

Nationwide dense seismic observation networks in Japan - *Hi-net, F-net, K-NET and KiK-net* -

Kazushige Obara

(*National Research Institute for Earth Science
and Disaster Prevention, Japan*)

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1 . Overview of recent Japan seismic network

1-1. Impact of KOBE Earthquake (Jan. 17, 1995)

1-2. Earthquake research plan by Japanese government

1-3. K-NET: Strong motion observation network

1-4. Hi-net (KiK-net): High sensitivity seismograph network with two sets of strong motion seismometer

1-5. F-net: Broadband seismograph network

2. Recent significant result : Slow earthquakes

2-1. Shallow very low frequency earthquake

2-2. Nonvolcanic deep low-frequency tremor

2-3. Short-term slow slip event

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2. Recent significant result : Slow earthquakes

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2-2. Nonvolcanic deep low-frequency tremor

2-3. Short-term slow slip event

Impact of Kobe Earthquake(1995)

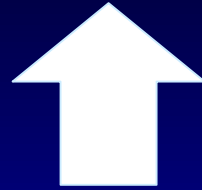
Prediction → *Basic research*



Headquart. Earthq. Res. Promotion

日本のビルは地震被害は世界でもトップクラスと考えられていたが、震下型地震にひとたまりもなかった(18日、神戸市役

Basic research of earthquakes

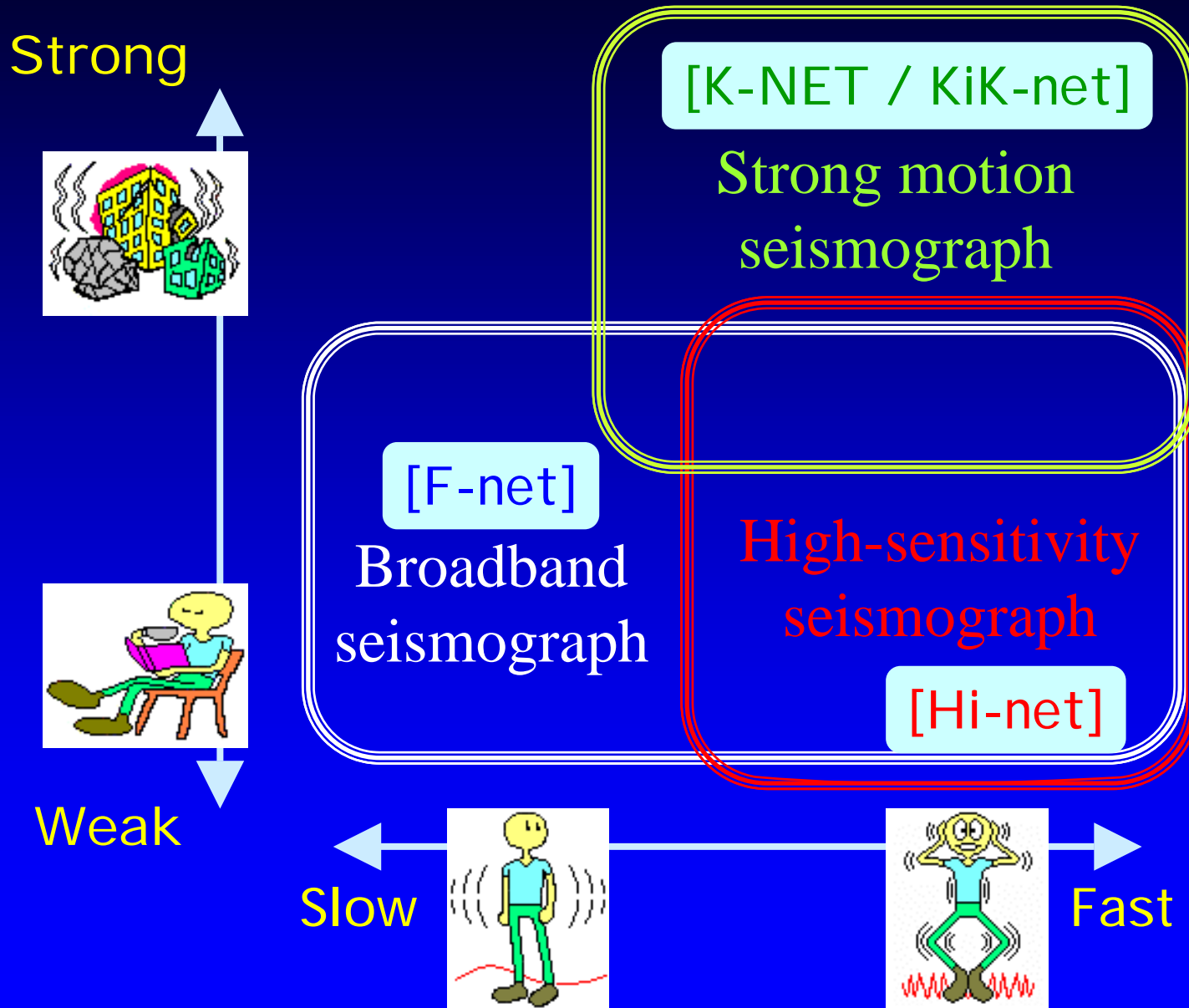


KIBAN (= *'fundamental'* or *'infrastructure'*) project

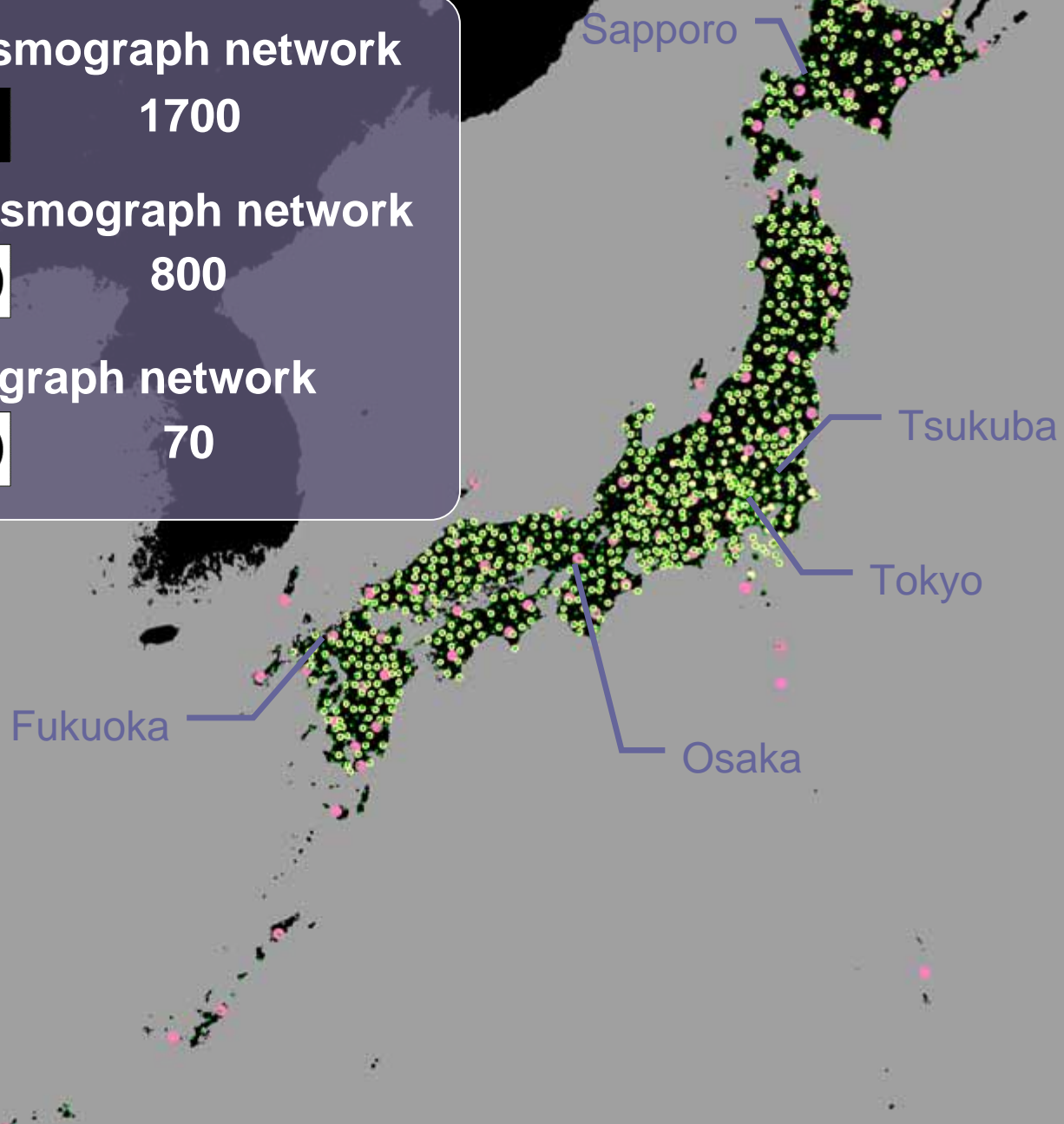
(1) Seismic network (2) GPS network (3) Active fault survey



Coverage of three kind seismographs



- Strong motion seismograph network
K-net **NIED Japan** **KiX** 1700
- High sensitivity seismograph network
Hi-net **NIED** 800
- Broadband seismograph network
F-net **NIED** 70



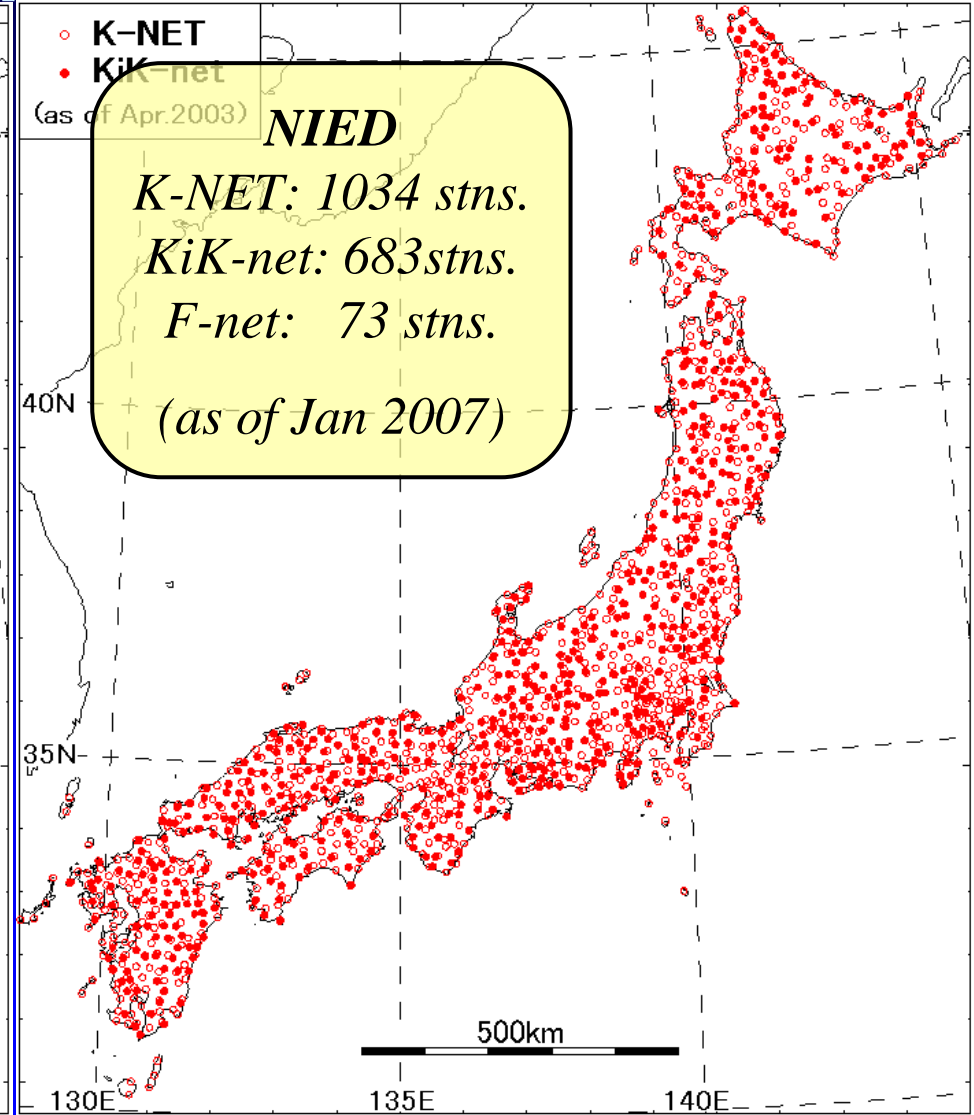
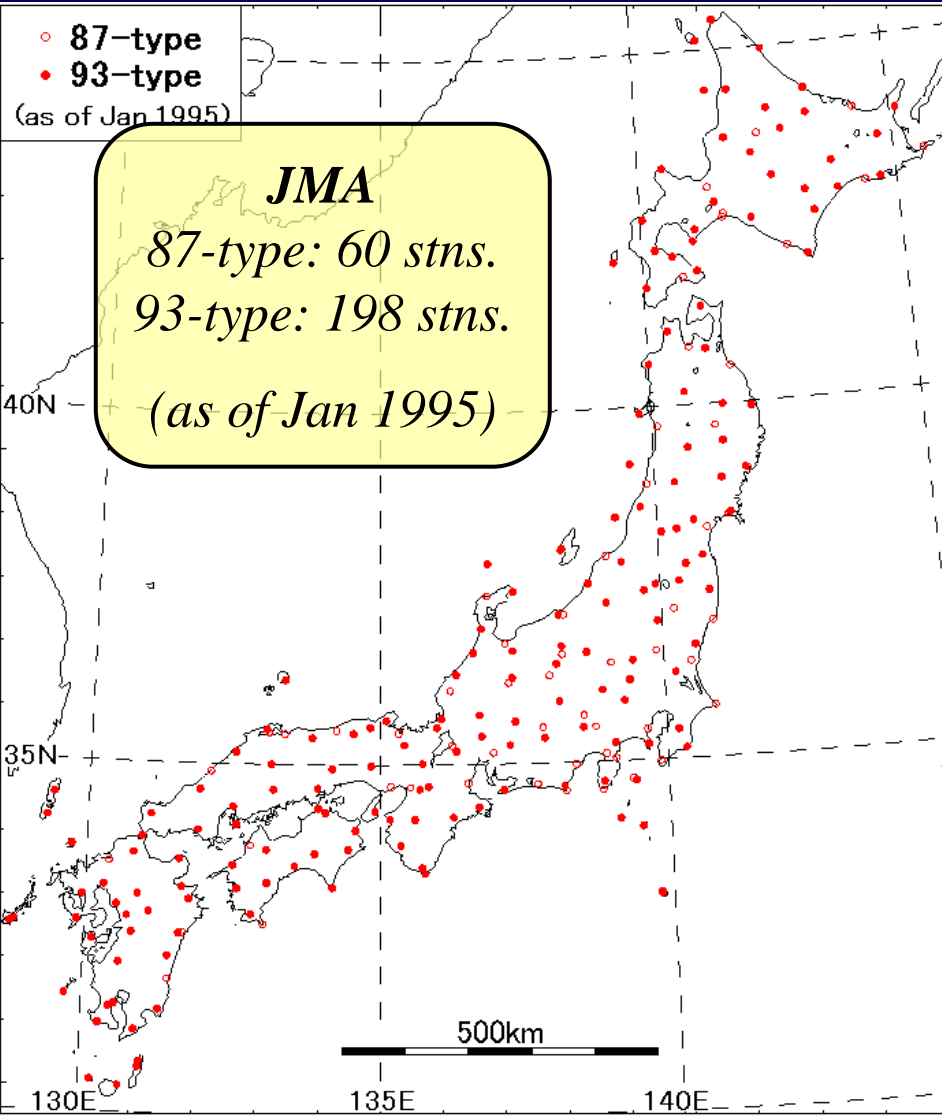
Strong-motion observation



