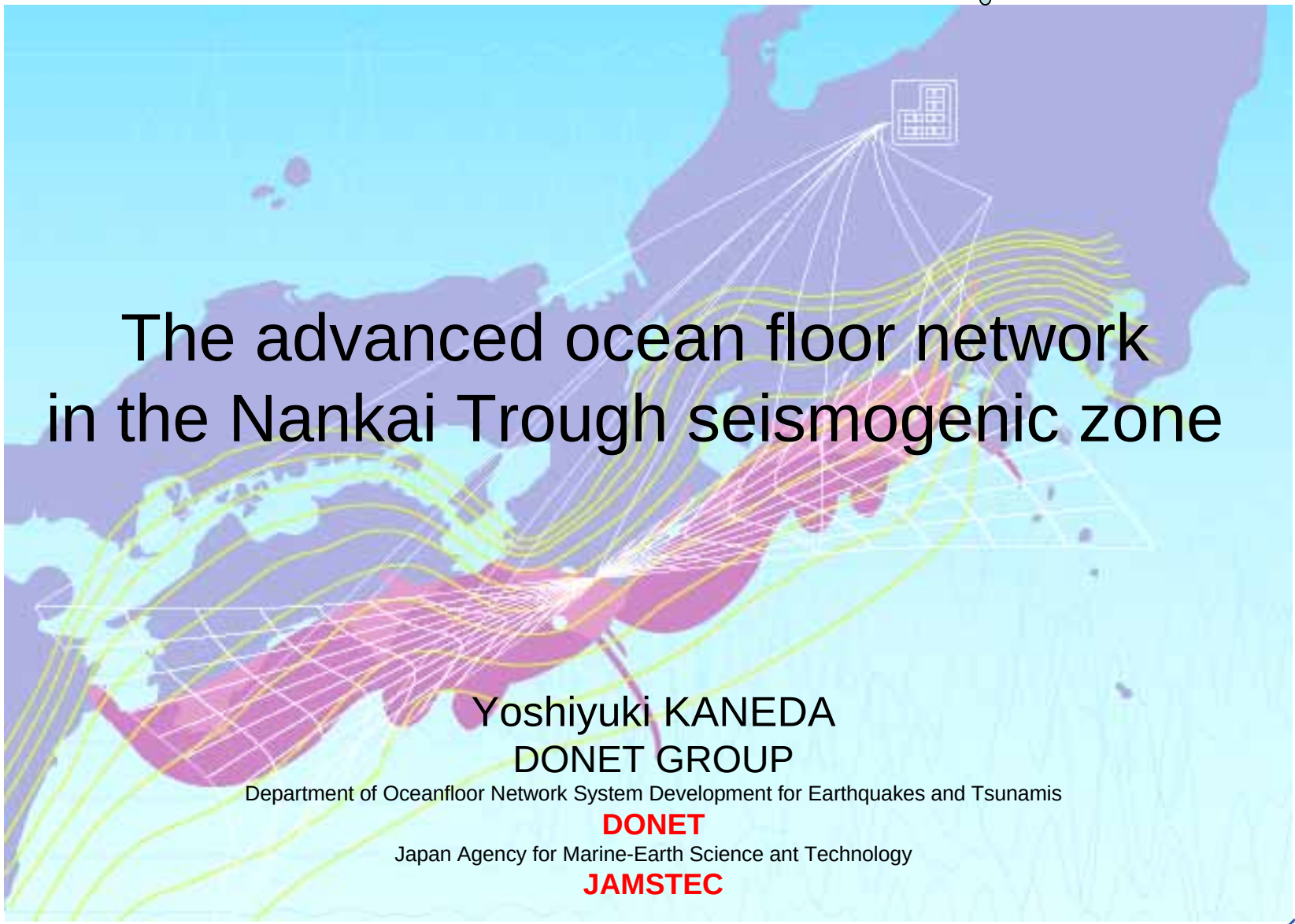
2007.1.11-12 GEOSS



The advanced ocean floor network in the Nankai Trough seismogenic zone

Yoshiyuki KANEDA

DONET GROUP

Department of Oceanfloor Network System Development for Earthquakes and Tsunamis

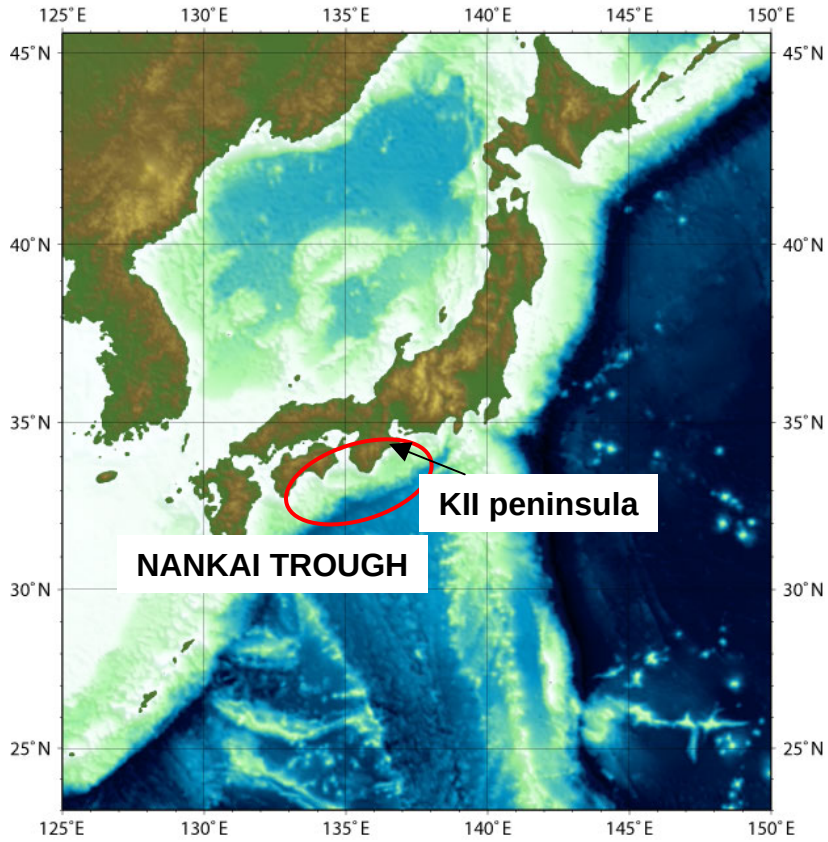
DONET

Japan Agency for Marine-Earth Science ant Technology

JAMSTEC

Previous research in the Nankai trough

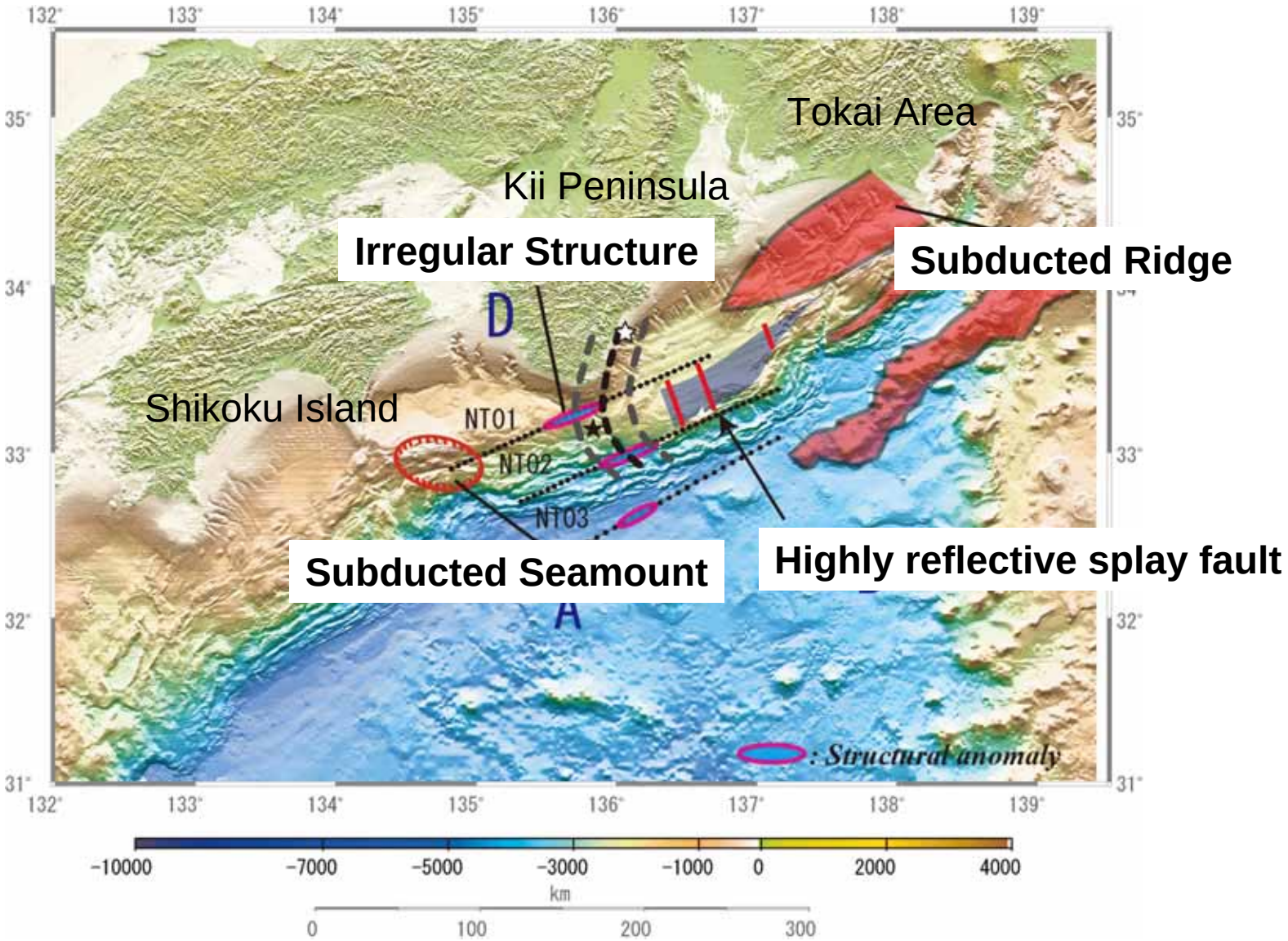
Historical EQs. in the Nankai trough



year	age	A	B	C
1605	KEICHO			?
1707	HOUEI			
1854	ANSEI			
1944	SYOWA			
1946	SYOWA			

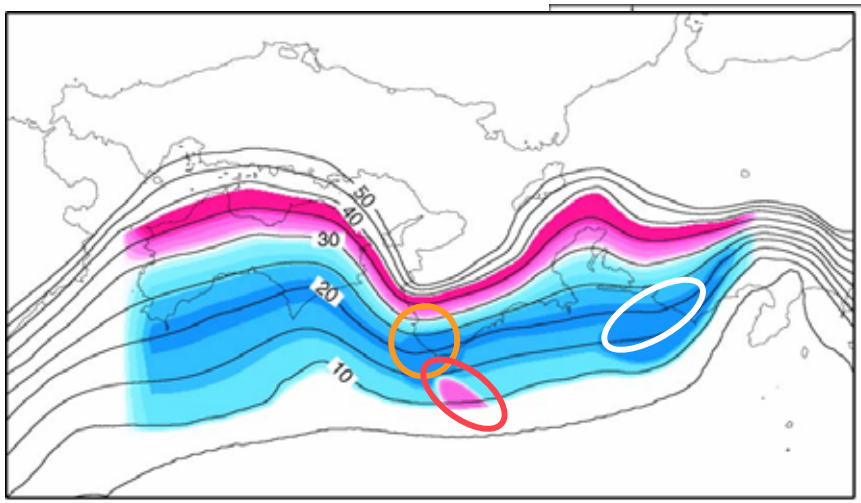
A;Nankai EQ.
B;Tonankai EQ.
C;Tokai EQ.

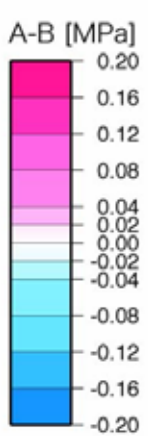
Distribution of significant deep structures along the Nankai Trough

