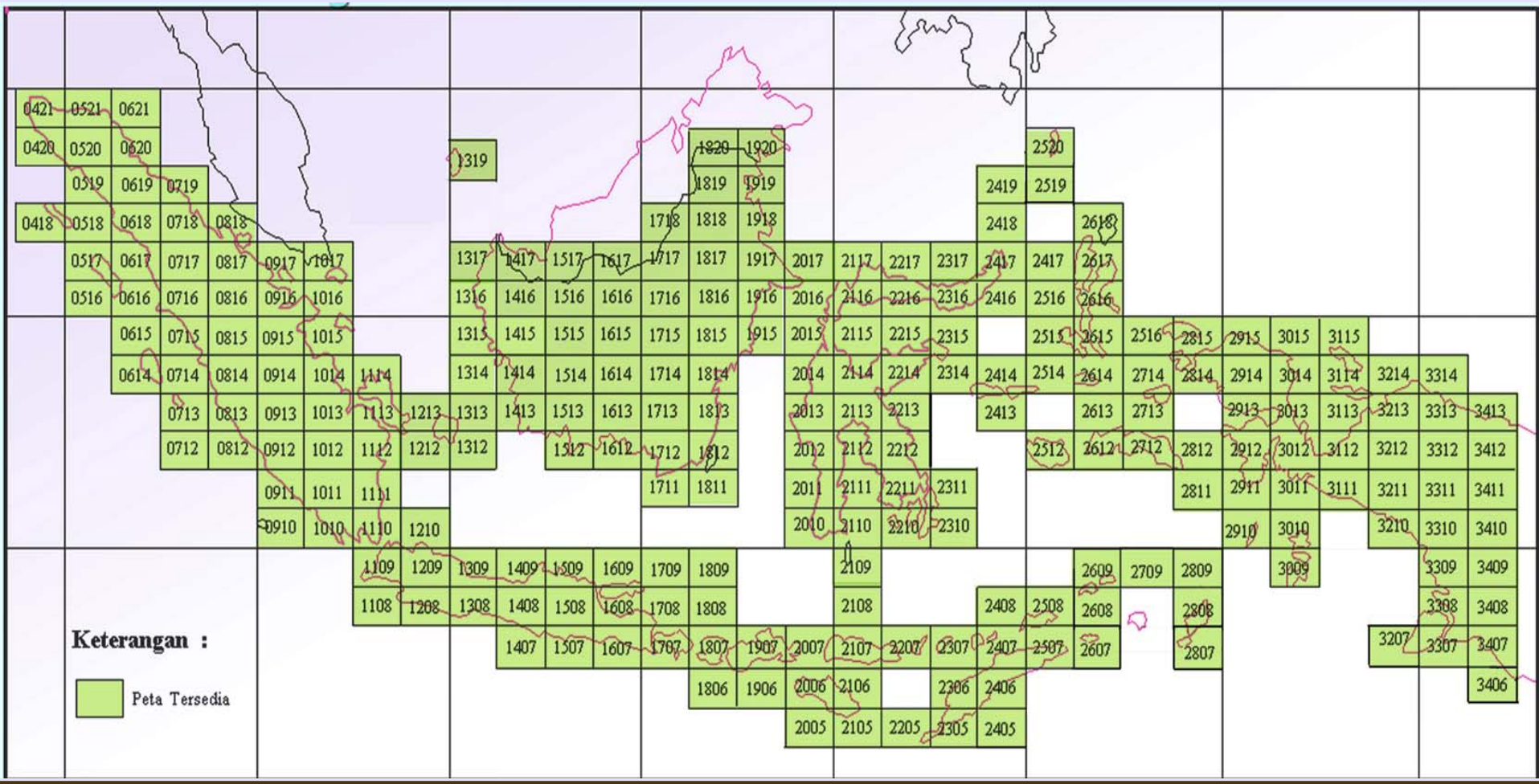
: PLAN JEPANG
: PLAN JERMAN
: JISNET
: JANGKAUAN GEL. SEISMIC SELAMA 1 MNT
: JANGKAUAN TSUNAMI SELAMA 10 MNT