Strong-motion seismograph network

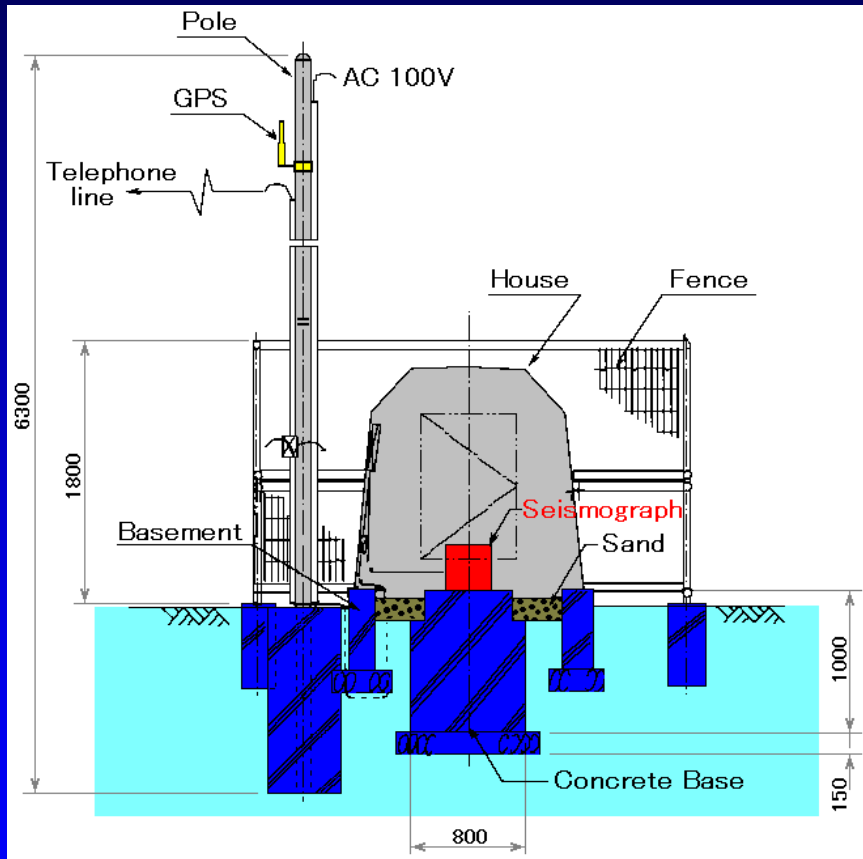
- before Kobe Eq. -

- after Kobe Eq. -

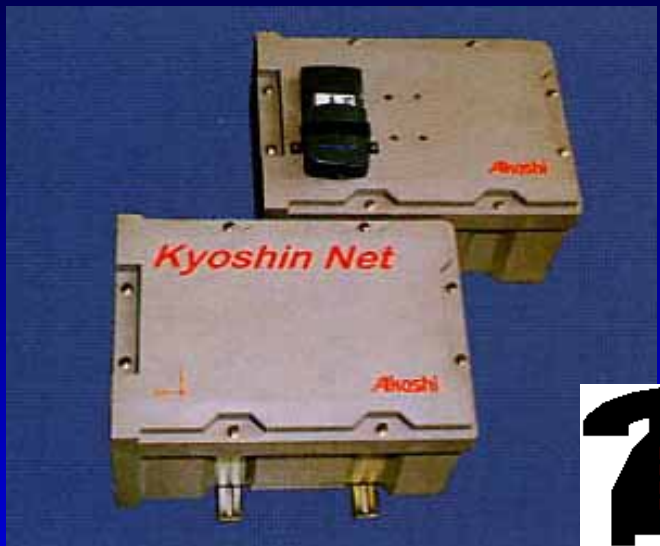


K-NET (Kyoshin network Japan) station

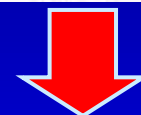
25km spacing, 1034 stations (as of April 2003)



K-NET: Sensor and Data acquisition (Dialup system)



Eq!



Resolution
Acceleration < 0.1 mGal
A/D converter 24 bit

Dynamic range ± 2G

Sampling 100 Hz

Memory capacity 8 Mbyte

*dial
up
Out*



K-NET: Data service on web site

Top Page

Select an earthquake
and Download data

Search for earthquakes
and Download data

Search and Download
data

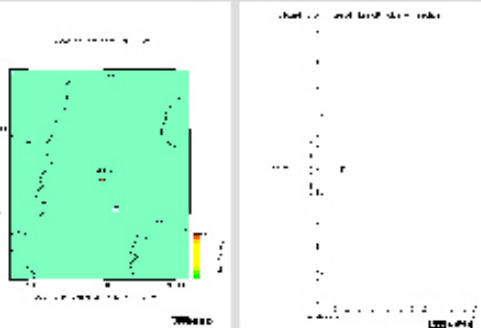
K-NET NIED

Kyoshin Network
K-NET [Japanese](#)

page access **60802**
data download **3024219**

Kyoshin Net (K-NET) is a system which sends strong-motion data on the Internet, data which are obtained from 1,000 observatories deployed all over Japan. The control center makes files with a common header including the source parameters determined by the Japan Meteorological Agency (JMA) for each event. Please use Netscape 4.X, or use Microsoft Internet Explorer 5.X or later. If your platform is the Macintosh, Netscape6.X is recommended.

Latest earthquake of K-NET



2002/10/04-13:05:00 ([->detail](#))
36.20N 138.00E 010km M2.9

What's New

- NEW** (Oct.8th,2002) WWW/FTP service will be stopped due to construction.
- (Jul.26,2002) Announcement of the K-NET Mirror Site#1 maintenance.
- (Jul.4th,2002) WWW/FTP service will be stopped due to construction.
- (May.15,2002) Announcement of the K-NET Mirror Site#1 maintenance.
- (Apr.2th,2002) Site SIG007(OUMIHACHIMAN) has moved.
- (Apr.05th,2002) Soil data of KMM014(TSUKI) was modified.
- (Apr.2th,2002) Site KMM014(TSUKI) has moved.
- (Oct.23th,2001) Movement of Site
- (Oct.12th,2001) It was changed about a period of construction. From 18:00 12th Oct. to 13:00 15th Oct., WWW/FTP service will be stopped due to construction.
- (Oct.9th, 2001) From 17:00 12th Oct. to 20:00 13th Oct., WWW/FTP service will be stopped due to construction.

[Old news are here.](#)

Main Menu

Select an earthquake
and Download data

Use this link if you know the origin time of an earthquake and want to download its data. You can also view and download a **hypocentral map** here. Please begin with this page.

Search for earthquakes
and Download data

Use this link to search for earthquakes using the origin time, magnitude, epicenter location, etc.

Search and Download data

Use this link to search for acceleration data independent of earthquakes, based on date and time, site location, site characteristics, maximum acceleration, epicentral distance, etc. The data can be compressed into a single tar file.

Information

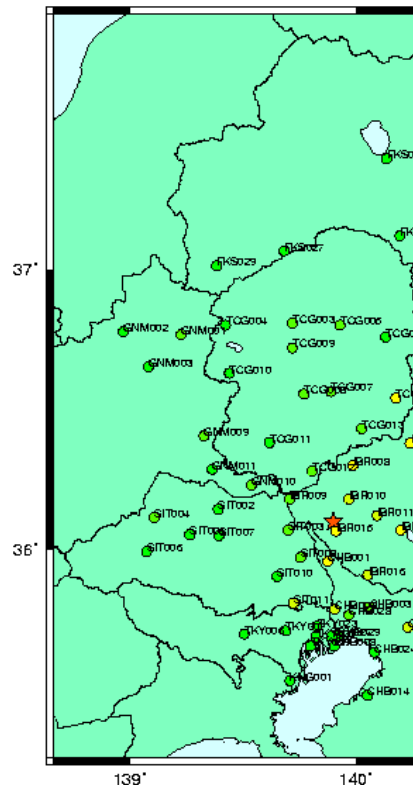
Acceleration map

Paste up of the records

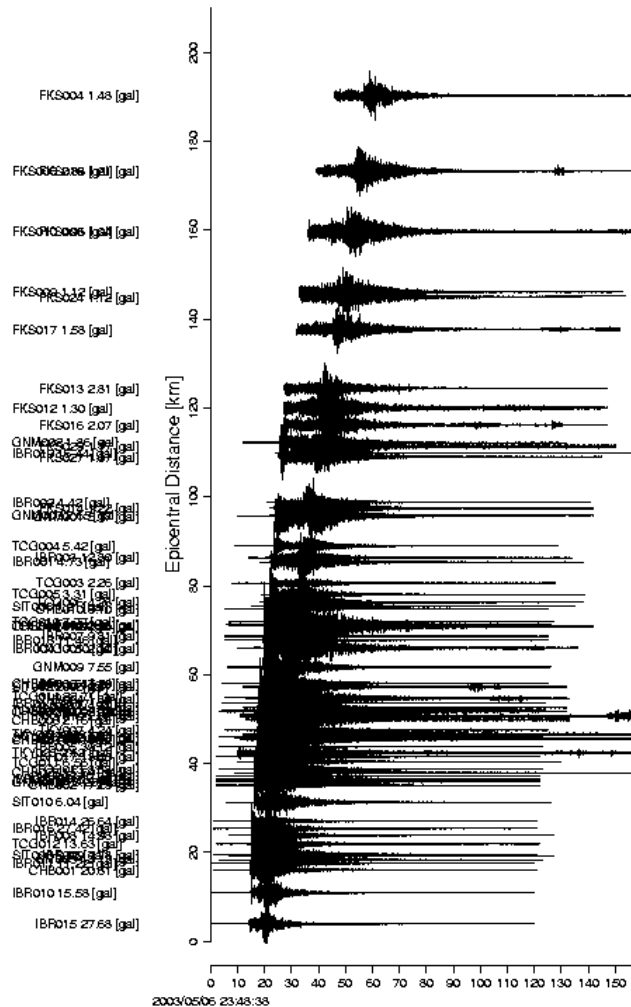
Site conditions

Hypocentral Location of K

2003/05/06-23:48:00 36.1N 139.9E 40km M4.3 (ch3)



2003/05/06-23:48:00 36.1N 139.9E

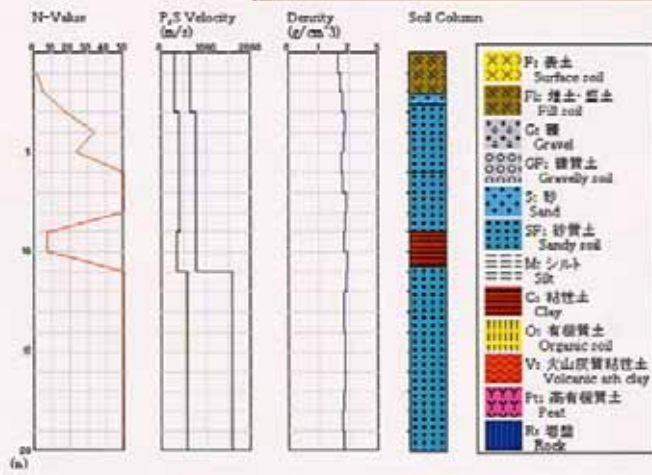
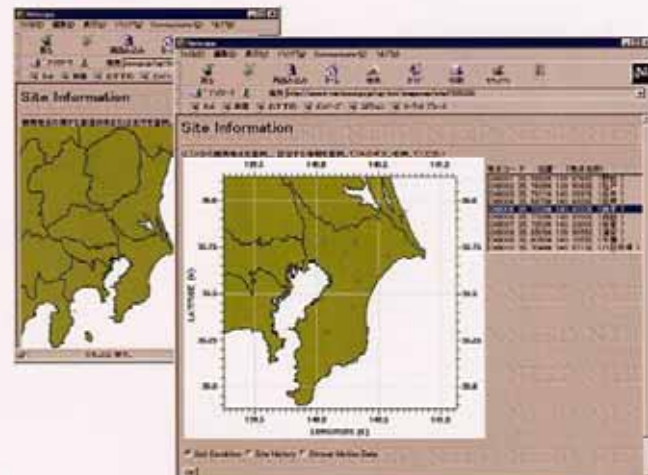


2003/05/06 23:48:38

K-NET

Site Information

K-NETWWWサーバからは、地図上で観測地点を選択することによりその観測地点の土質情報を引き出すことができます。



- XX P: 表土 Surface soil
- YY P: 埋土-腐土 Fill soil
- ZZ C: 礫 Gravel
- GP: 砂質土 Sandy soil
- G: 砂 Sand
- SP: 砂質土 Sandy soil
- M: シルト Silt
- C: 粘性土 Clay
- O: 有機質土 Organic soil
- V: 火山灰質粘性土 Volcanic ash clay
- P: 高有機質土 Peat
- R: 岩盤 Rock