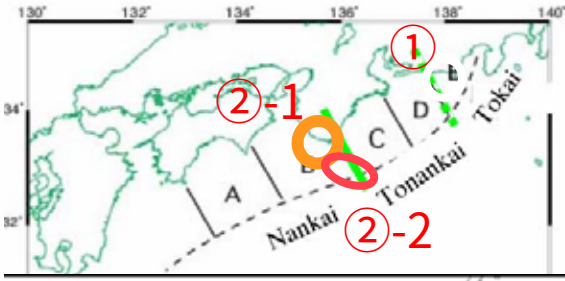


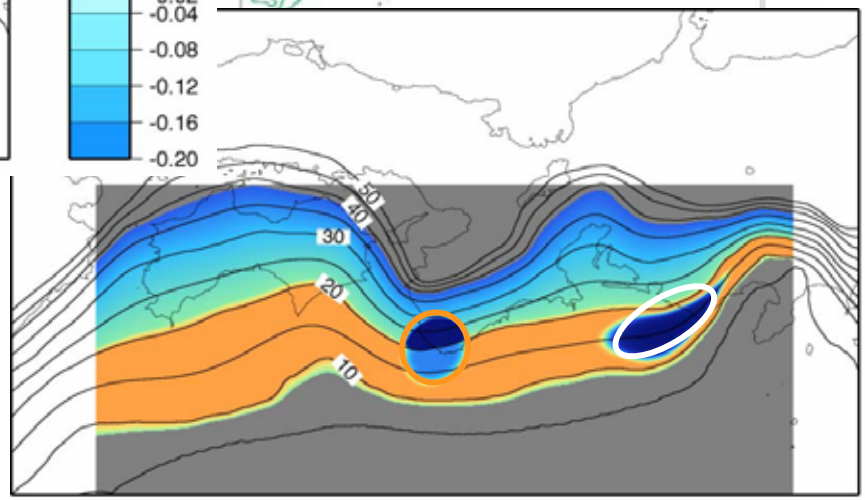
Model of Mega-Thrust EQ. recurrence cycle simulation

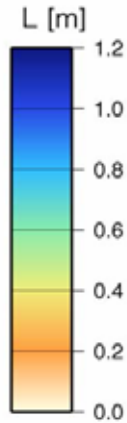
Simulated earthquake history and distribution of co-seismic slip as obtained by the numerical simulation which includes heterogeneous frictional property based on the deep structures imaged along the Nankai Trough







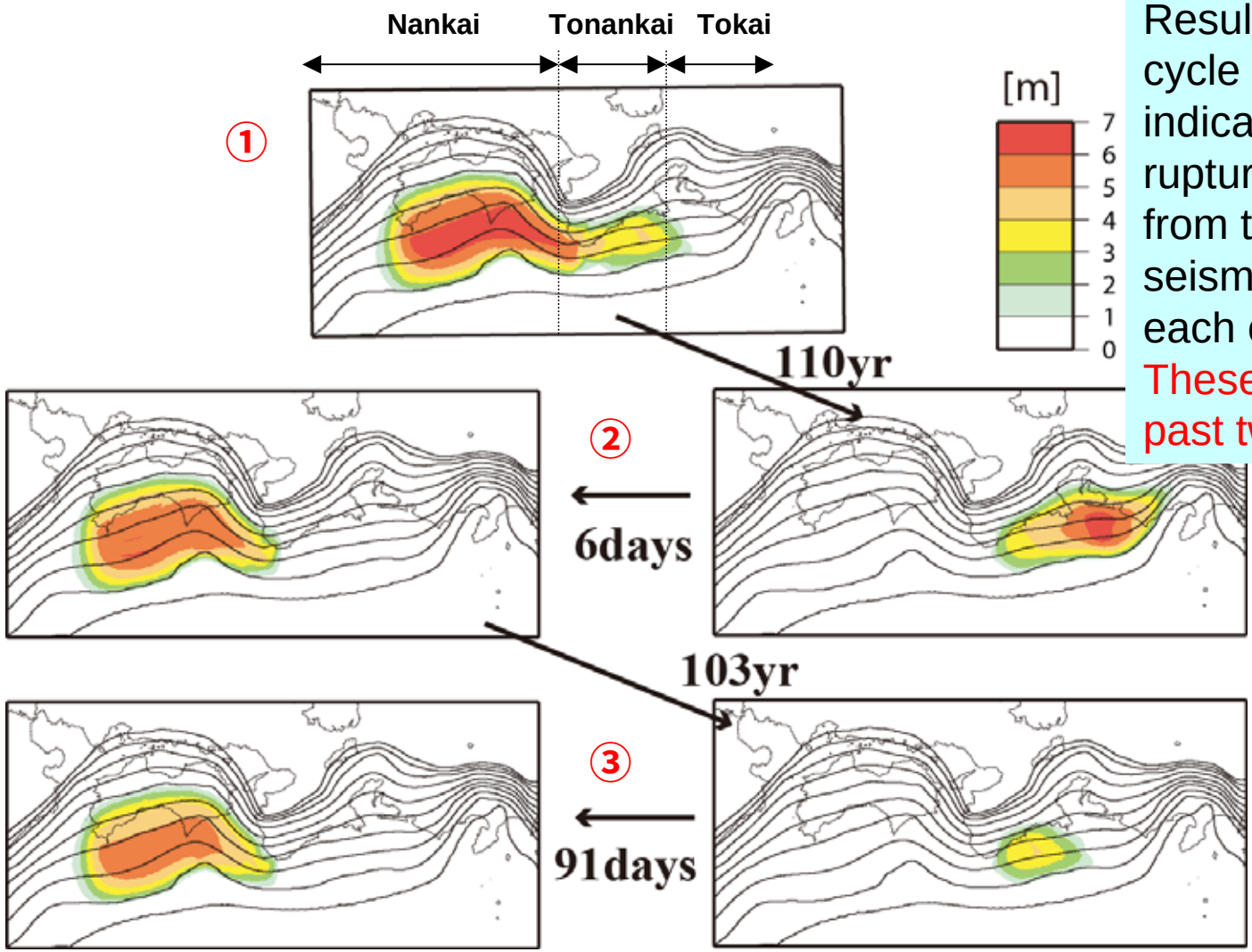




- Large scale heterogeneity
  - Depend on the slab geometry
    - Shallower than 10km

  (deformable backstop): stable sliding
- Small scale heterogeneity
  - High fracture energy area
    - Effective normal stress (+200MPa) & L (max: x 5.0)
  - Stable sliding area
    - b=0.0