DIGITAL TOPOGRAPHIC MAP
SCALE 1 : 250K

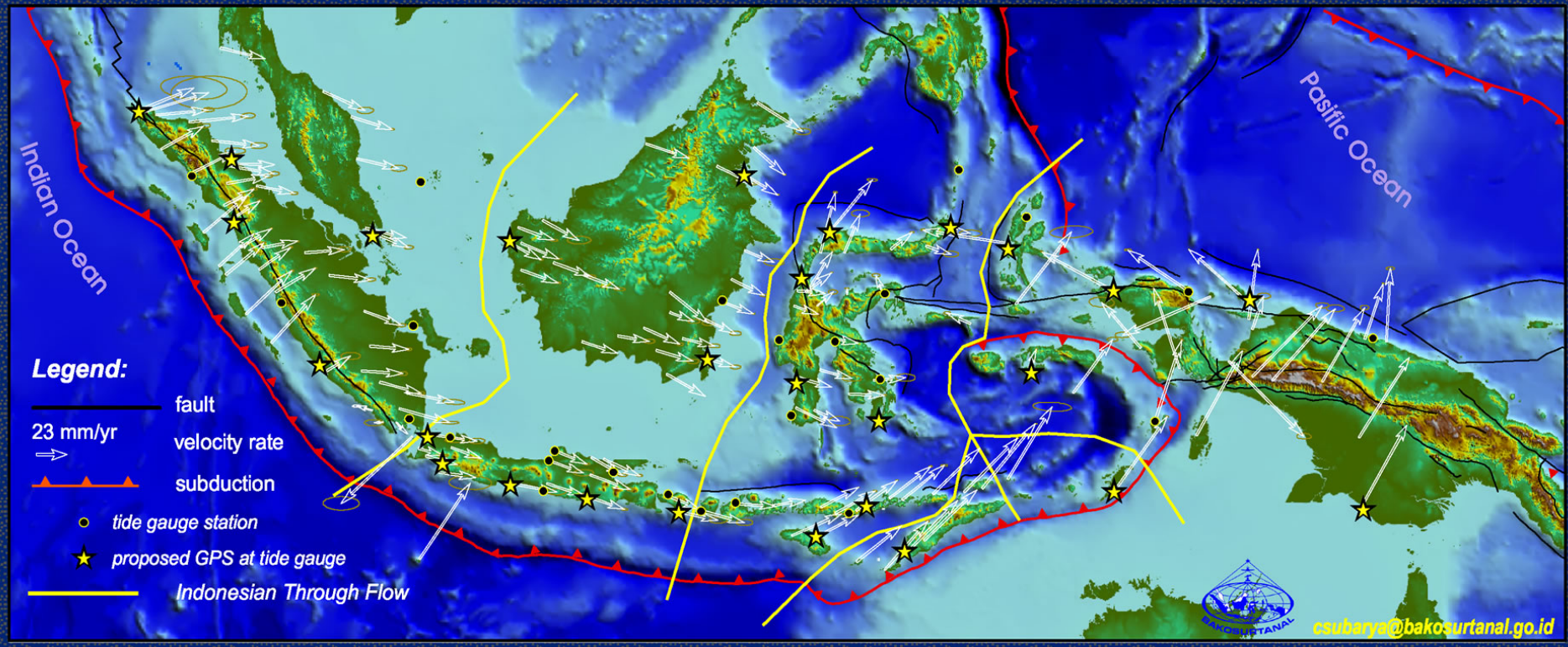


General Issues and Looking Forward

- How to implement the system operational on 24/7 basis with high reliability
- Sustainability:
  - Excellent national and international cooperation to maintain level of investment
  - Aimed at multi hazard approach and multi purpose utilisations
  - Encouraging regional R&D focus
- The System should be capable of covering possible tsunami sources in Indian Ocean and Indonesia Internal Waters
- More resources for Geospatial data of coastal line and near shore bathymetric maps along the Indian Ocean for modeling and inundation map