High sensitivity observation

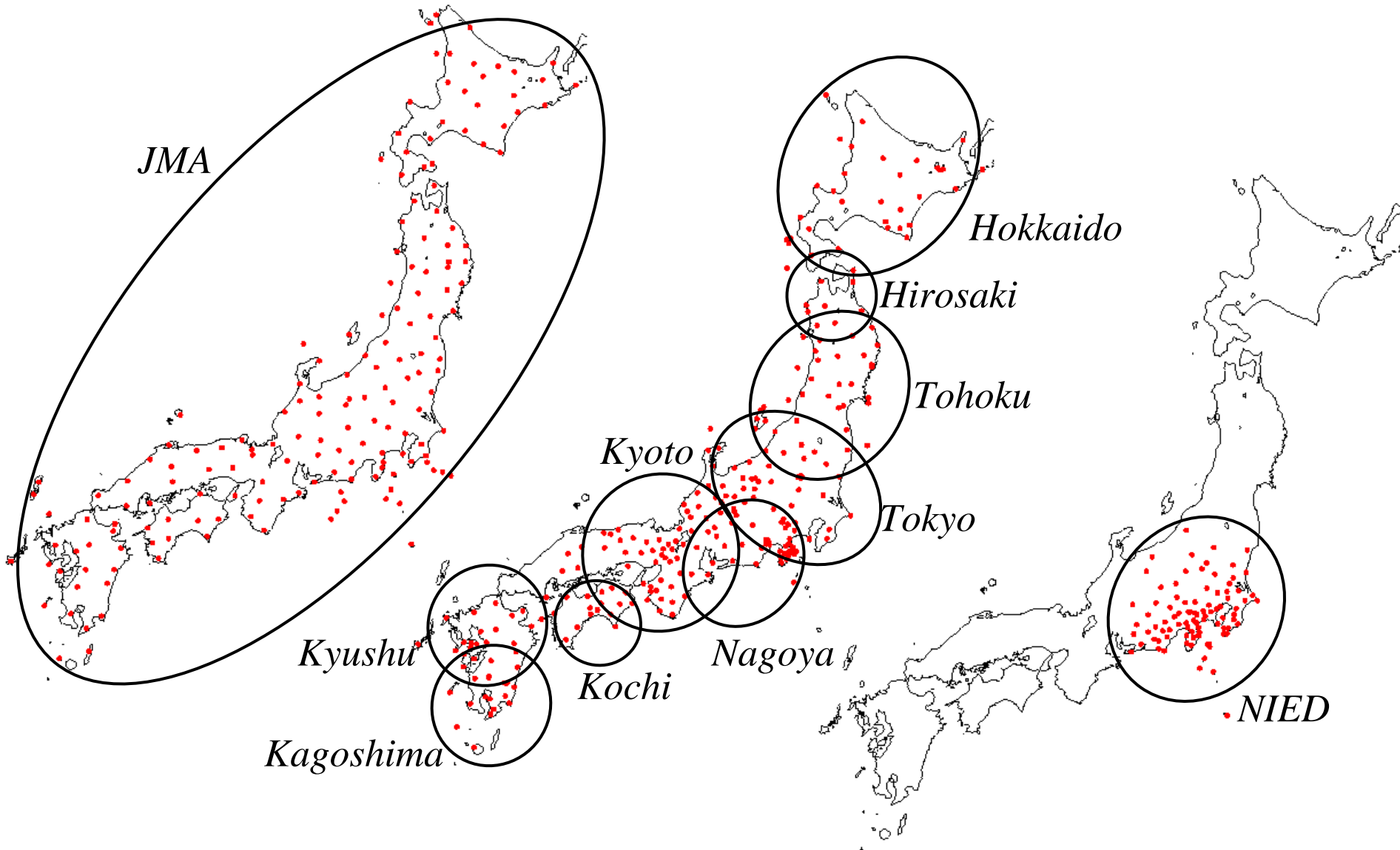


- before 1995 Kobe earthquake -

JMA:188 stations

UNIV:274 stations

NIED:89 stations

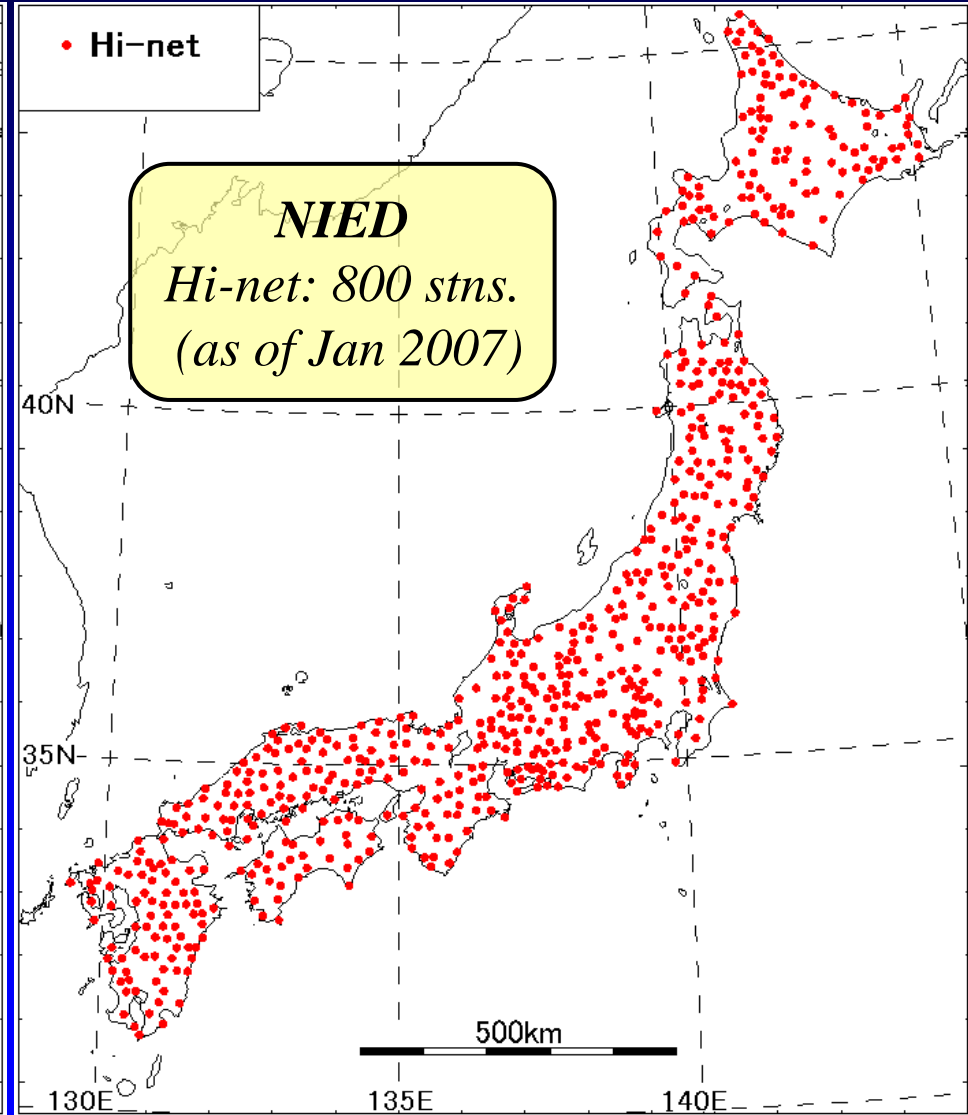
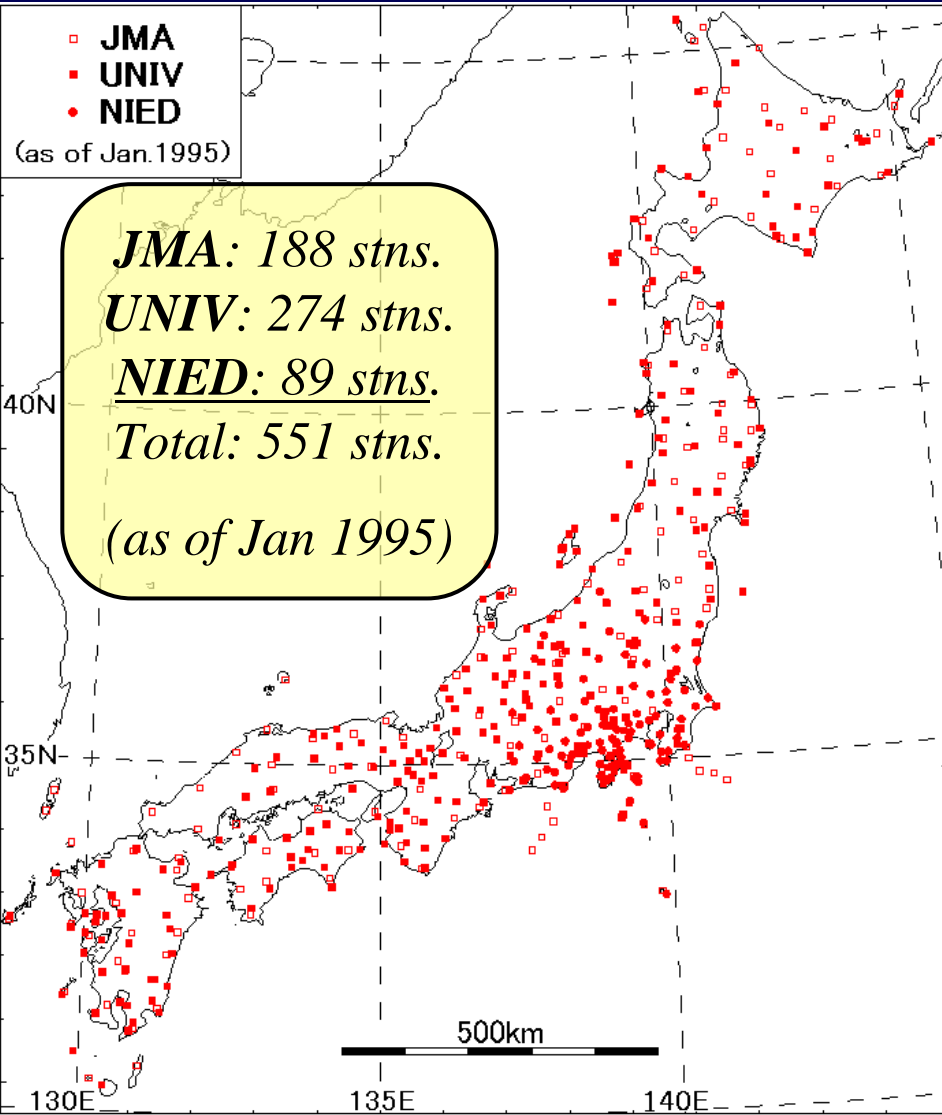


High sensitivity seismograph network

- before Kobe Eq. -



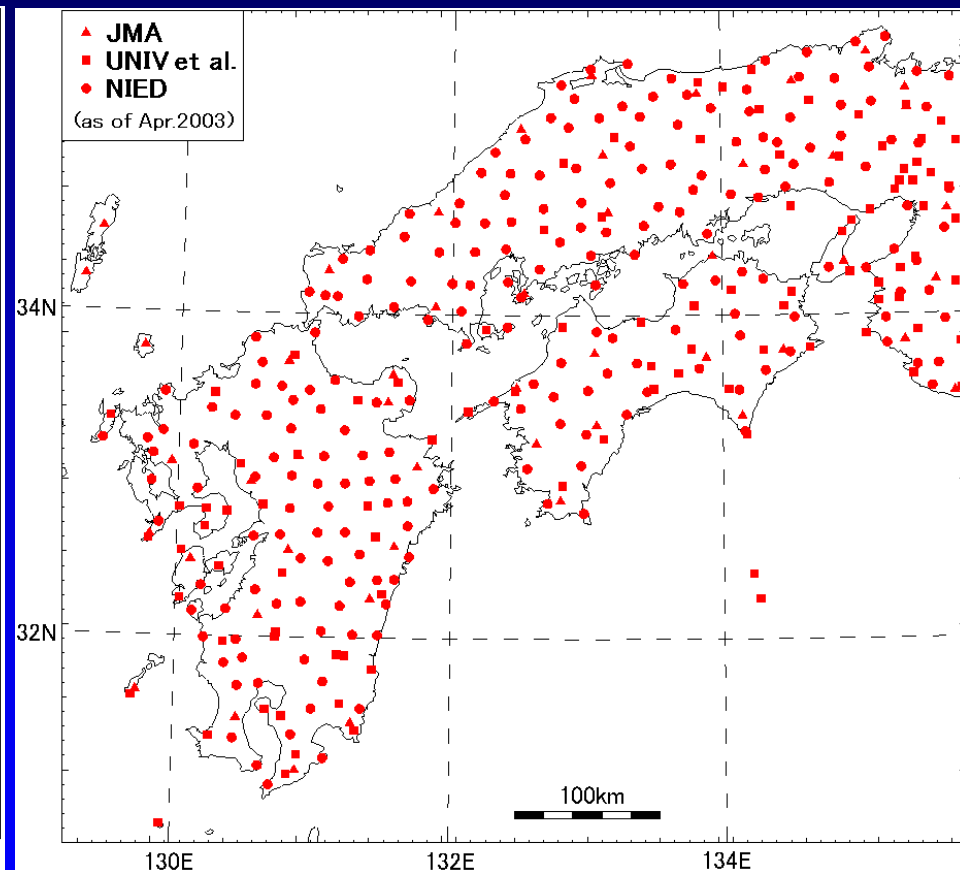
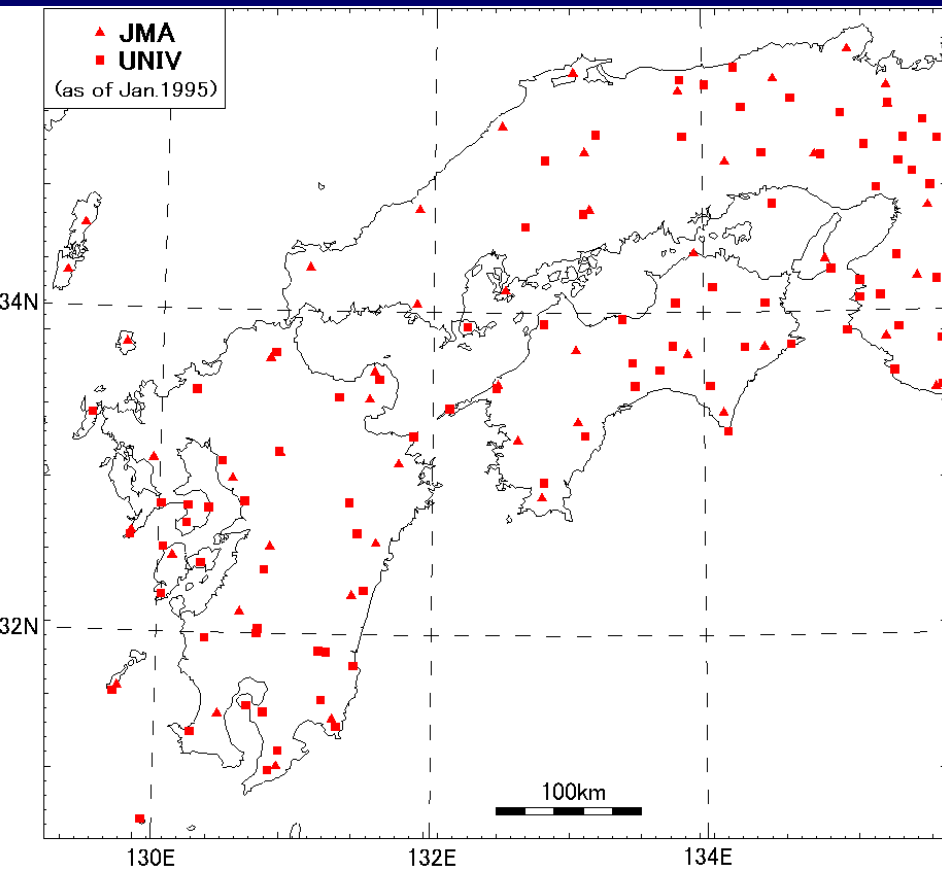
- after Kobe Eq. -