The results of mega-thrust EQ. recurrence cycle simulation in the Nankai trough

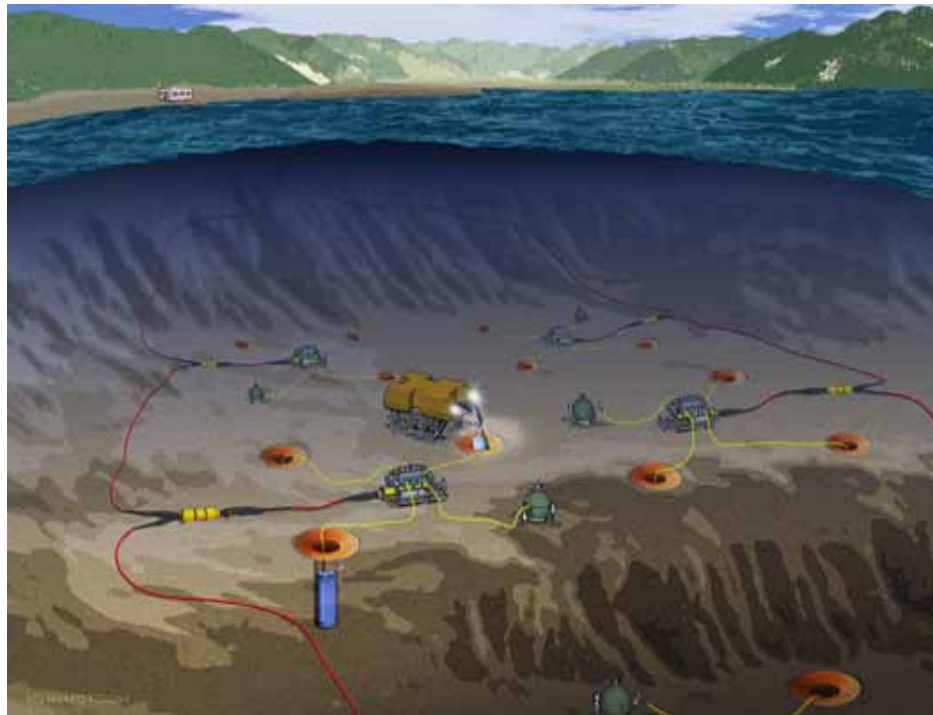


Results of recurrence cycle simulation indicate that the initial ruptures are starting from the Tonankai seismogenic zone in each cycle.(①.②.③)
These are consistent with past two EQs.

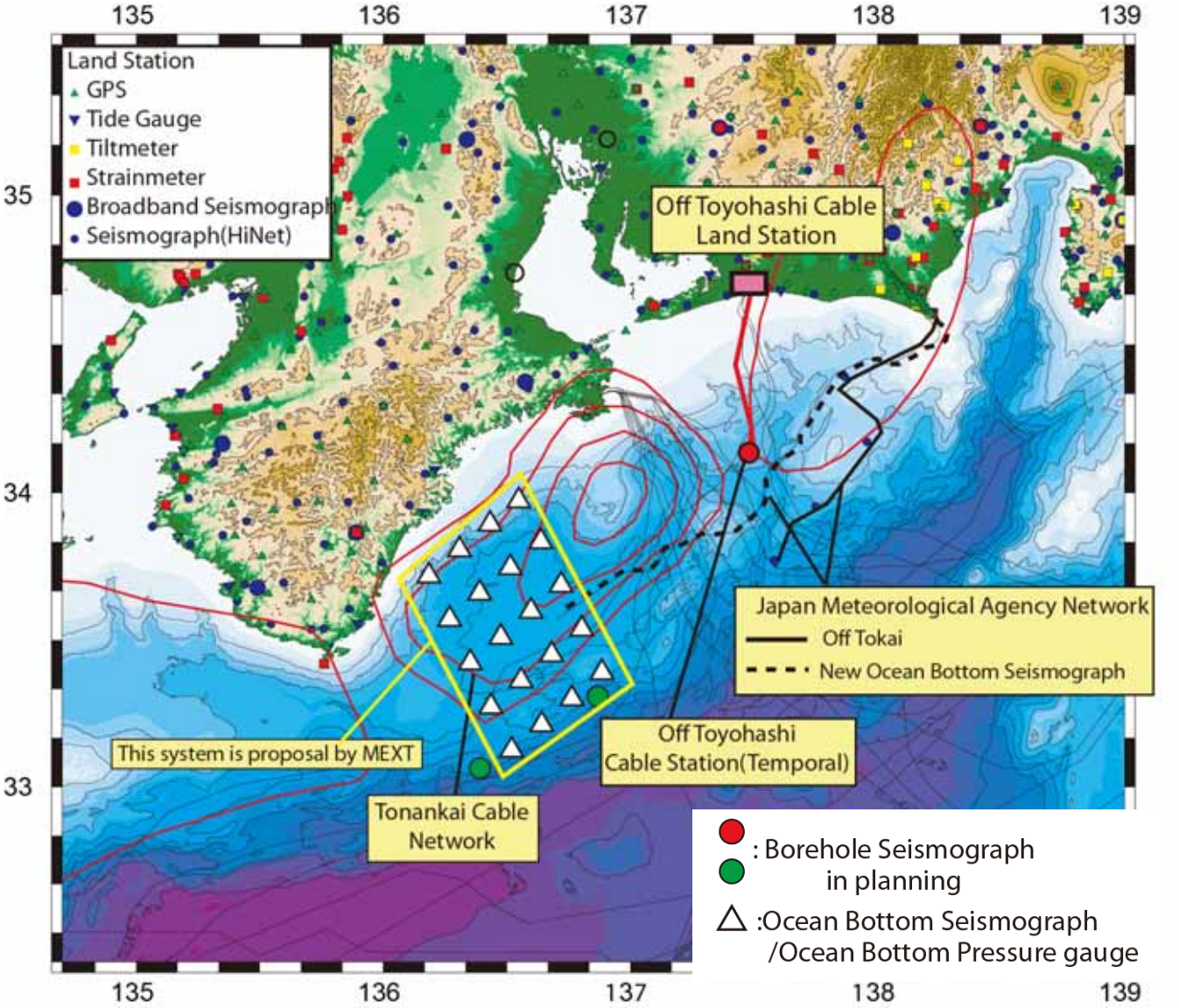
Advanced Ocean Floor Cable System

Outline & Concept

Image



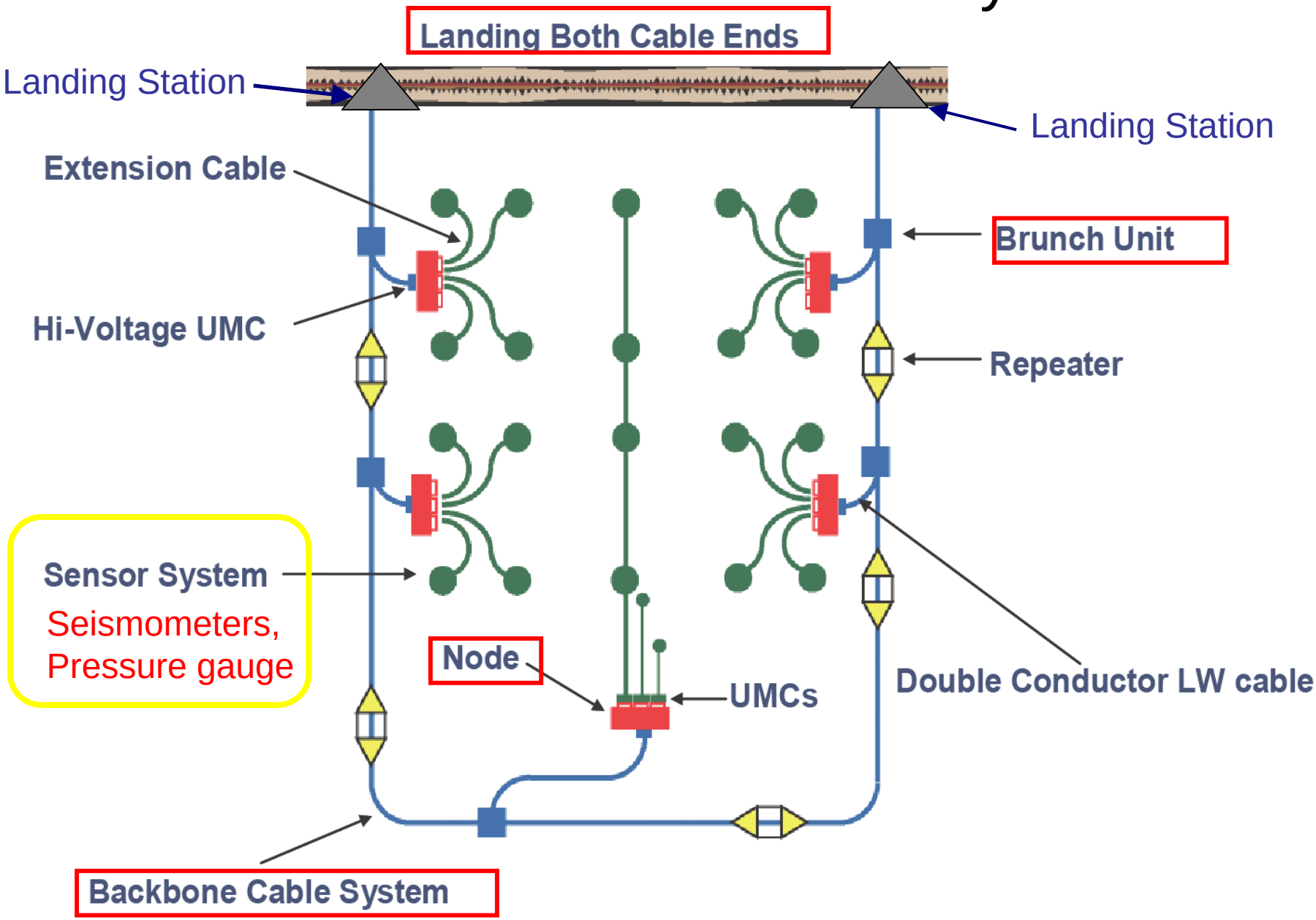
Ocean floor cable network system as MEXT project



Sensors

- 20 Seismometers
- 20 Pressure gauges

Outline of ocean floor cable system



System Concept

- Redundancy, Extension and advanced maintenance system using the looped cable system, Node, Brunch unit and the ROV/AUV etc.