Thank you for your kindly attention

PRESENT DAY PLATE MOTION IN INDONESIA



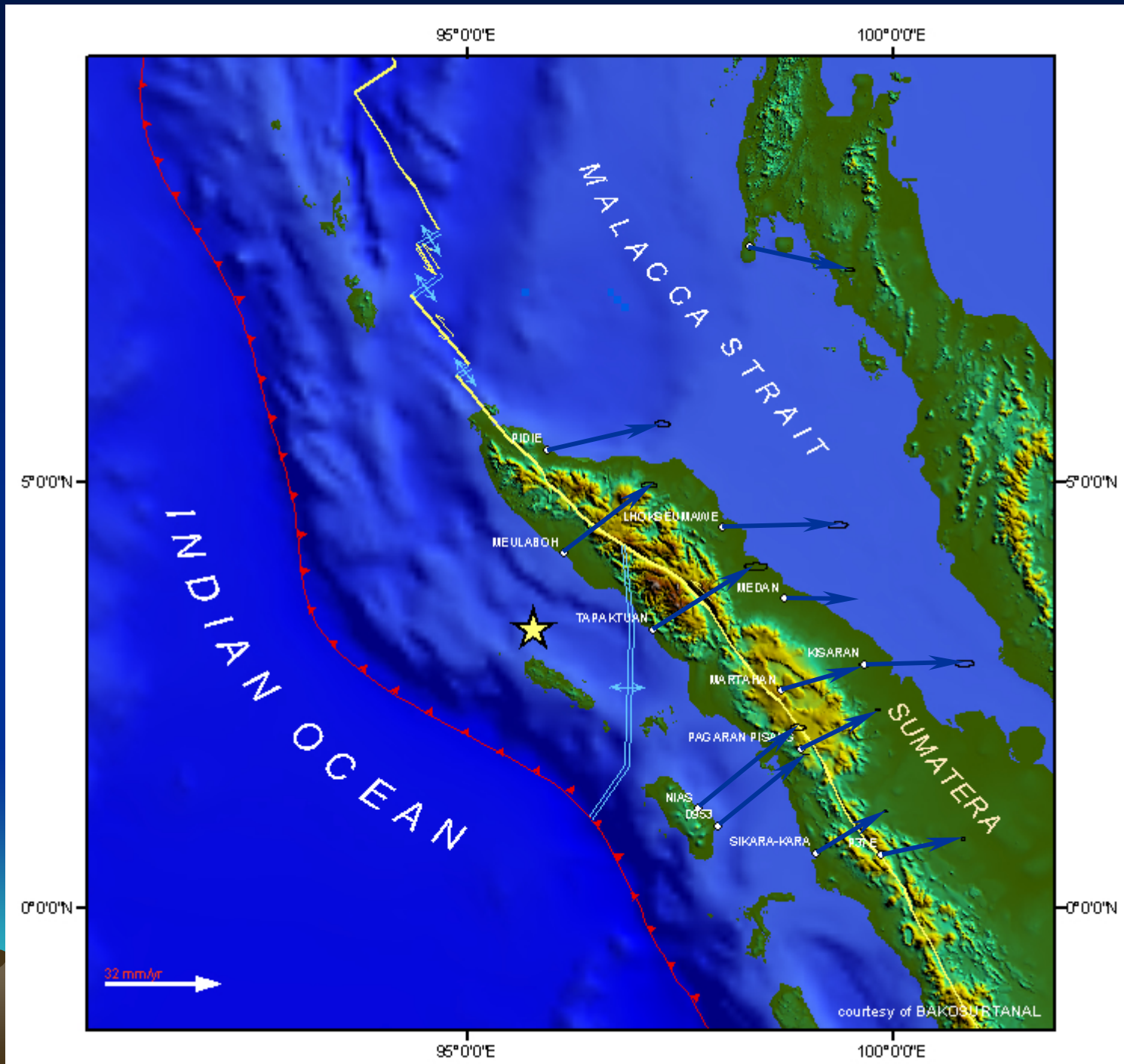
Tectonic Setting

The islands of Indonesia lie between Indian Ocean and Pasific Ocean and at the junction of the Eurasia, Australia, Pasific, and Philippine Sea plates, resulting in rugged topography, frequent earthquakes, and active volcanism. In the west, the Australia plate is subducted beneath the Eurasia plate along the Java trench (~70mm/yr). The direction of convergence is normal to the trench of Java, but oblique to the trench southwest of Sumatra (~70mm/yr). Further east, the island of New Guinea, the leading edge of the northward moving Australian continent, is dominated by the rapid oblique convergence (~110mm/yr) between the Pasific and Australian plates.
The oblique convergence has produced a complex array of micro plates whose motions result in rapid shear, arc-continent collision, oceanic and continental subduction, continental rifting, and seafloor spreading. In West Papua a large section of the continent (the Bird's Head) is being detached along a rapid (~80mm/yr) shear zone and subducted at Seram trough.

Indonesia as the Archipelagos state experiences active tectonic deformation and frequent earthquakes and volcanoes eruption that was generated tsunamis. Several giant historical earthquakes in West Sumatra (1833 and 1861), Krakatau (1883), Maumere-Flores (1992), Biak-Irian Jaya (1996), and in recent months in Simeulue-Aceh (2004) suggest that infrequent very large earthquakes dominate strain relief at the subduction zone. The presence of an archipelago on the outer arc ridge (Australia and Pacific major plates) and back arc ridge (Flores and Banda), above the subduction interface enables collection of geographically robust geodetic and geologic data, and we have to date amassed a substantial set of geological and geodetic data from those islands.