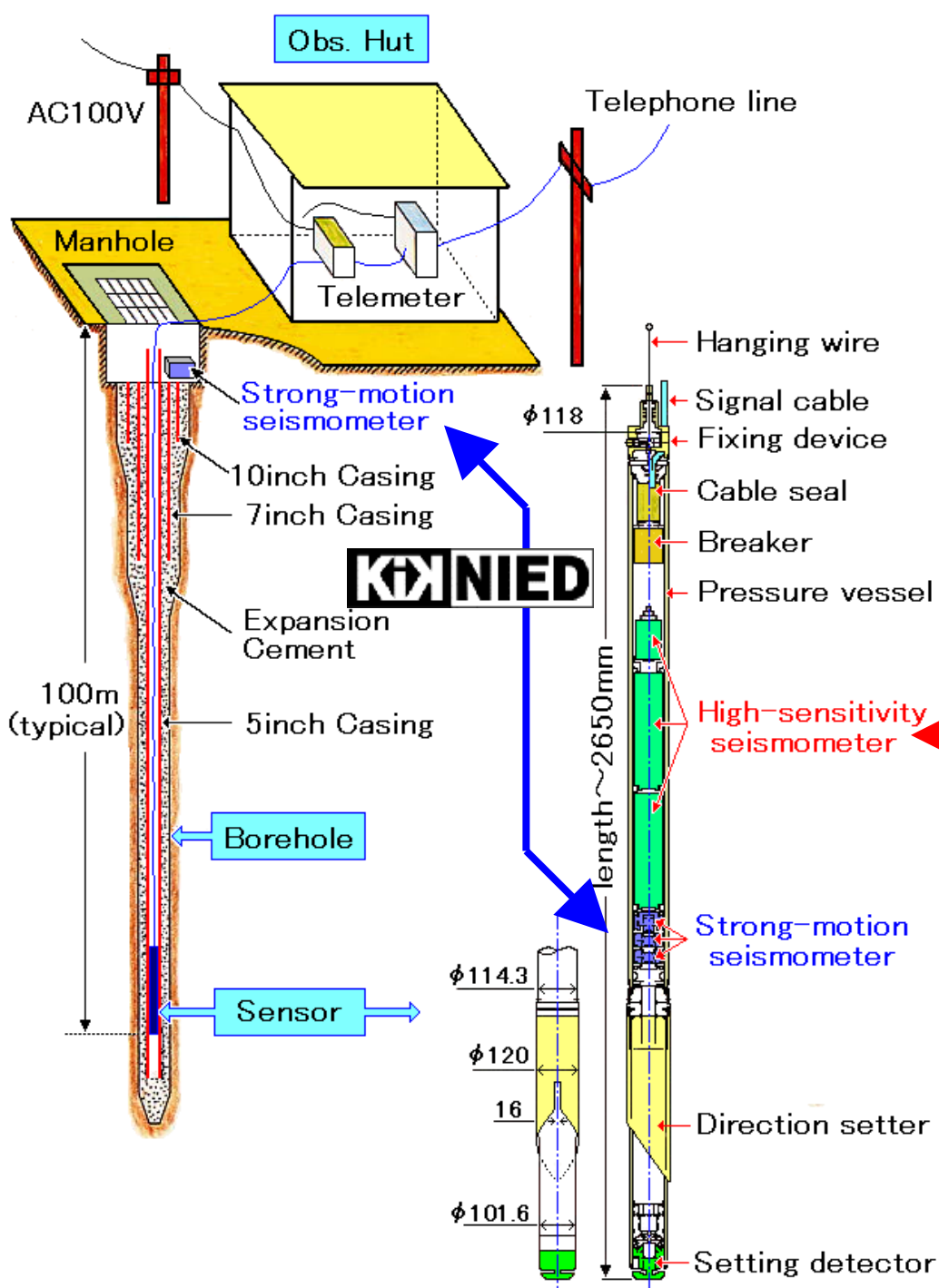


Change in the distribution of high sensitivity seismic stations in west Japan

- before Kobe Eq. -

- after Kobe Eq. -



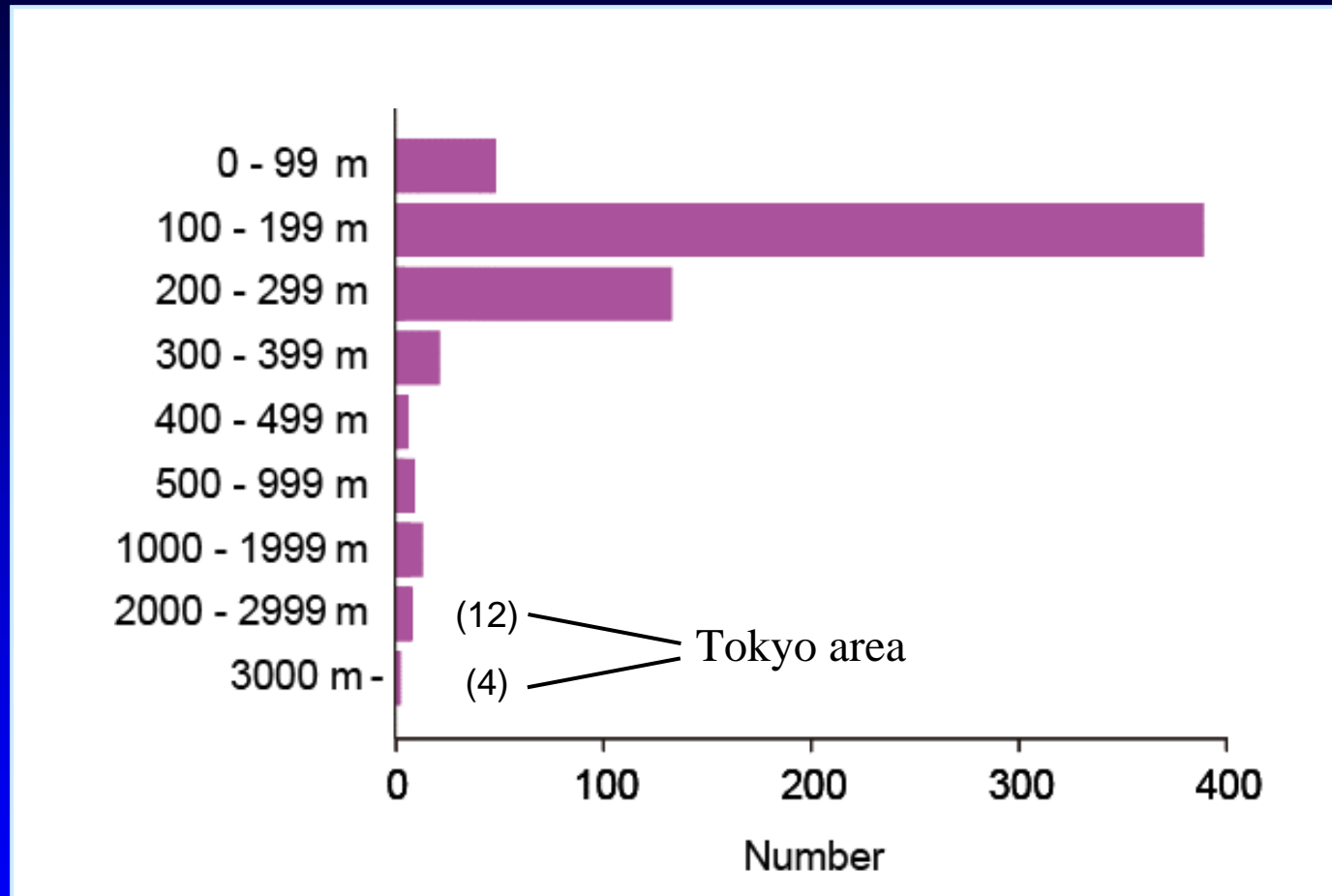


Hi-net station
 High sensitivity seismograph network
 800 borehole stations

KiK-net
 KIBAN Kyoshin network

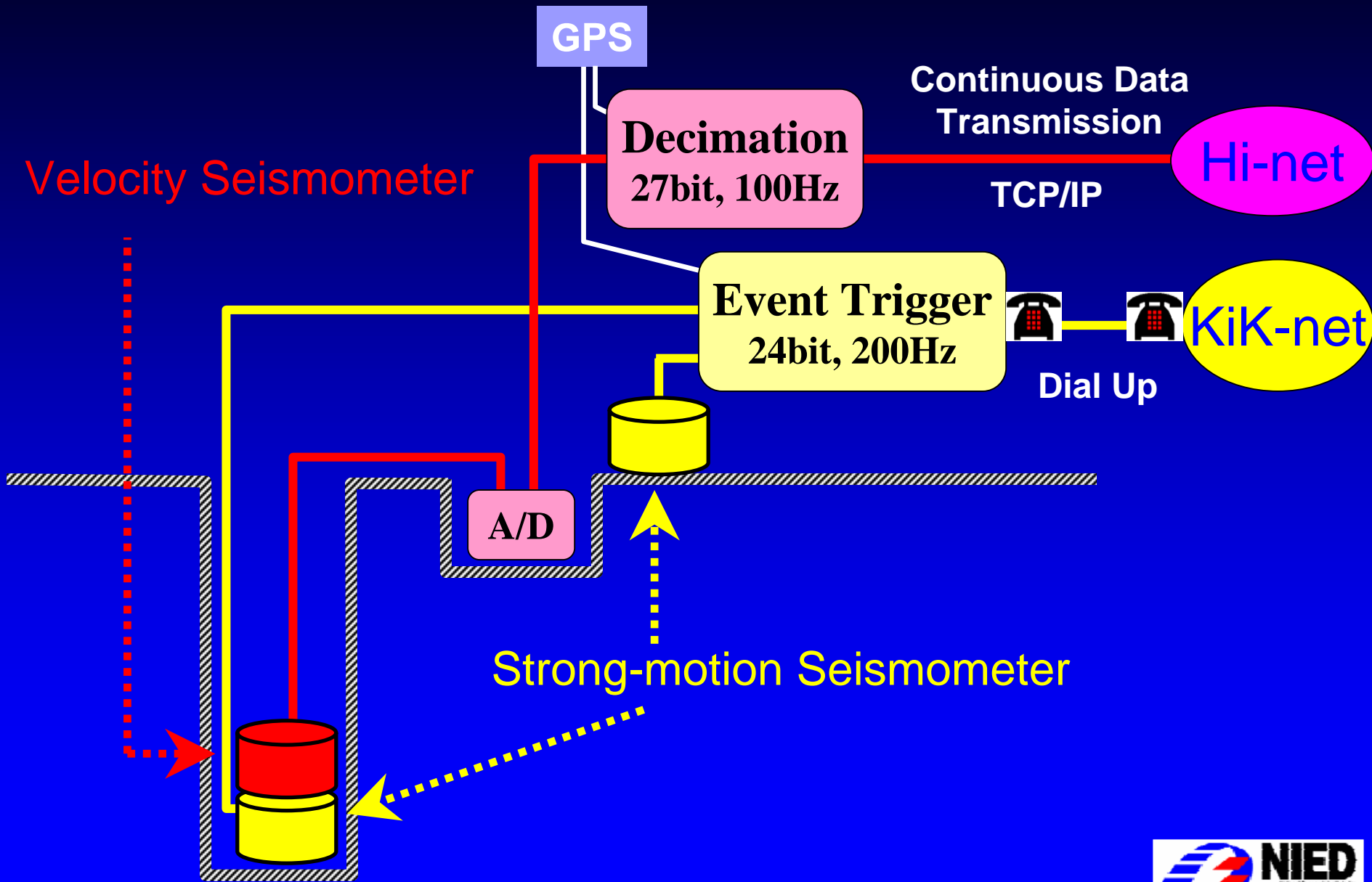


Depth of borehole

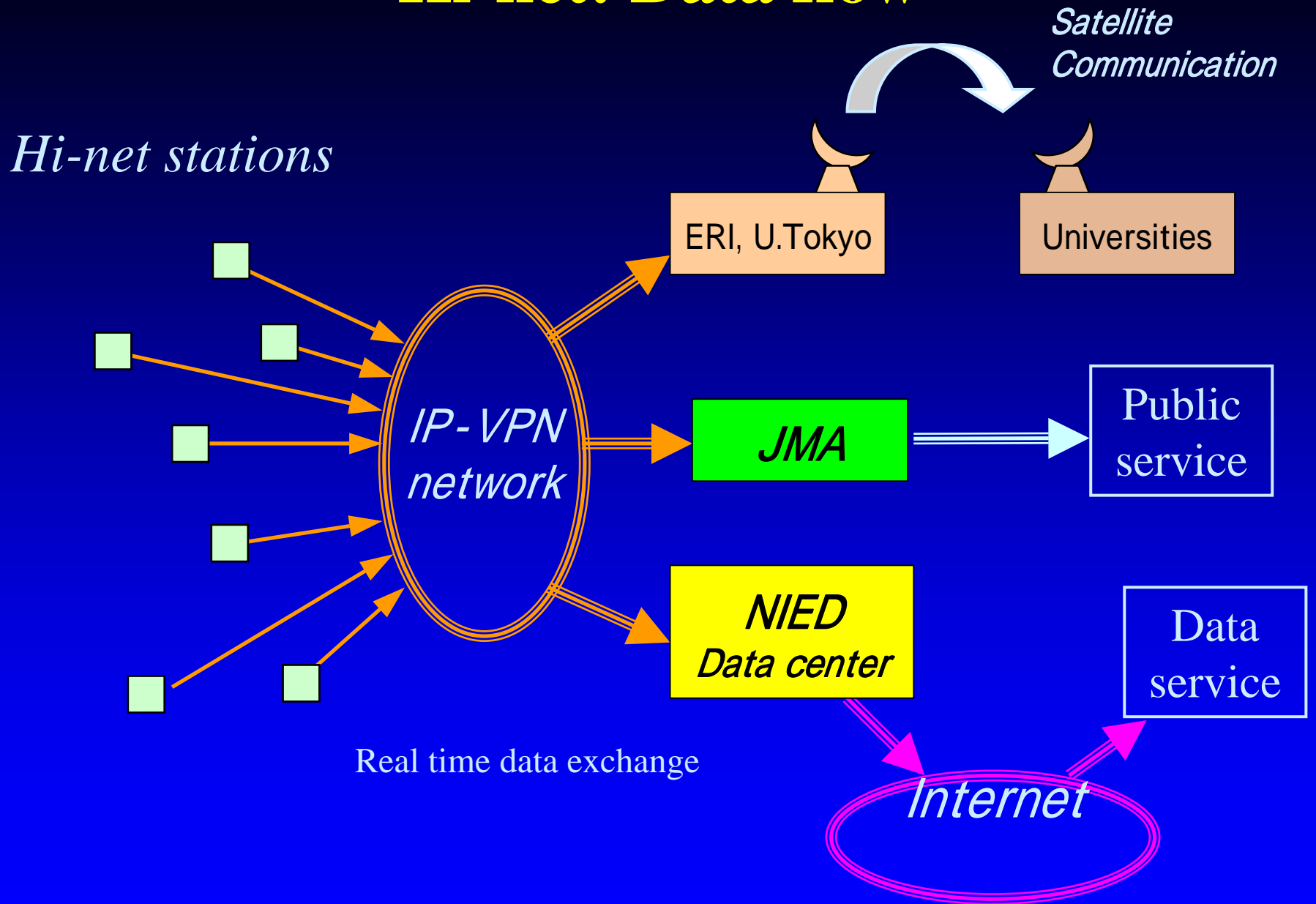


Control factor: Thickness of sediment layer
Cultural noise
Budget

Hi-net/KiK-net: Sensor and Data acquisition



Hi-net: Data flow



Hi-net: Data service on web site

Quick information

Epicentral distribution

Hi-net 高感度地震観測網 High Sensitivity Seismograph Network Japan

トップページ サイトマップ サイトポリシー 本館に関するお問い合わせ

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[データ公開について](#)
[ユーザ登録](#)
[地震の基礎知識](#)
[トピックス](#)
[地震情報](#)
[連続波形画像](#)

[連続波形データダウンロード【登録ユーザ専用】](#)
[観測点情報](#)
[マニュアル](#)
[研究成果](#)
[更新履歴](#)
[新規観測点情報](#)
[サイトマップ](#)

Access 推奨文字サイズ: 小・12px

最新震源マップ

ここではHi-netの地震観測システムで自動的に求められた情報を表示しています。あくまでも速報的なものなので正式には気象庁が公表する情報を御覧ください。(M>2.5)

震源地	茨城県西部
発震時刻	2002/07/18 18:22:28
緯度	35.125N
経度	133.142E
深さ	8.8km
マグニチュード	2.5

2002/07/17 20:15 ~ 2002/07/18 20:15

2002/07/18 18:22:28 M2.5
35.1N 133.1E Depth: 8km

M: -1 2 3 4 5
Depth [km]: 0 10 20 30 50 100 200 700

INFO 2002/07/13 茨城県南部の地震

過去の地震の最大振幅分布図はこちら

■ 起震時震源決定とは ■ 過去の最大振幅分布図

震源情報

震源地	茨城県南部
発震時刻	2002/07/13 21:45:48
緯度	36.002N
経度	140.112E
深さ	63.7km
マグニチュード	5.1

メカニズム解

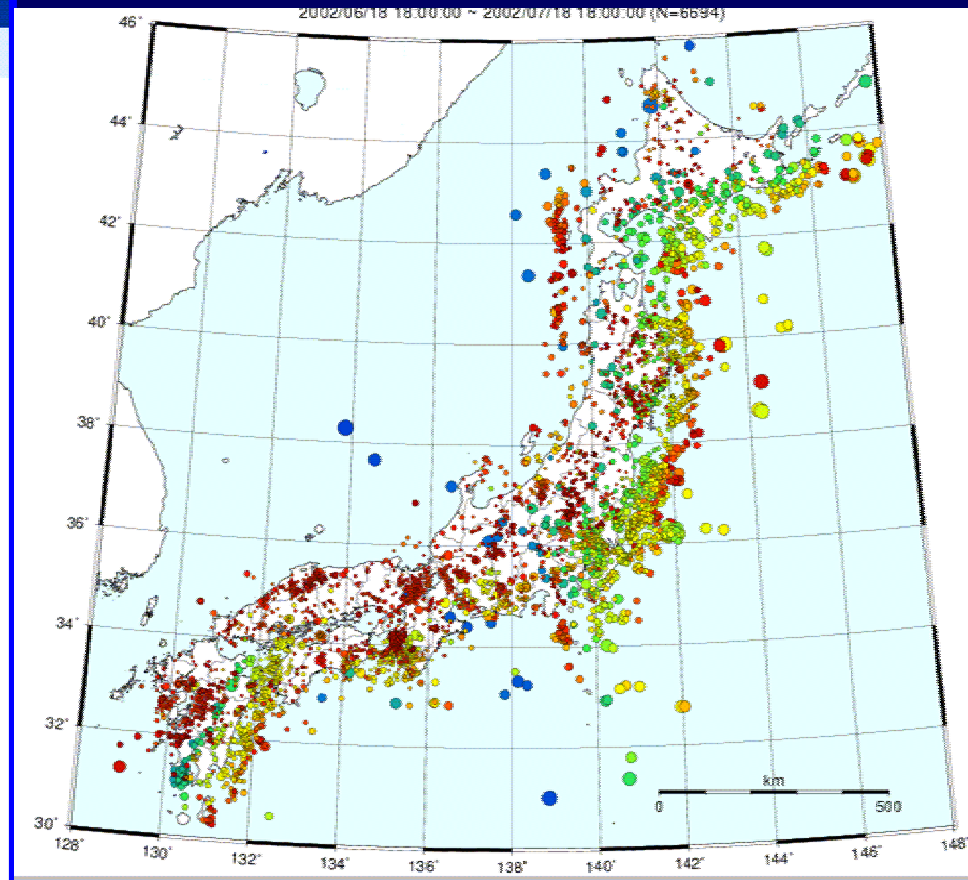
節面1 走向/斜角	189.0/34.4
節面2 走向/斜角	9.0/55.6
P軸方位/鉛直角	99.0/79.4
T軸方位/鉛直角	279.0/10.6

Hi-net最新情報

- トピックスにウラジオストク付近の地震を追加しました。 **21EWT**
- 気象庁一元化震源リスト・イベント波形データダウンロード一元化観測値ダウンロードのサービスを開始致しました。
- M3以上の震源情報・メカニズム解情報の公開を始めました。
- 大学・気象庁等の連続波形データ公開を始めました。