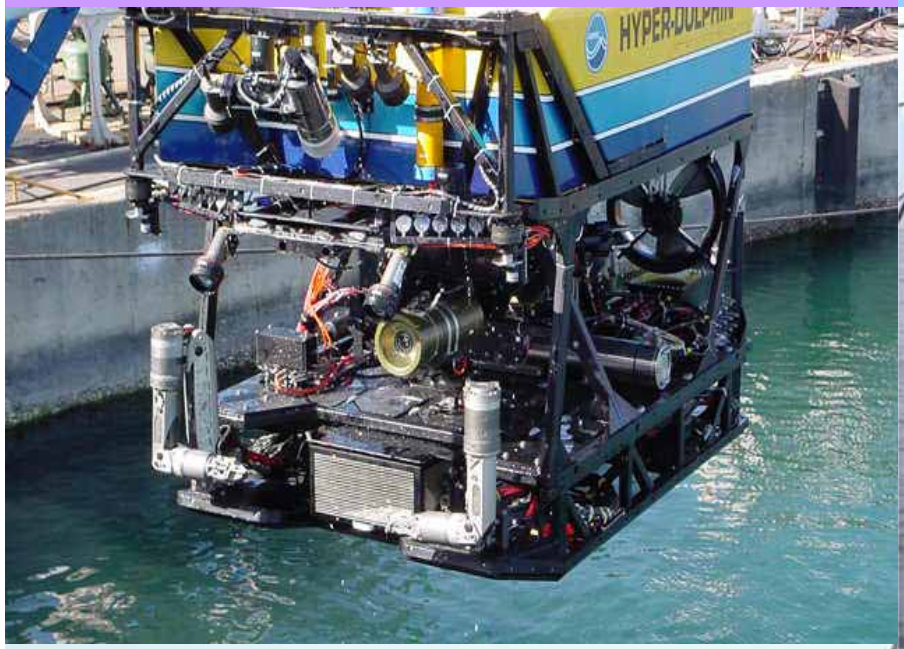
Keywords: Landing both cable end, Node, Brunch unit

Data Application

- Speedy evaluation and notification for earthquakes and tsunamis.
- Provide observed data such as ocean floor deformation derived from pressure gauges to improve the simulation and modeling researches about the mega-thrust earthquakes. (**Data assimilation**)
- Understanding of the interaction between the crust and upper mantle around subduction zone.