Geographic Setting

The Indonesian Archipelago geographically located between Indian Ocean and Pasific Ocean is connected by Indonesian Trough Flow (ITF). Sea level is a fundamental parameter in the sciences of oceanography, geophysics and climate change. Changes in observed sea level occur across a wide spectrum from seconds and minutes (wind waves, earthquakes, tsunami), hours to days (tides, storm surges), years (seasonal cycles, El Niño), through to long term changes due to climate change and the slow vertical land movements which are still occurring following the last ice age. Significant consequences of sea level changes can be expected in some continental coastal populations areas and on oceanic islands such as flood.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100°0'0"E
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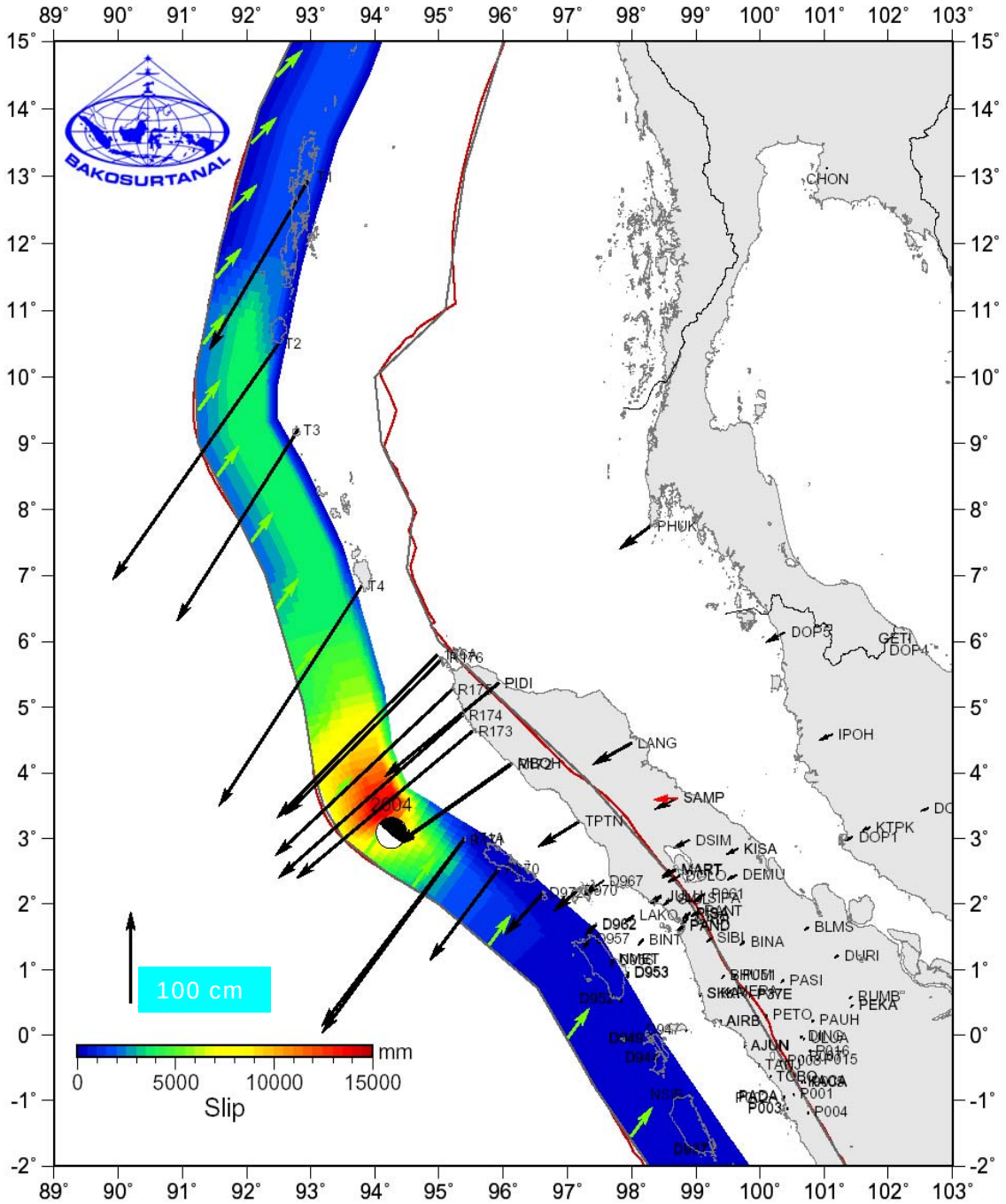
0°0'0"N
MALACCA STRAIT
INDIAN OCEAN
SUMATERA
PIDIE
MEULABOH
MEDAN
TAPAKTUAN
KISARAN
NIAS
SIKARA-KARA
32 mm/yr
courtesy of BAKOSURTANAL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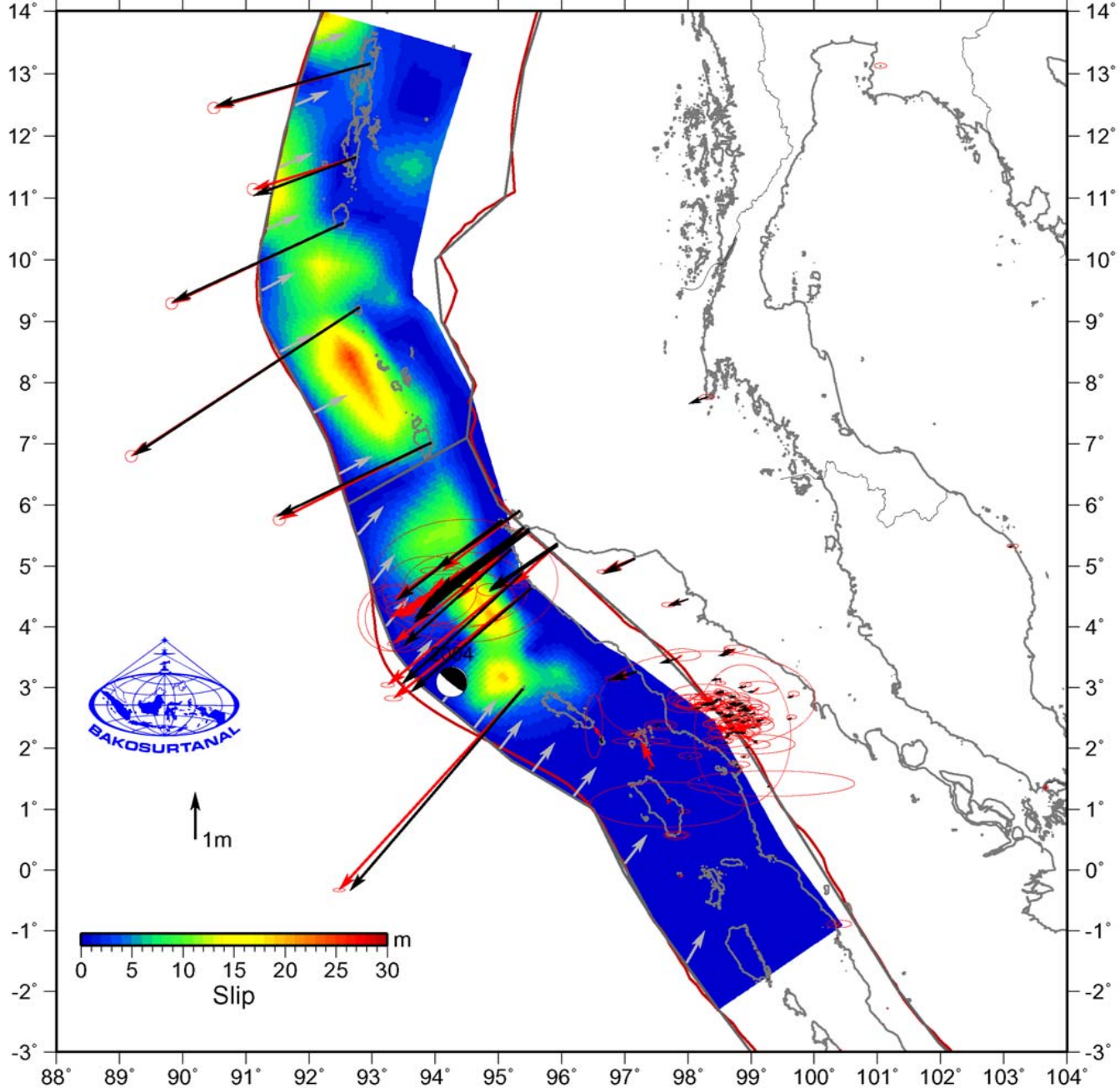
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