ユーザ登録

連続波形データダウンロード・イベント波形データダウンロードをご利用を希望される方は必ず **ユーザ登録** を行って下さい。



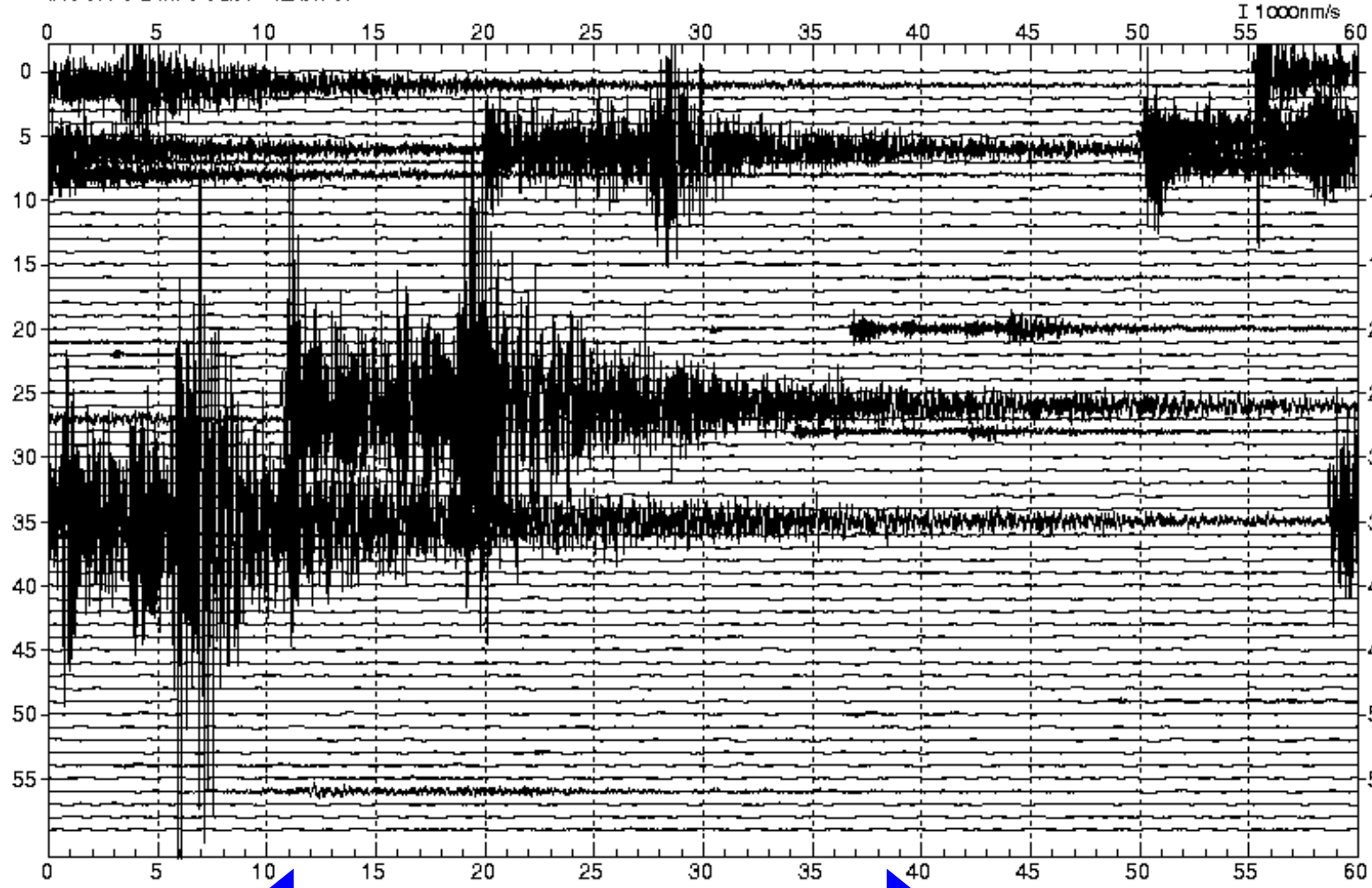
Continuous record of UD-component

- 検索機関
 - 検索観測網
 - 検索エリア
 - 検索時間
- 防:
Hi:
宮:
200



防災科学技術研究所：陸前高田

RZTH-U 2003/06/05 20h



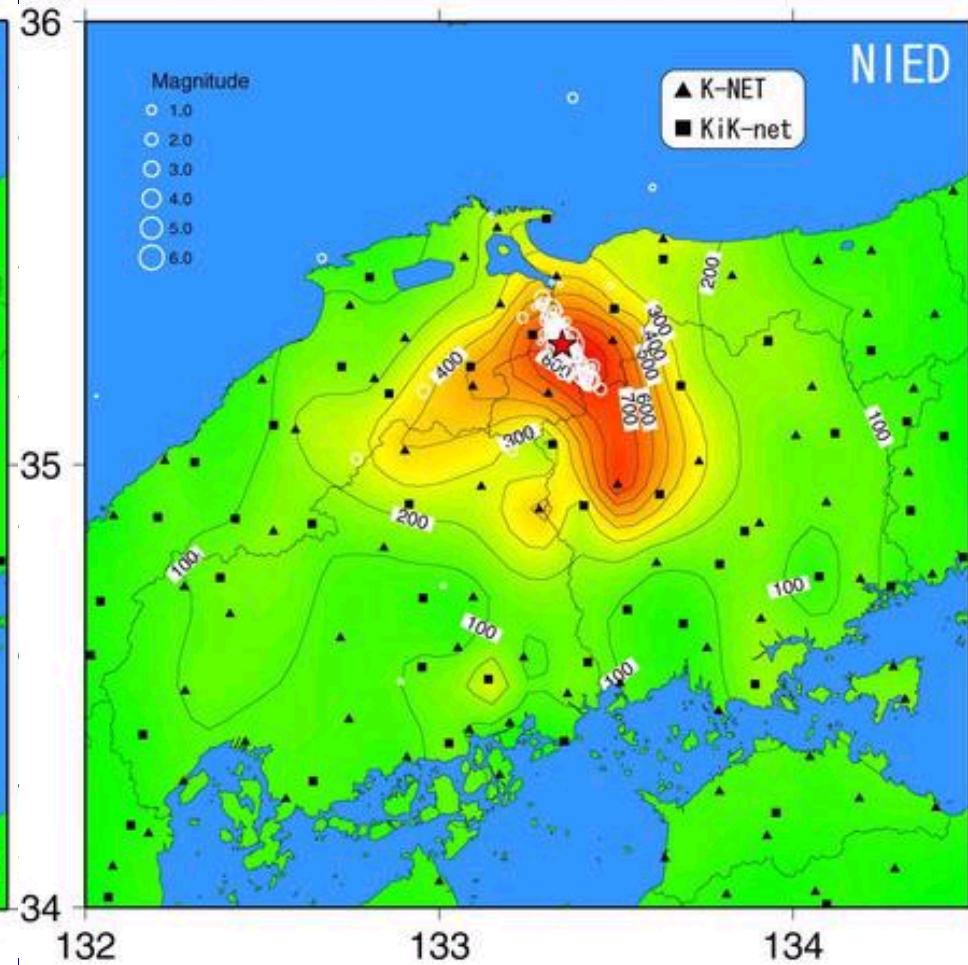
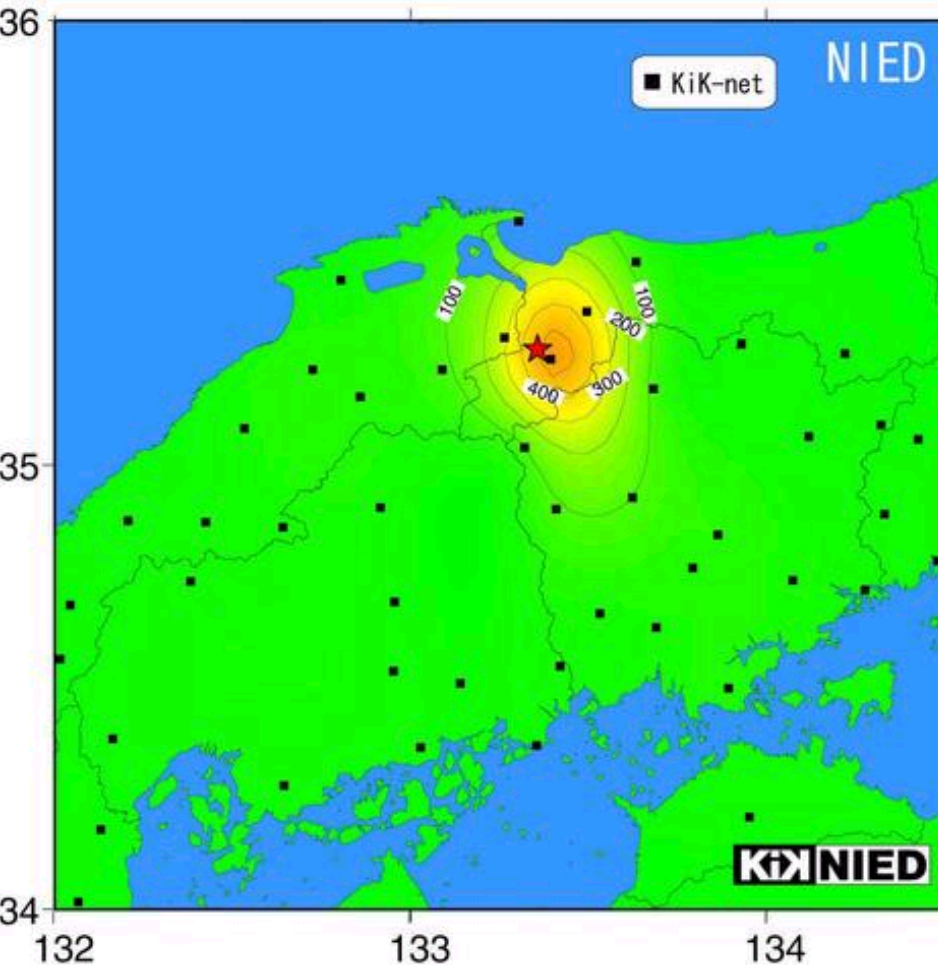
防災科学技術研究所 作成

KiK-net: Data service on web site

Western Tottori earthquake (M7.3) of Oct.6, 2000

At depth of 100-200m

Ground surface



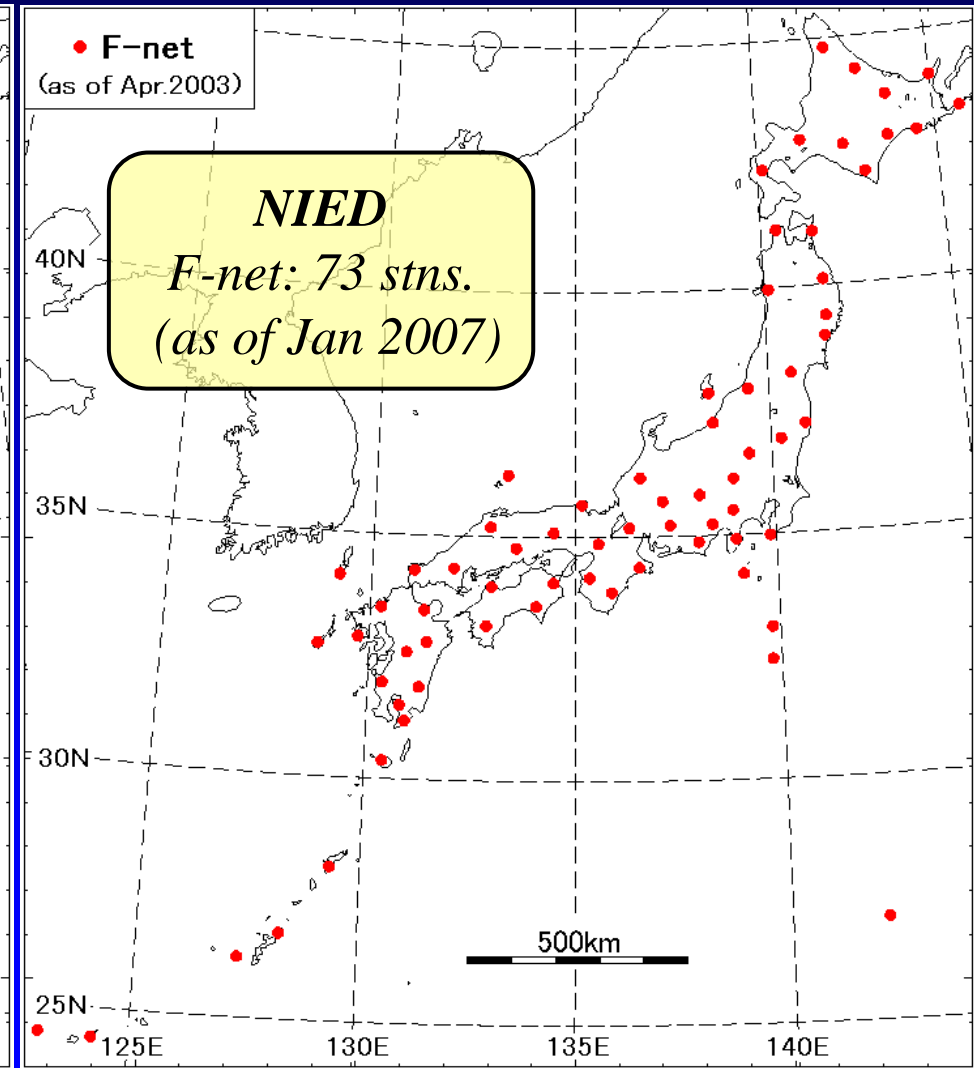
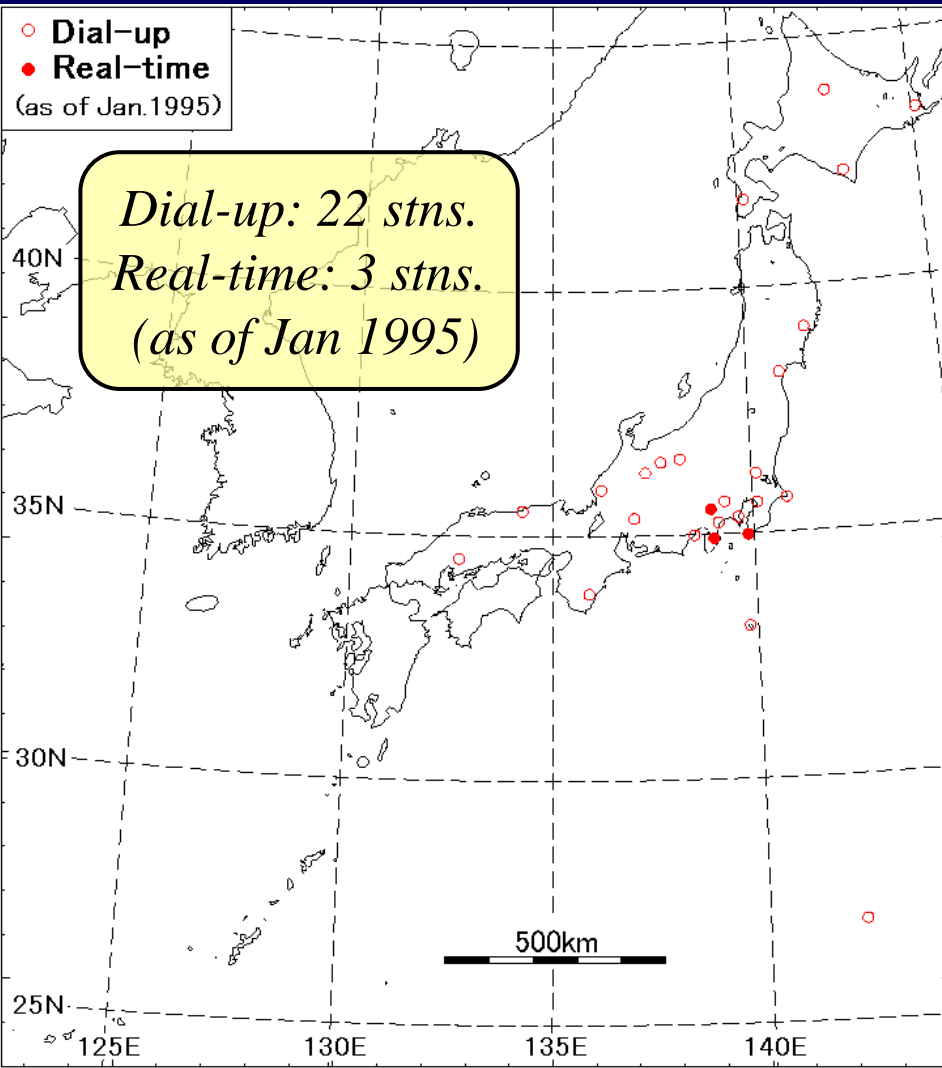
Broadband observation



Broadband seismograph network

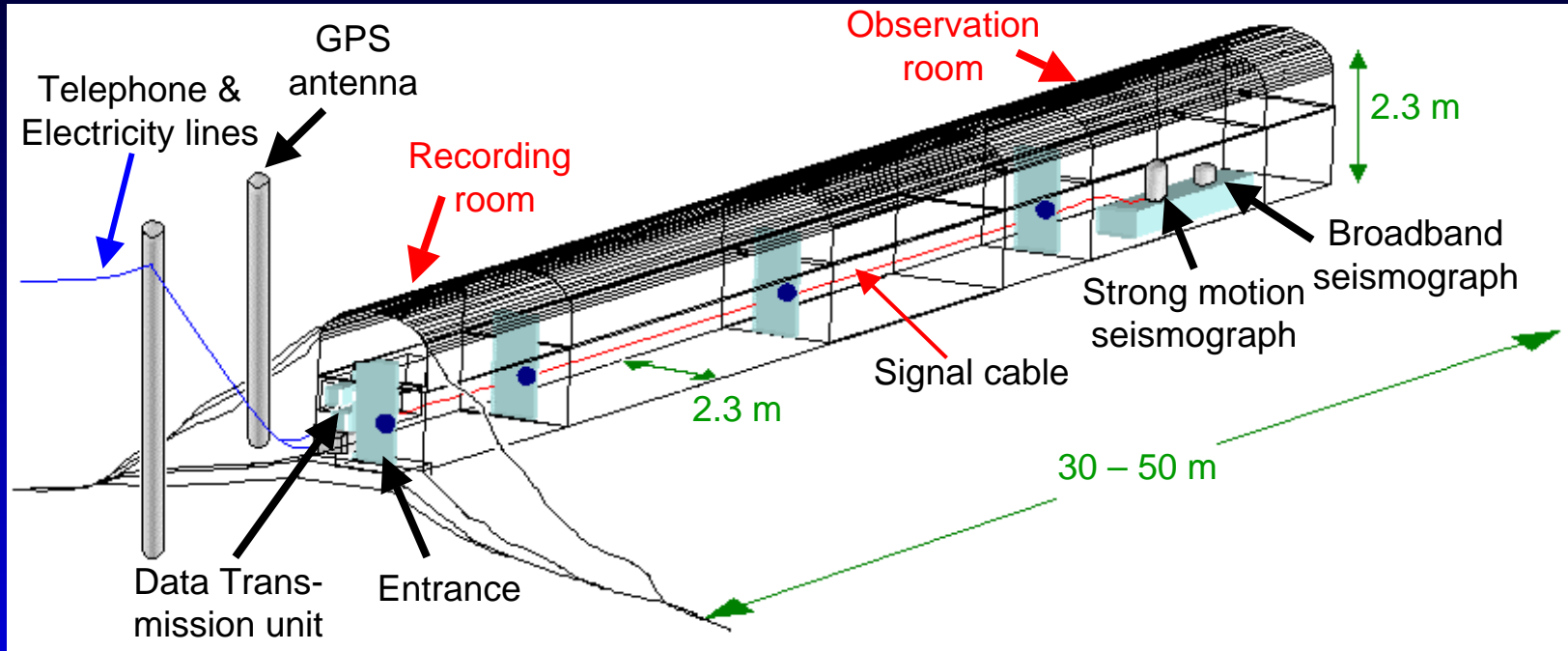
- before Kobe Eq. -

- after Kobe Eq. -



F-net station (Full-range seismograph network)

100km spacing, 100 stations are planned



F-NET: Data service on web site

F-net
Broadband Seismograph Network

What's New

* 2002/07/12 ... F-net home page address will be changed in July 29.