Maintenance systems of JAMSTEC

3000m Class ROV
「HYPER-DOLPHIN」



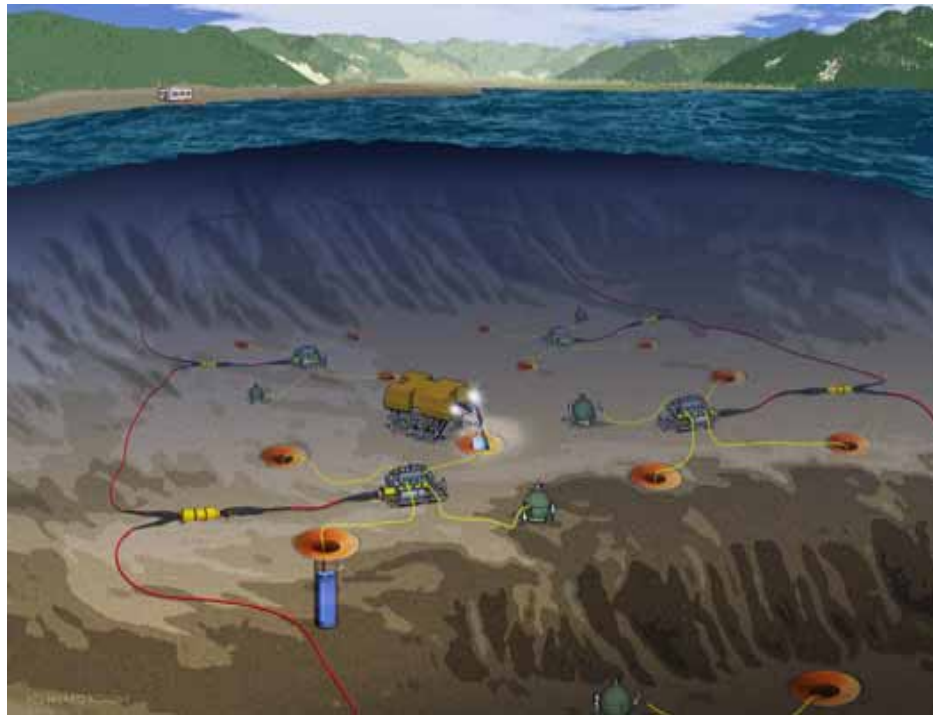
7000m class deep sea ROV
「KAIKO7000」

Deep Sea Cruising AUV 「URASHIMA」

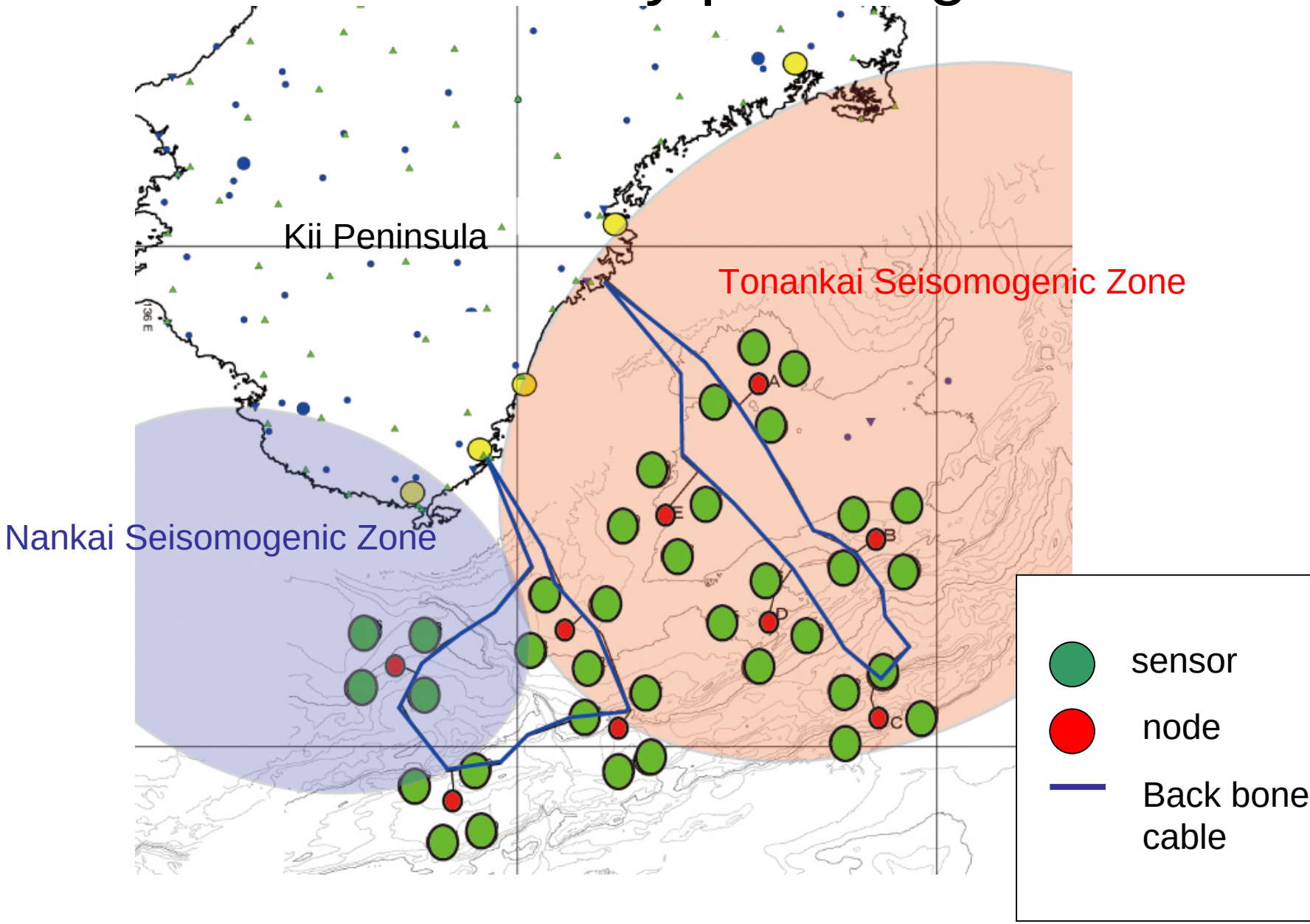
Advanced Ocean Floor Cable System

Network Array Planning

Image

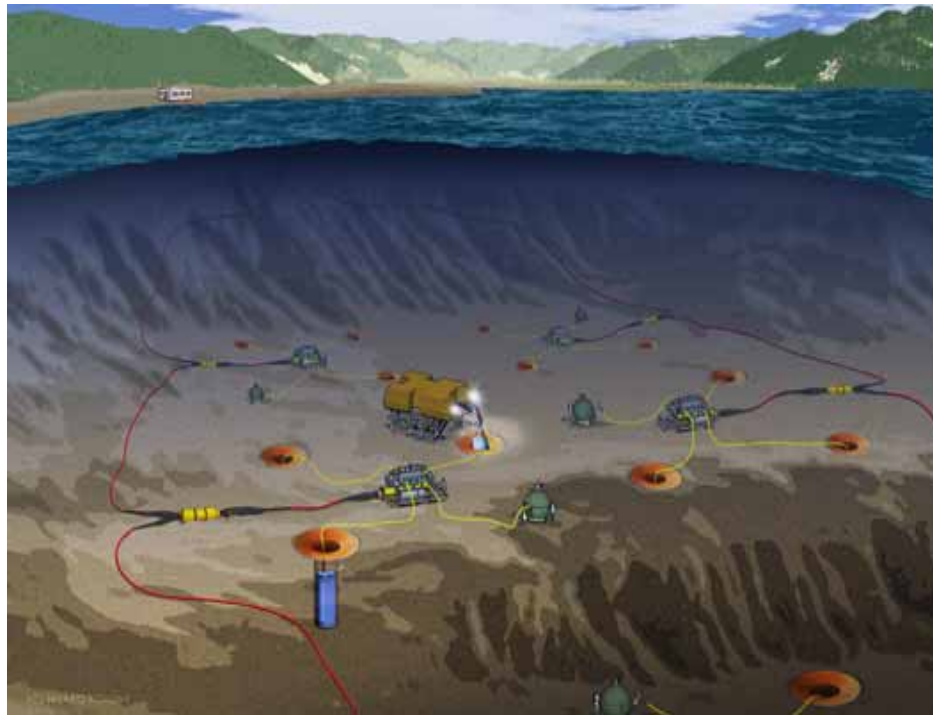


Network array planning

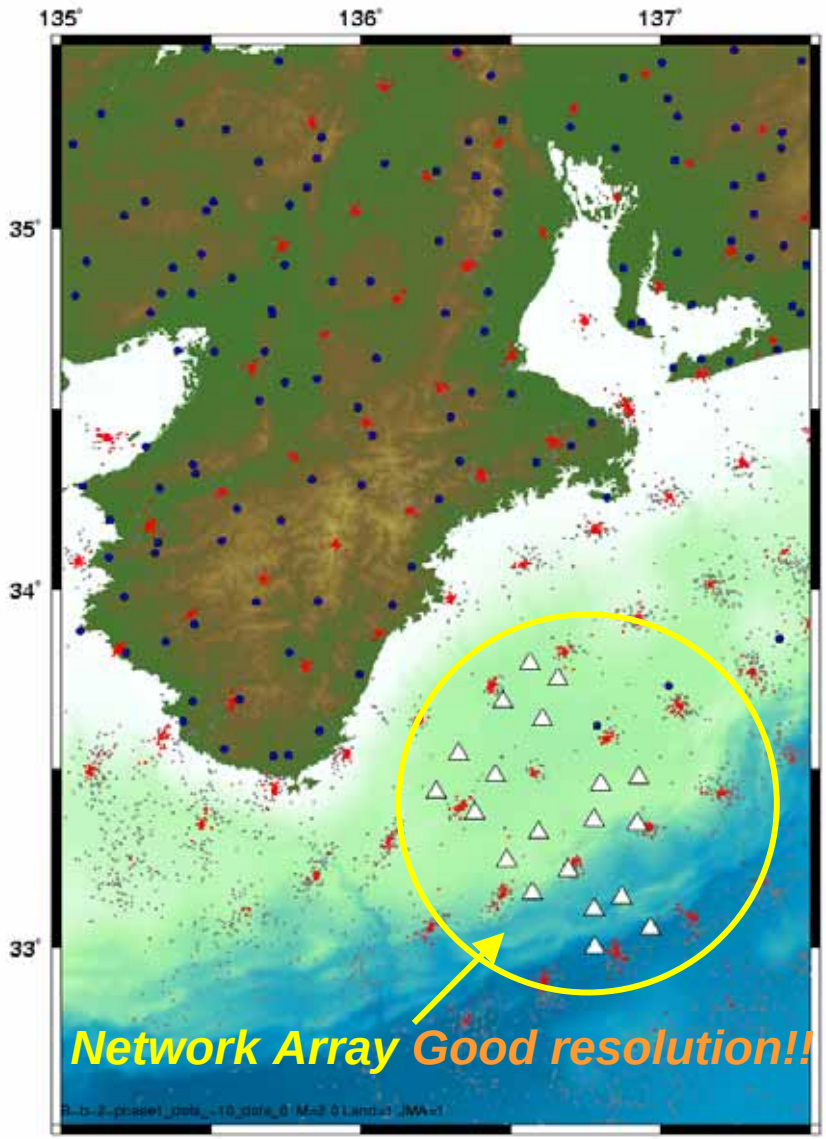


Advanced Ocean Floor Cable System

Image

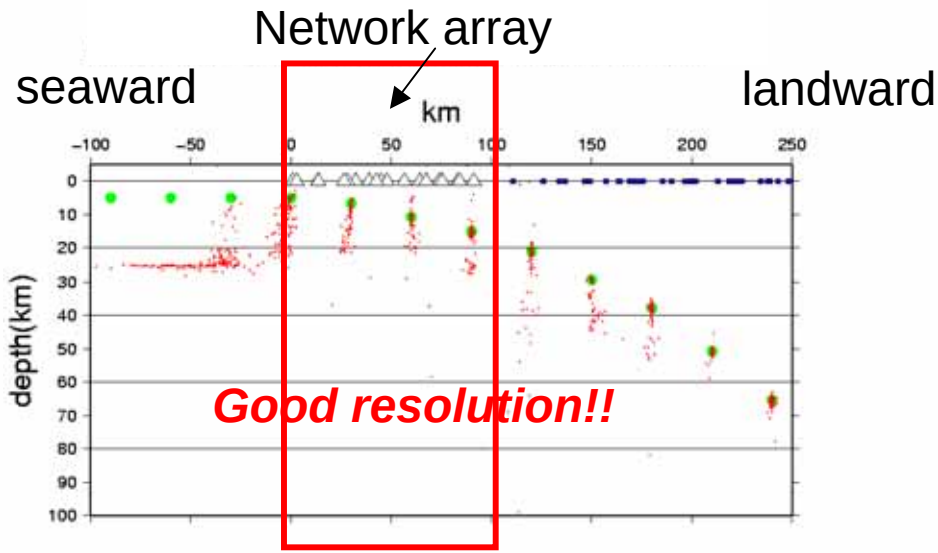


The resolution test of hypocenter determination using oceanfloor network



Sources：located on plate boundary
△:Network sensor

The network array improves the resolution of hypocenter determination

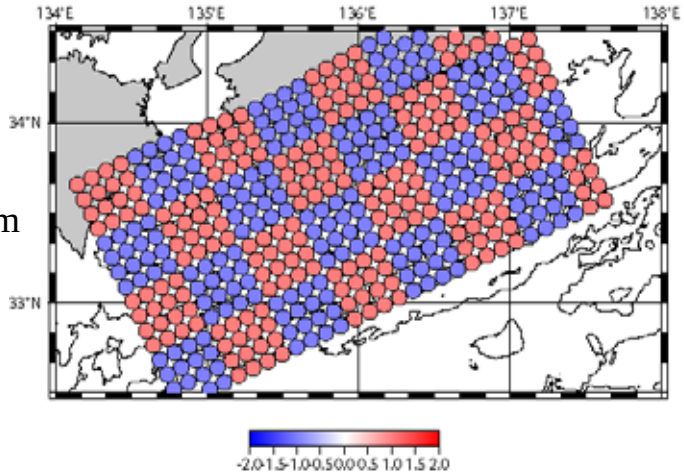


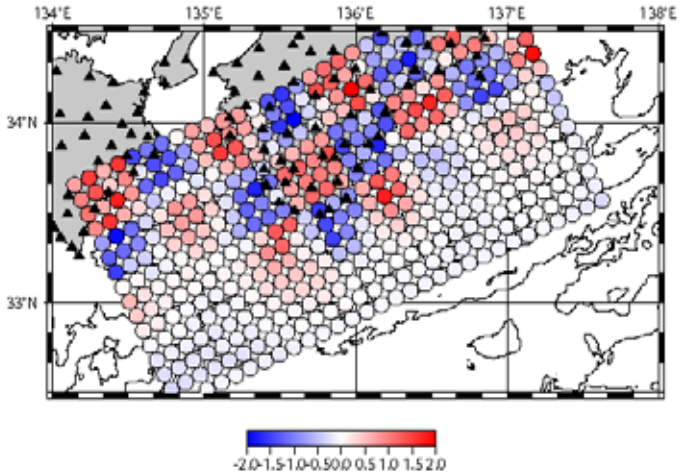
The checker board test for offshore geodetic data analyses

Model

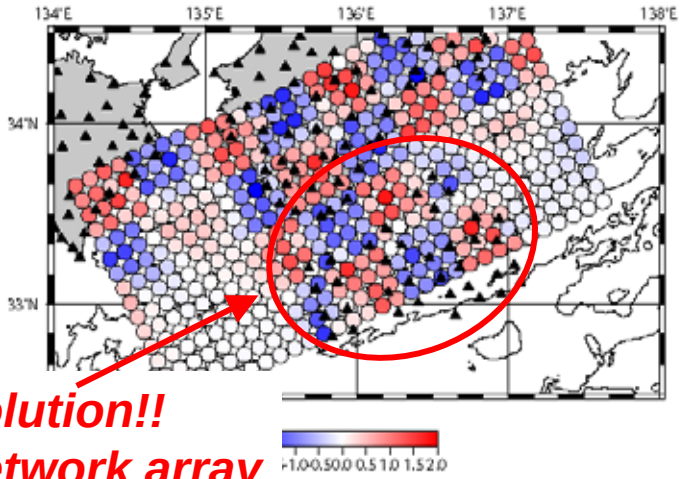
Land GPS

40 km square checker board
Slip rate : ±1m





Ocean network system(36 pressure gauges)+ Land GPS



Good resolution!!
Around network array

▲：Land GPS and Pressure gauge

Resolution

- Land GPS：
  horizontal; 1mm
  vertical; 3mm
- Pressure gauges: 10mm

Advanced Ocean Floor Cable System

Sensors

1) Multi seismometers for
   - Broad band phenomena
   - Strong Motion
   - Micro EQs.
2) Precise pressure gauges for
   - Tsunami
   - Ocean floor deformation
3) Data storage function at the trouble