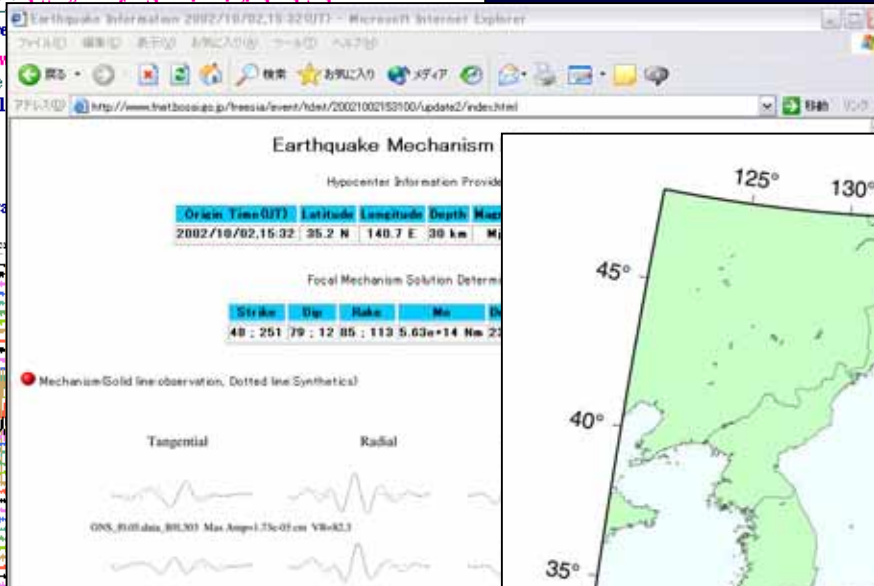
New URL
Click here

* 2002/06/24 ... Sensors were changed from June 2002.
See detail

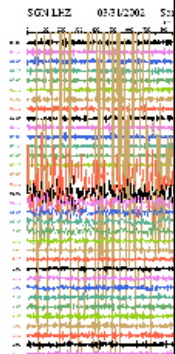
Japanese Version

CMT solution

CMT map



Mar. 31, 2002, Taiwan



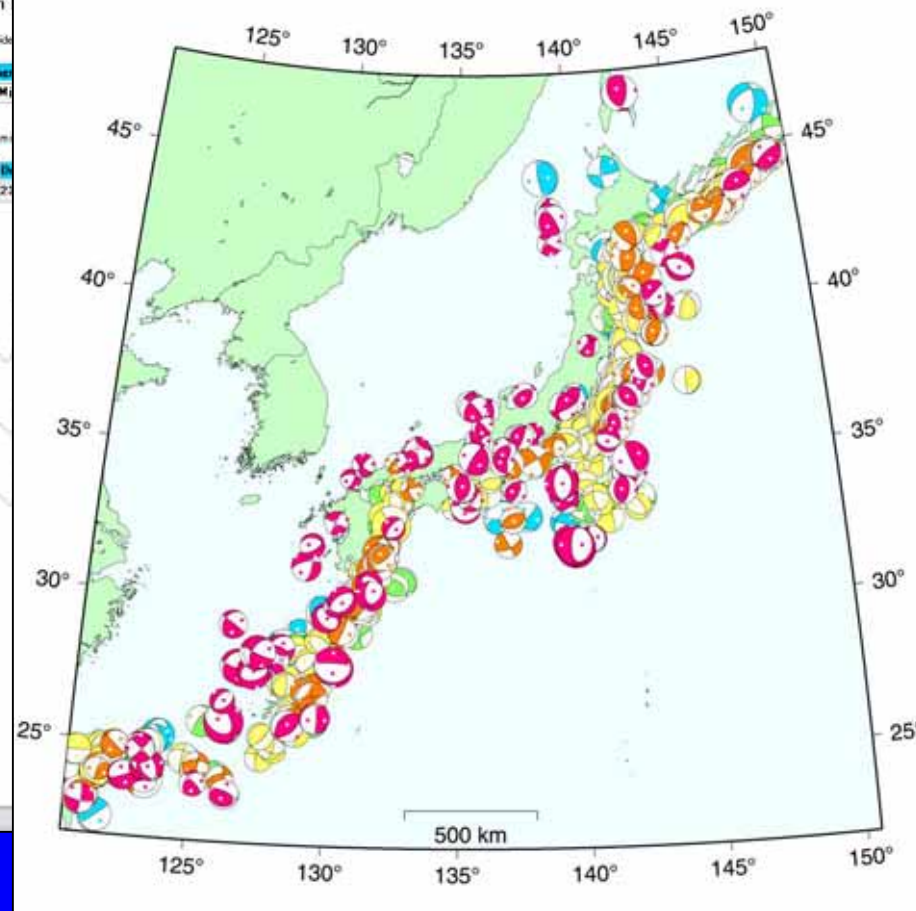
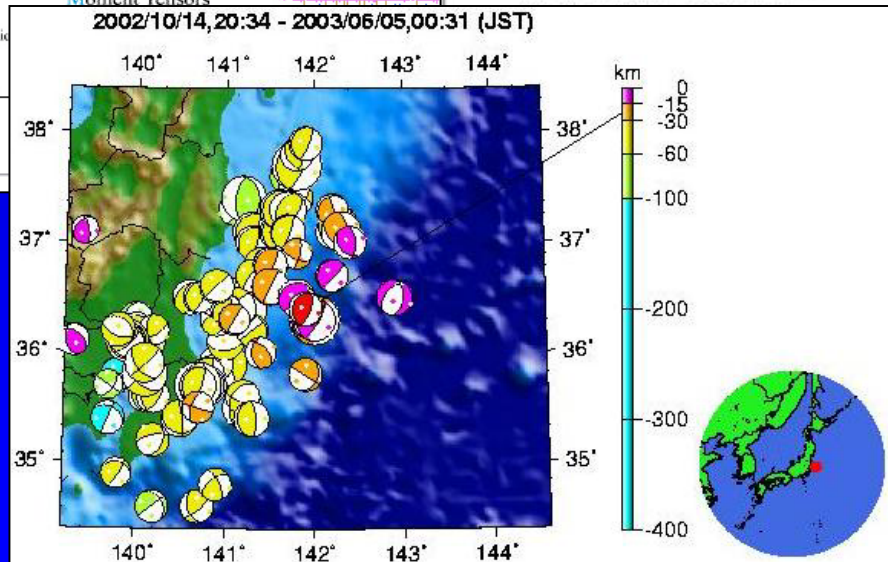
What is F-net

Station Information

Station Map

Preview of Waveforms

Moment Tensors



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2. Recent significant result : Slow earthquakes

2-1. Shallow very low frequency earthquake

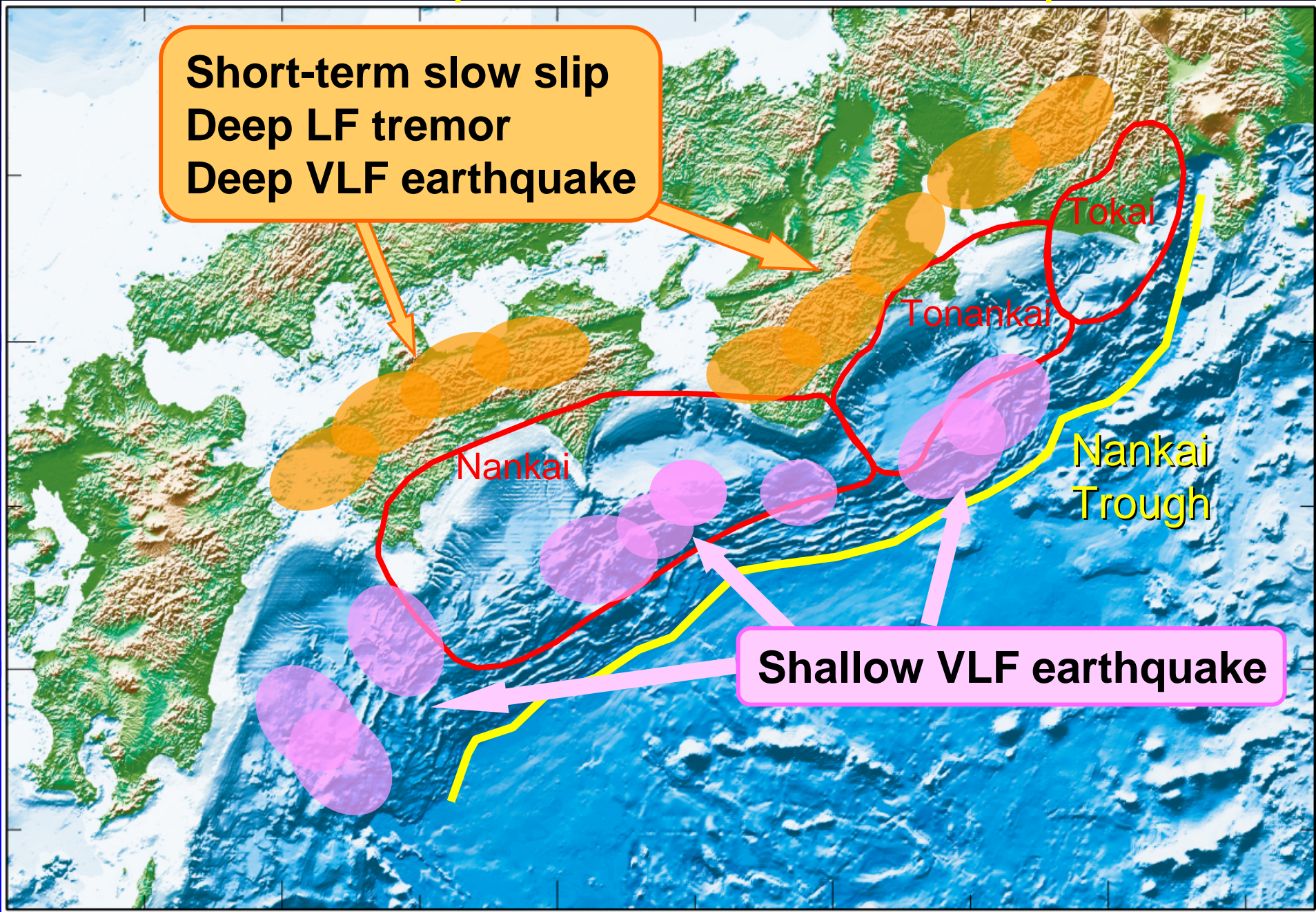
2-2. Nonvolcanic deep low-frequency tremor

2-3. Short-term slow slip event

Slow earthquakes in southwest Japan

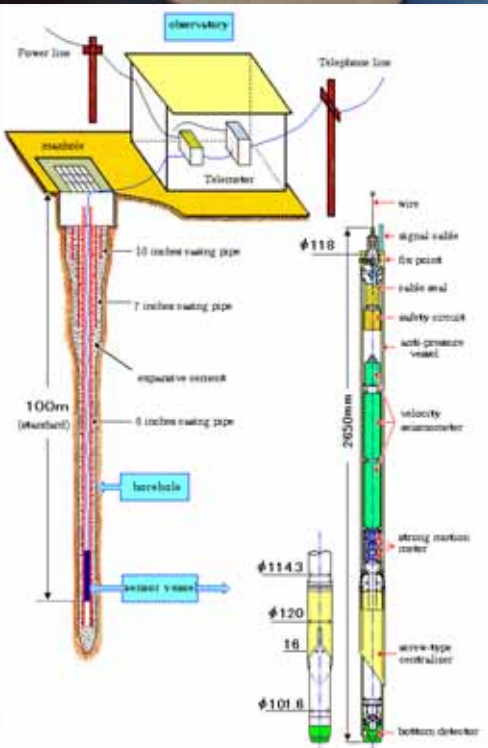
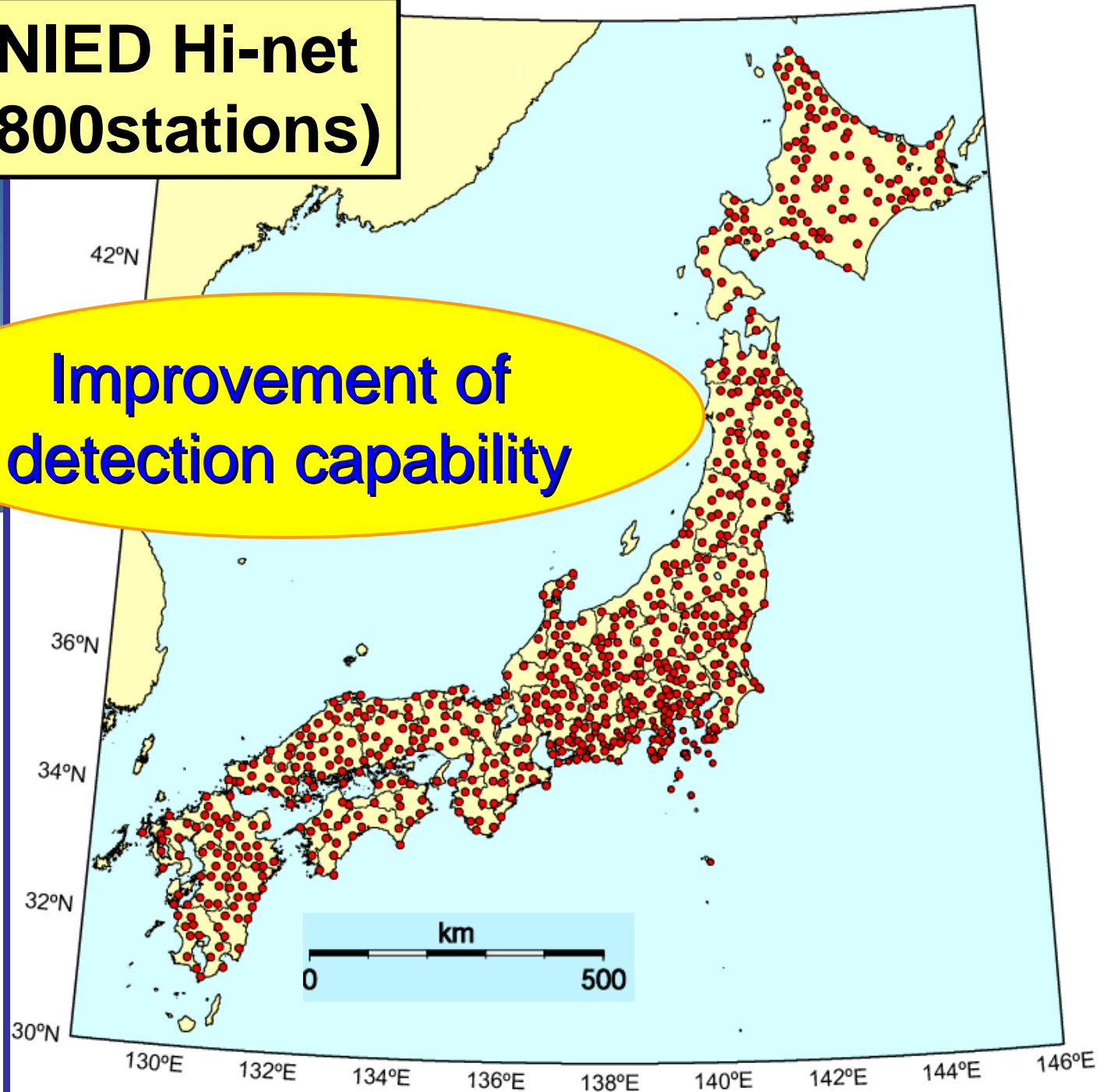
Short-term slow slip
Deep LF tremor
Deep VLF earthquake

Shallow VLF earthquake

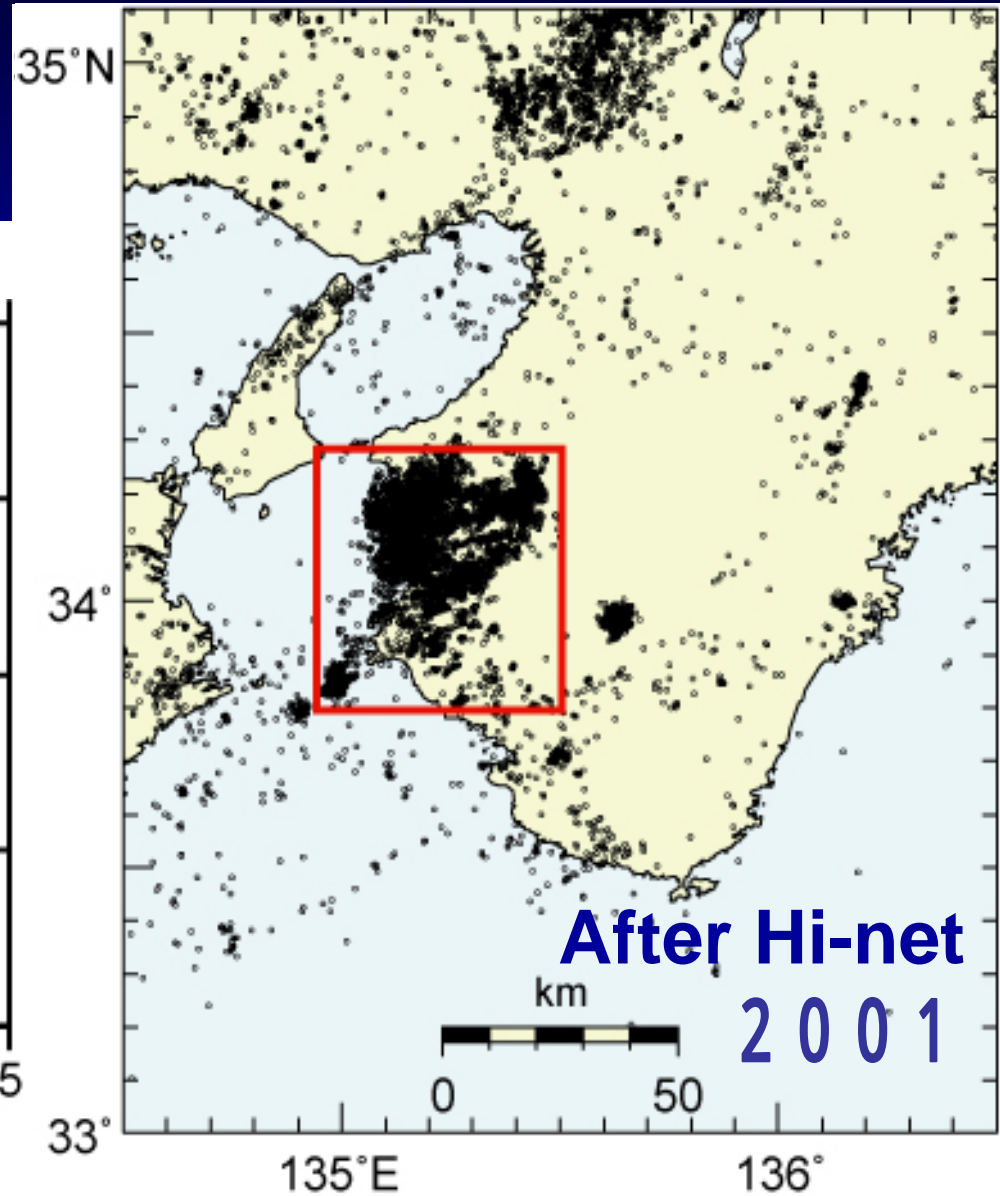
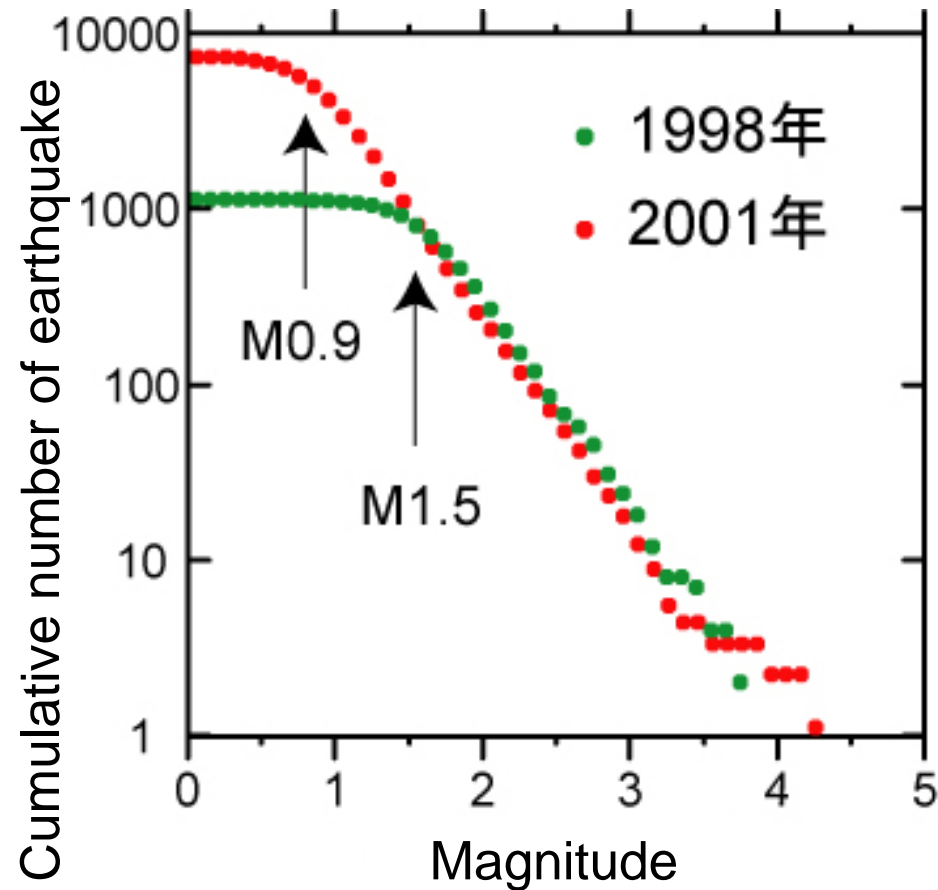


NIED Hi-net (800stations)

Improvement of detection capability



Improvement of microearthquake detection capability



NIED Hi-net (800stations)

High-quality dense
seismic network

Tremor

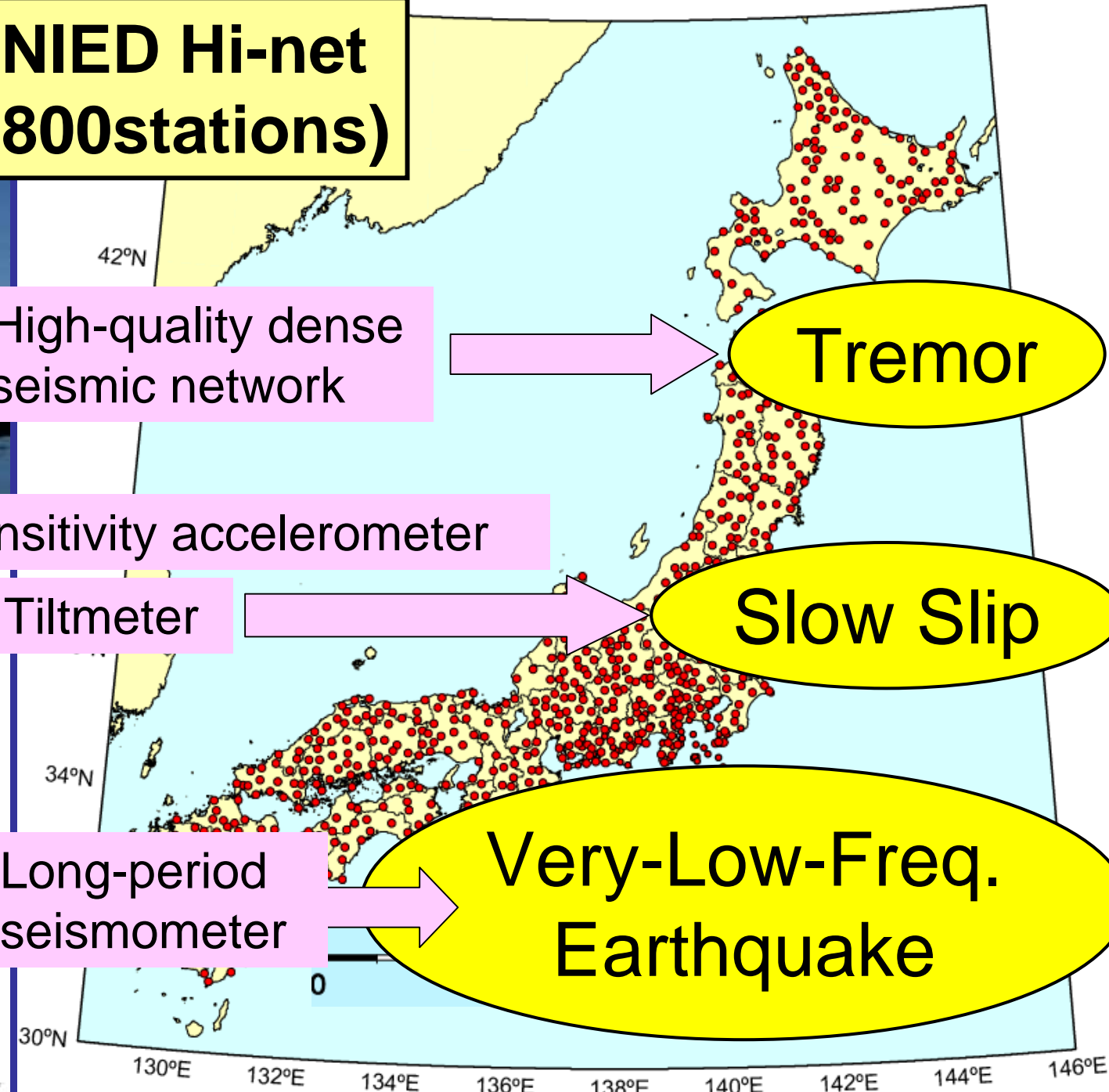
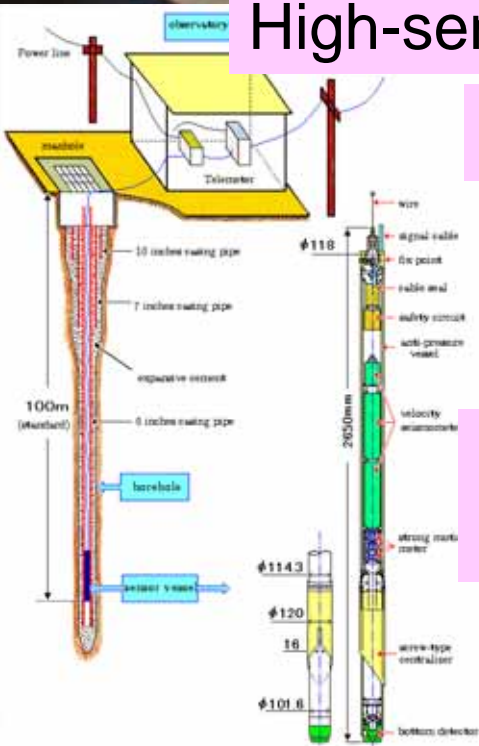
High-sensitivity accelerometer

Tiltmeter

Slow Slip

Long-period
seismometer

Very-Low-Freq.
Earthquake



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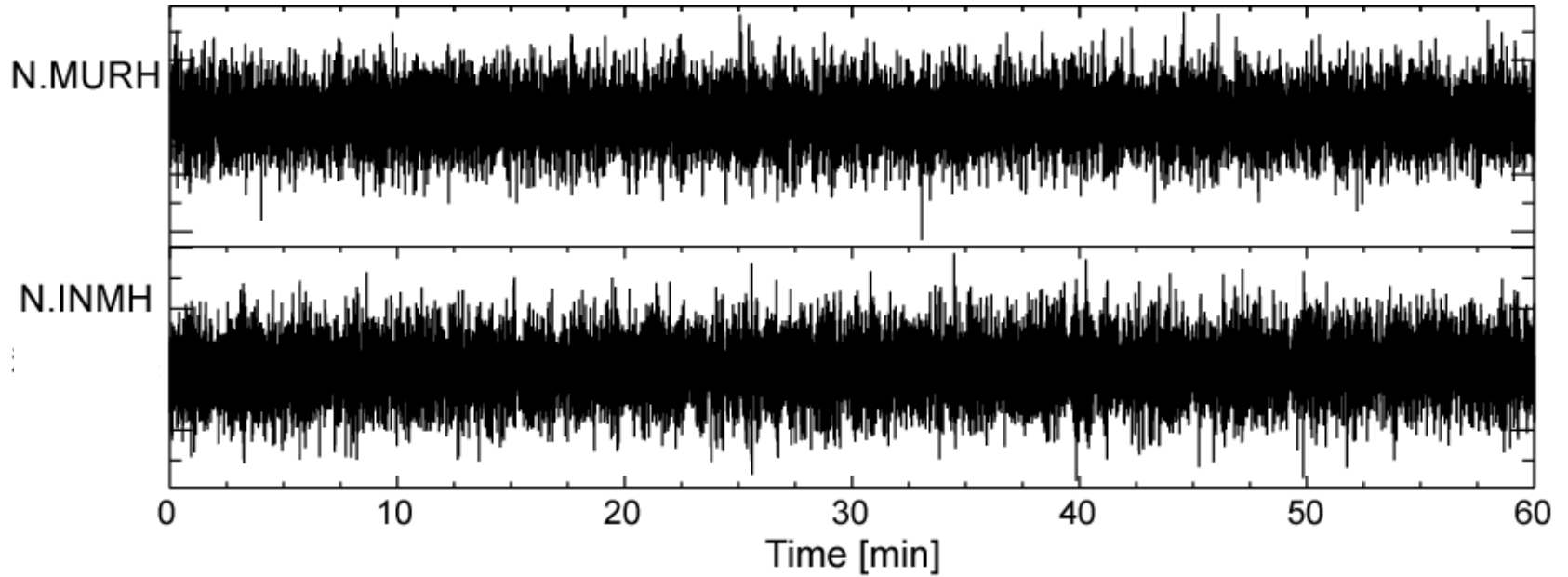
2. Recent significant result : Slow earthquakes

2-1. Shallow very low frequency earthquake

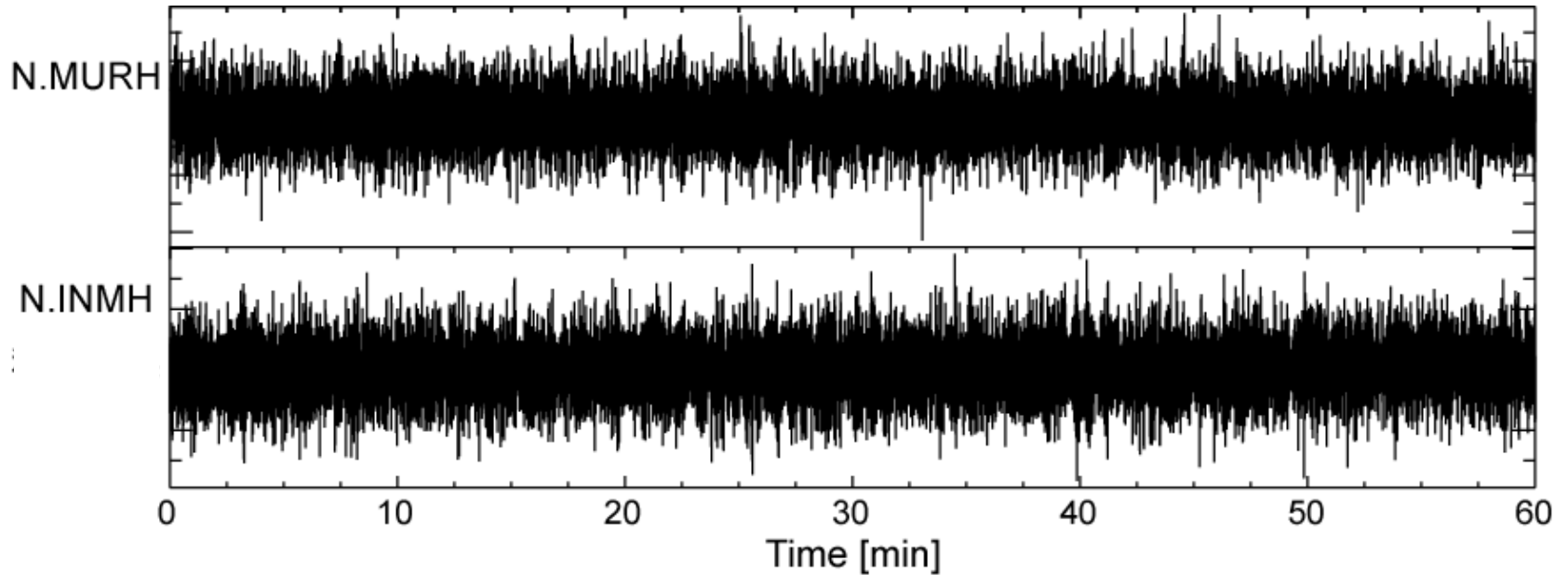
2-2. Nonvolcanic deep low-frequency tremor