Under development

* Precise ocean floor deformation monitoring system
* Advanced in lined sensor cable system

Sensors

Broadband seismometer

Strong motion accelerometer

Seismometer

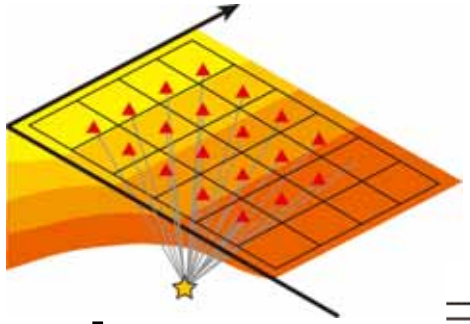
Pressure gauge

Other

Experiment institution
-Sensors test as pre study-

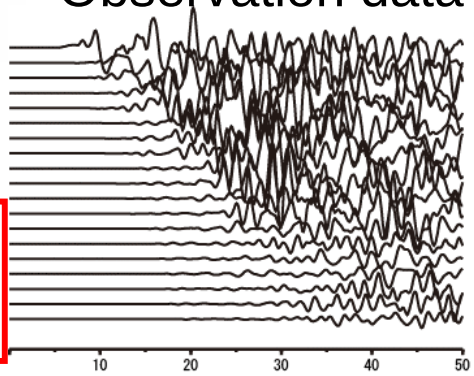
Matsushiro Earthquake Center (JMA)
Matsushiro Seismological Observatory

Flow of semi real-time analyses using ocean floor network data



Collection and arrangement of a large amount of high-precision observation data

Observation data



Oceanfloor network

Theoretical data

Database of synthetic seismograms simulated for various cases

Analysis using both observed and synthetic seismograms

Analysis of observed seismogram

Determination of Magnitude, Seismic source mechanism

Tsunami simulation

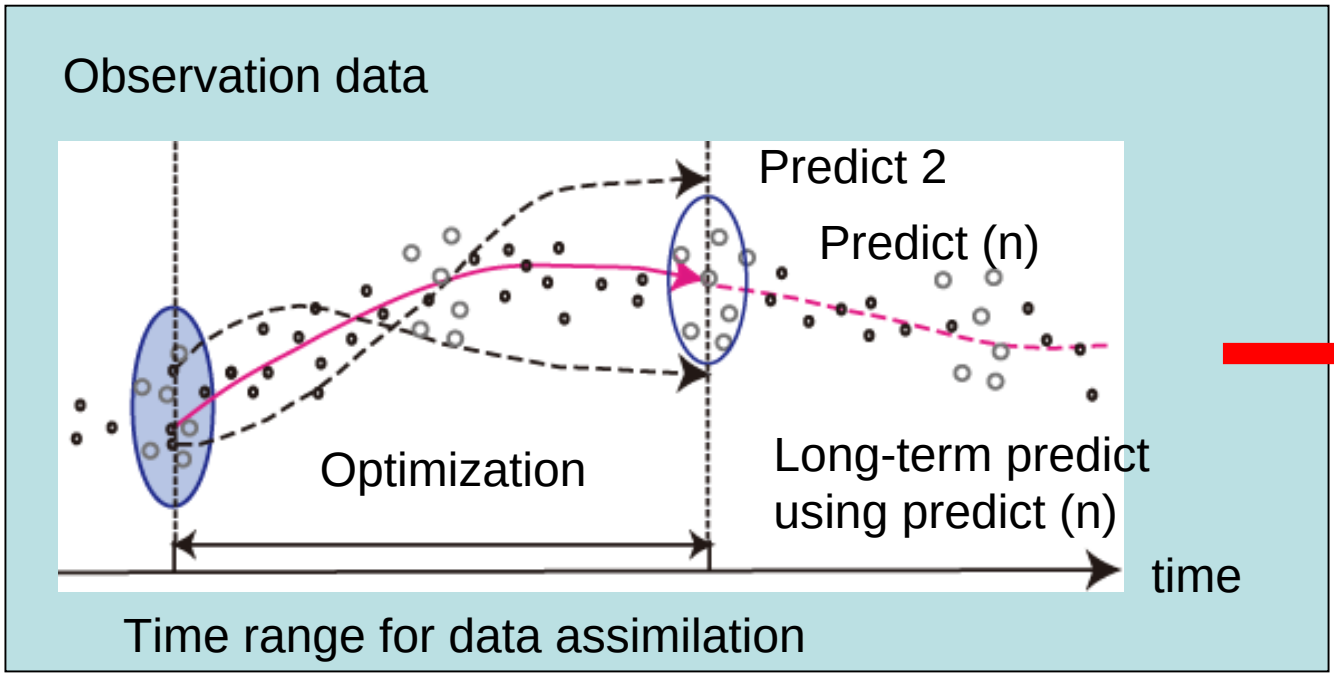
Estimation of strong motion

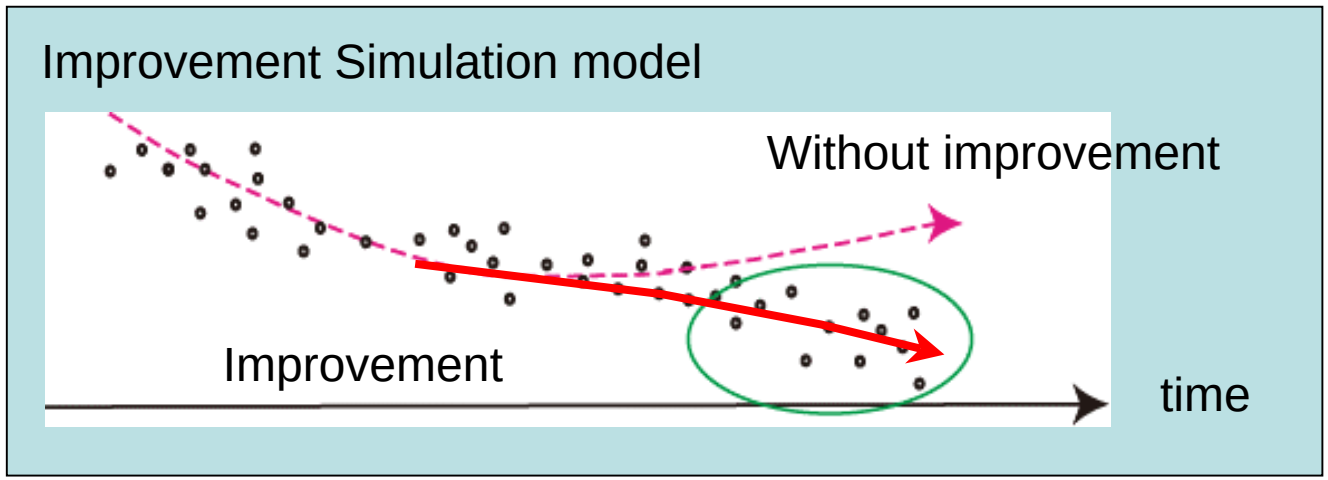
Improve the simulation model

Data assimilation：
using pressure gauge data as
ocean floor deformation monitoring

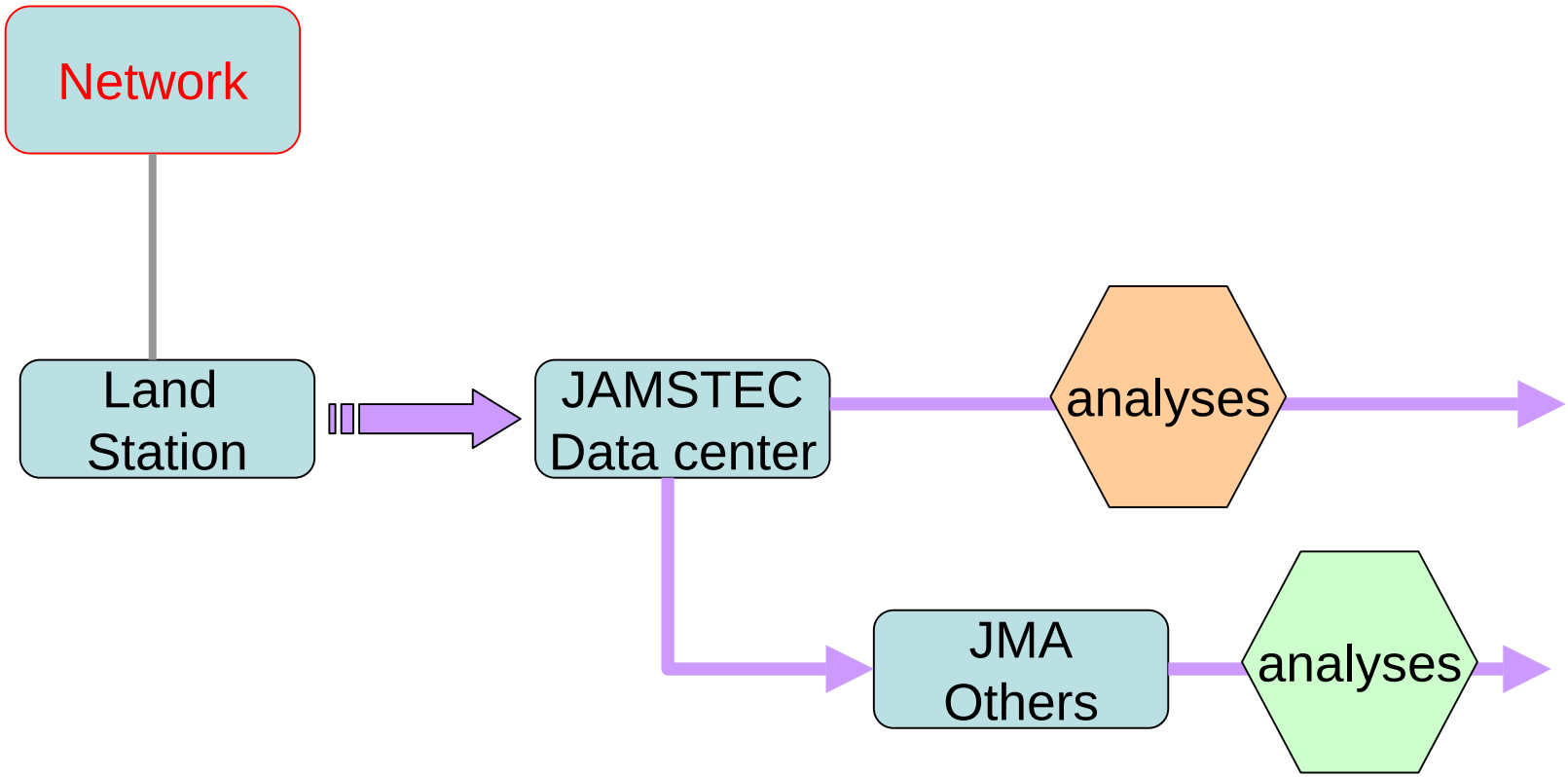
Keyword: Long term observatory

Data assimilation



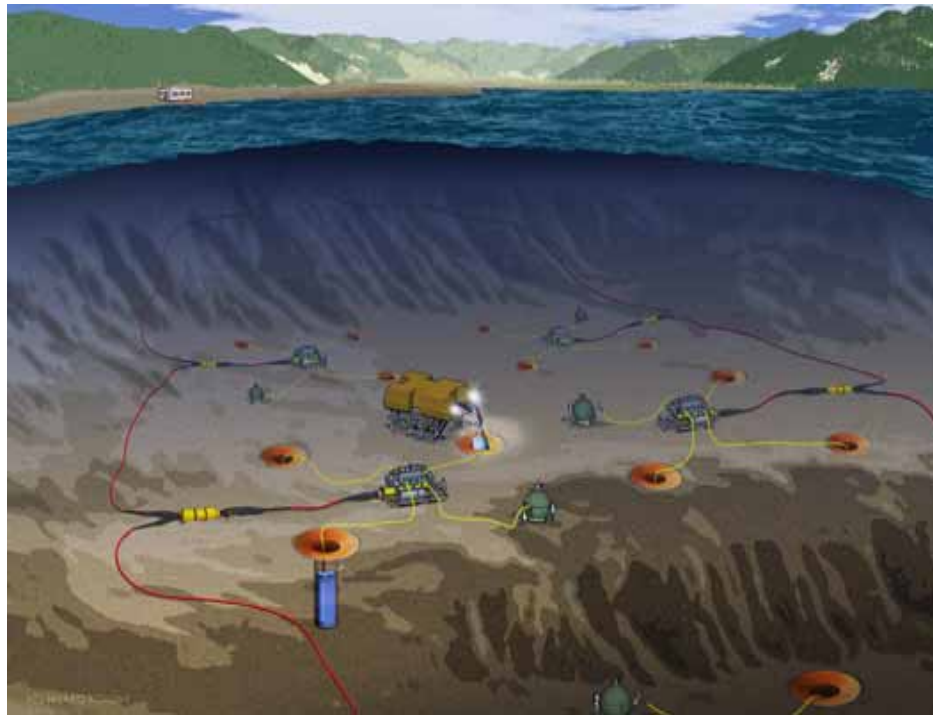


Network data flow

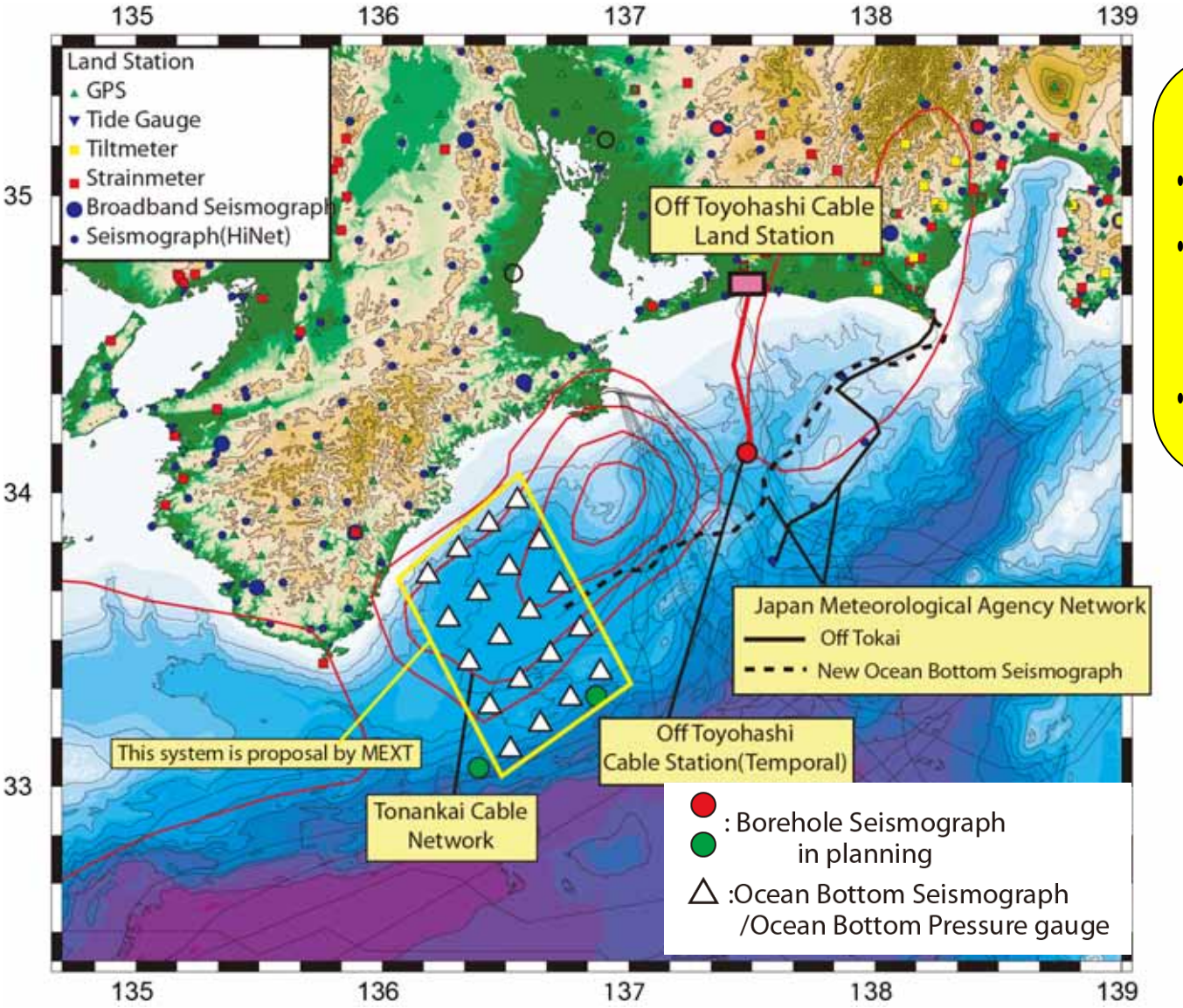


Advanced Ocean Floor Cable System

Image



Ocean floor cable network system



Sensors

- 20 Seismometers
- 20 Pressure gauges

Project

- FY2006-FY2009
  4 years

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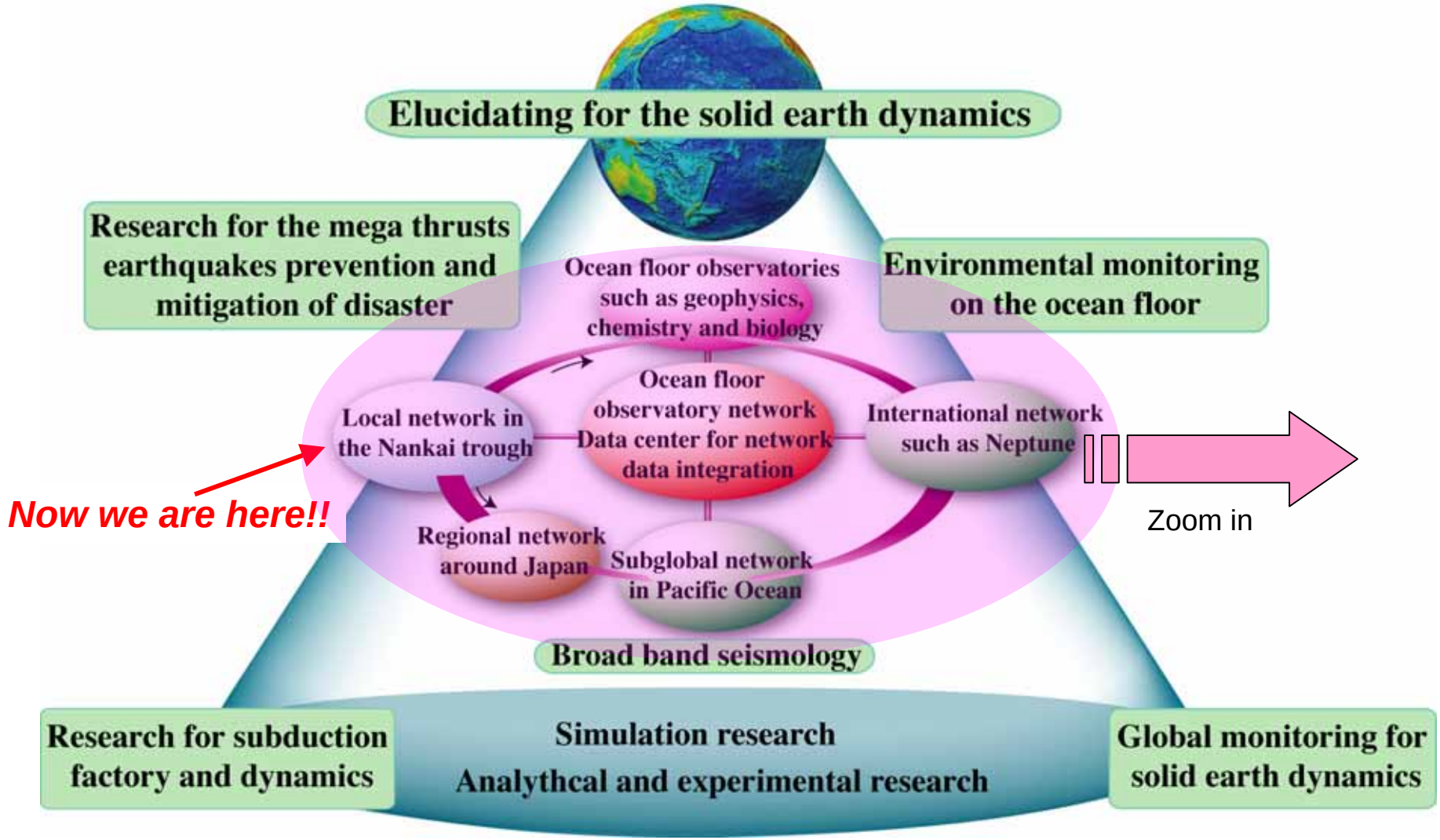
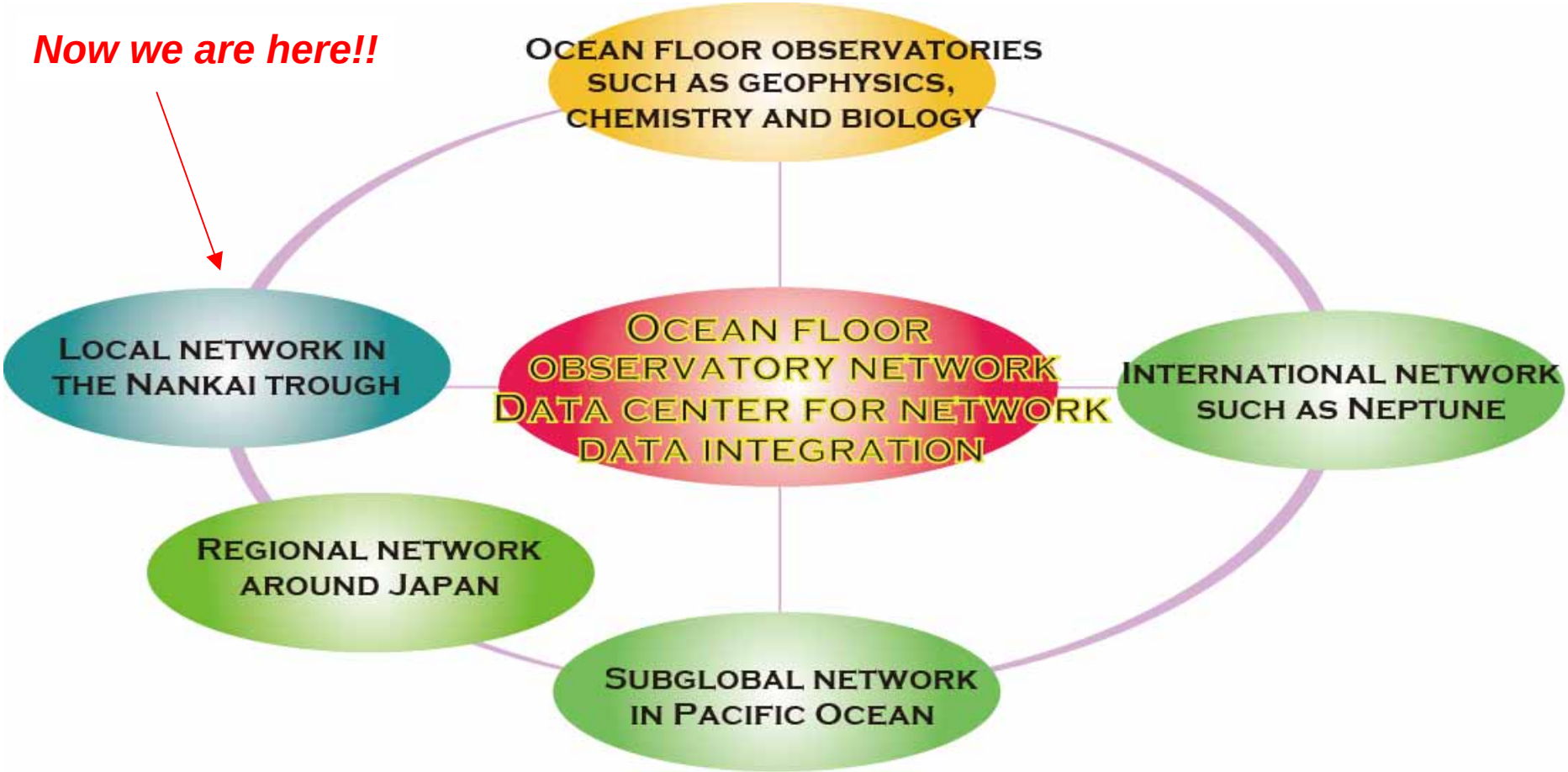
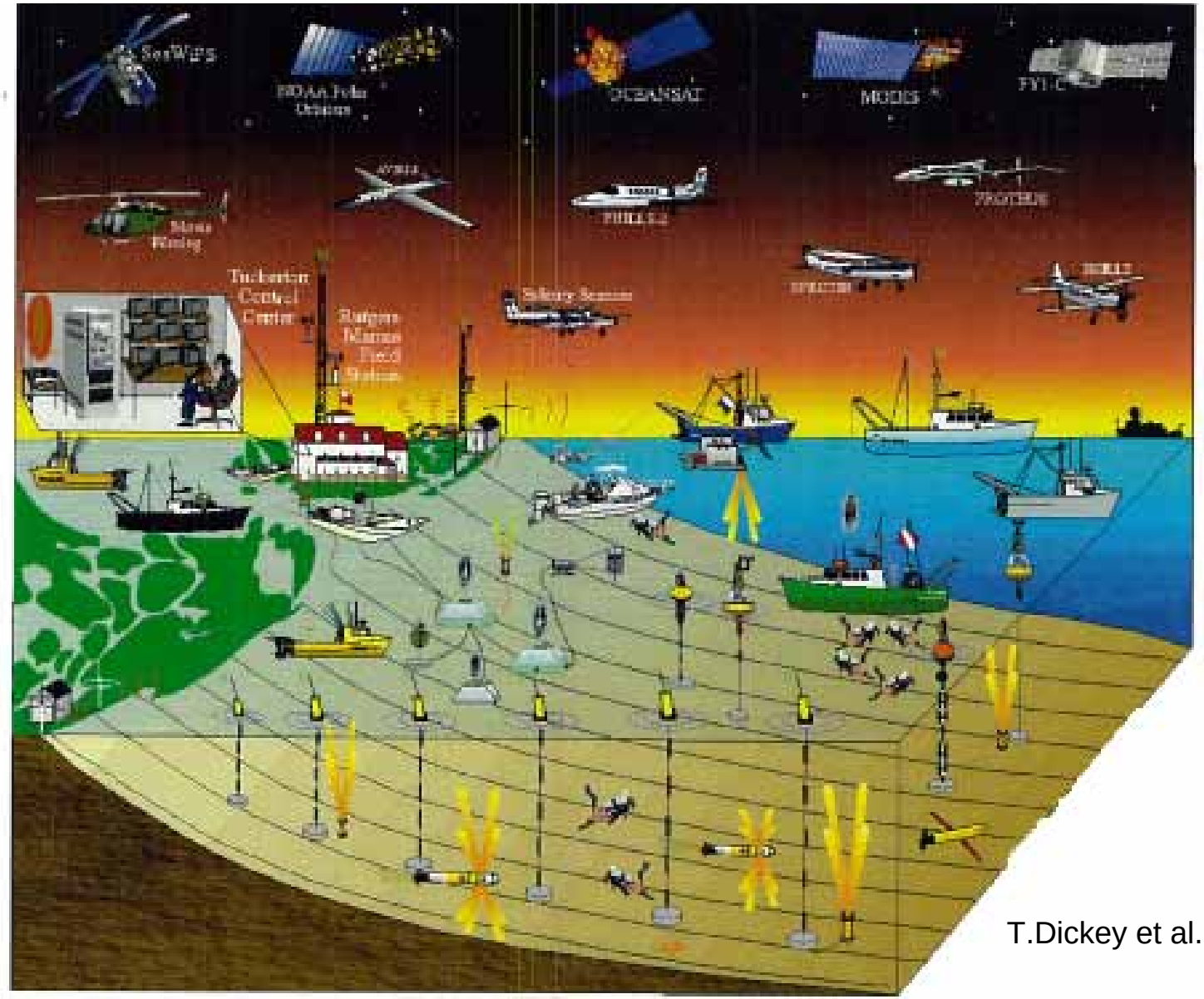
Future Network for Geosciences



Future Network for Geosciences



Total geosciences network image
-Integration of multi-spheres data-



T.Dickey et al., 2006