2-3. Short-term slow slip event

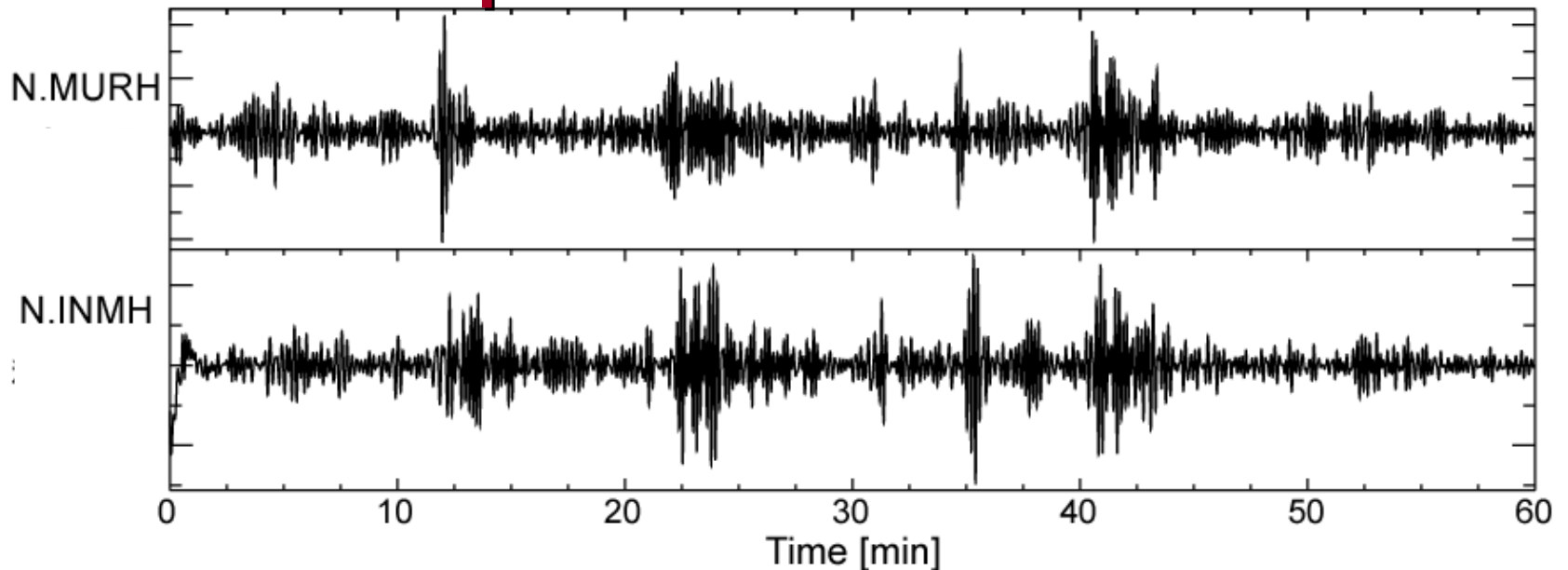
1 hour broadband seismograms (2003/7/6 03h)



1 hour broadband seismograms (2003/7/6 03h)

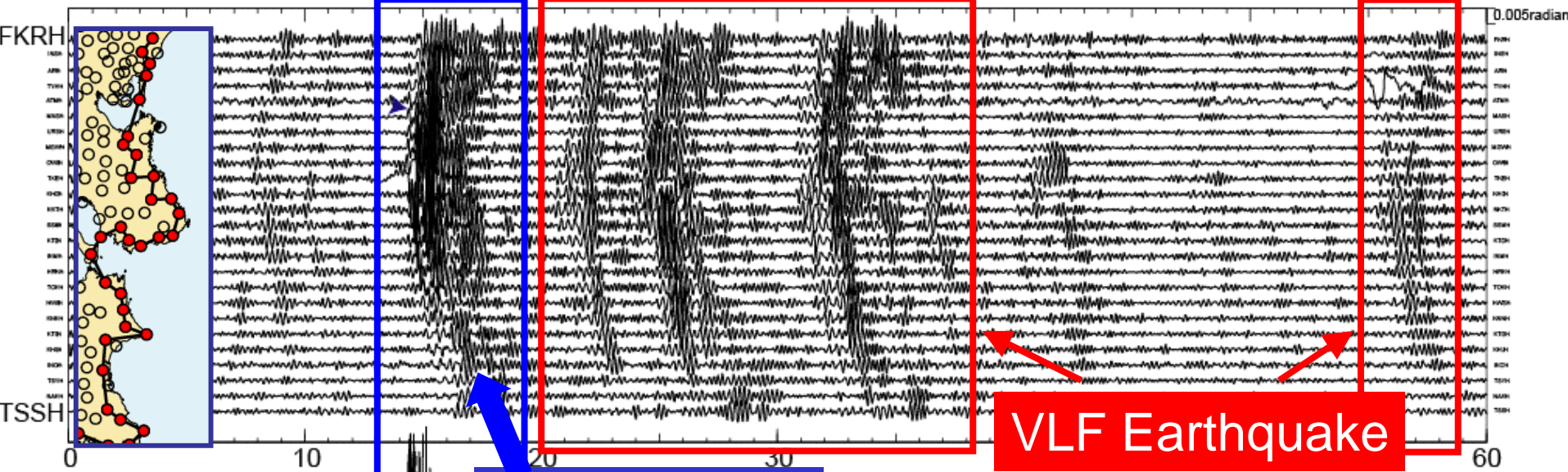


10-100s Band-pass filtered traces

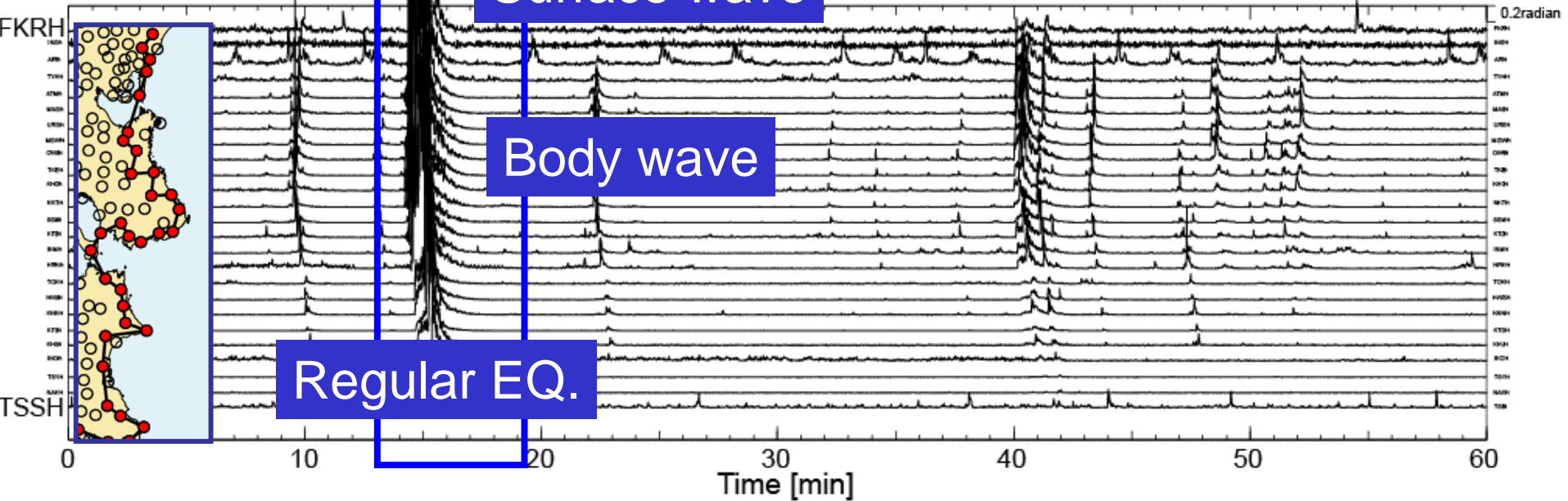


VLF and regular earthquake after the M7 major event

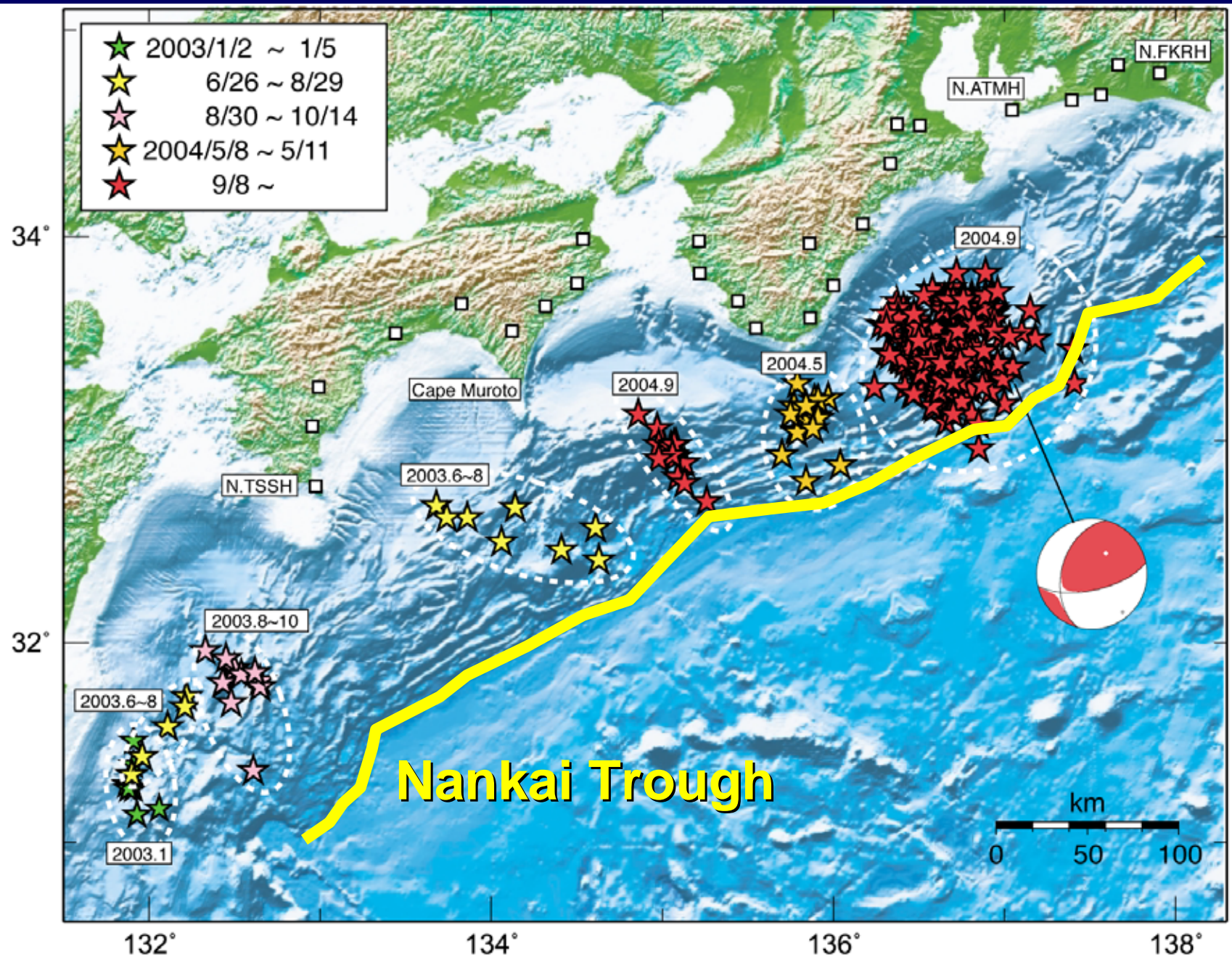
BPF:10-100s NS 2004/09/10 18h



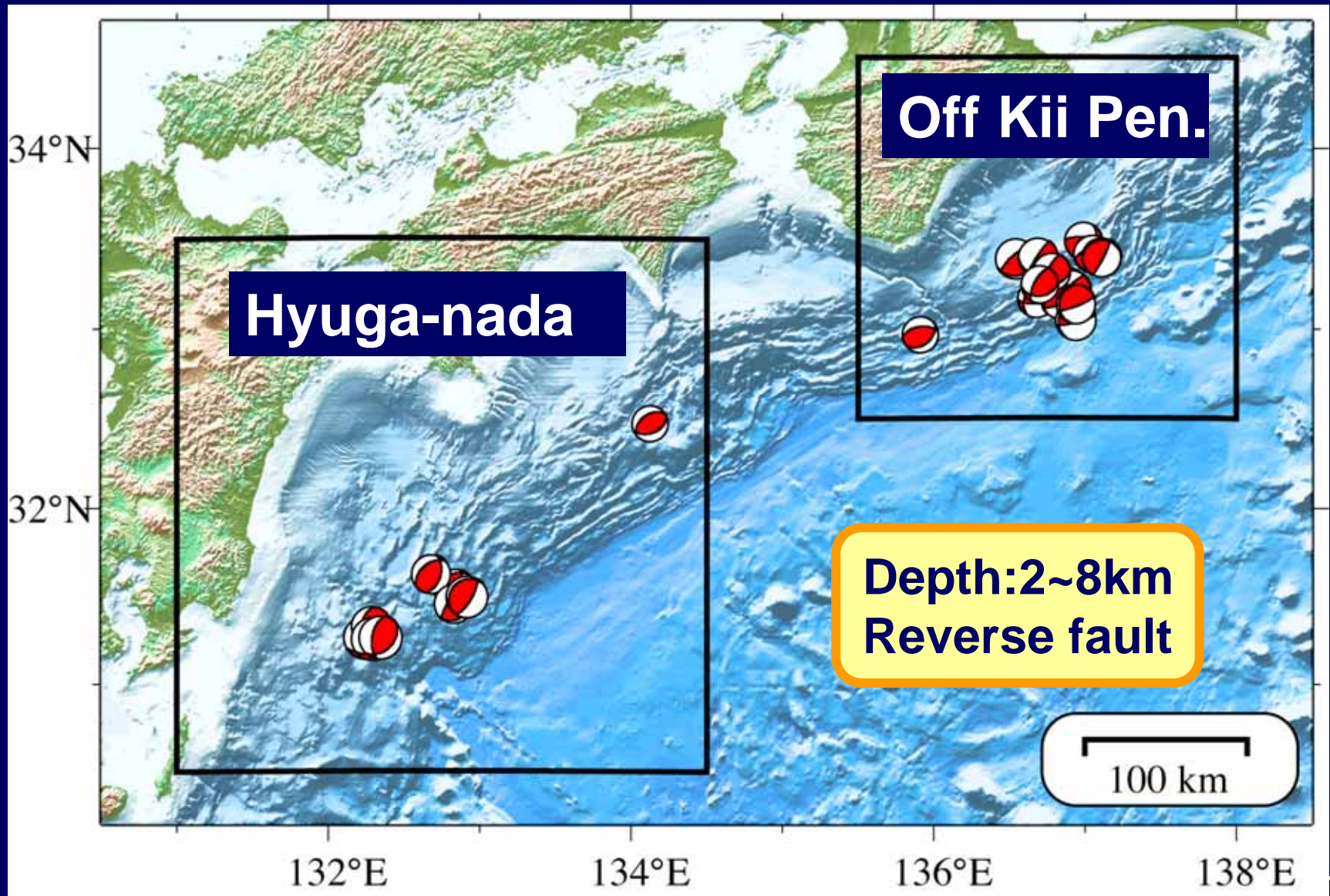
HPF:2Hz NS



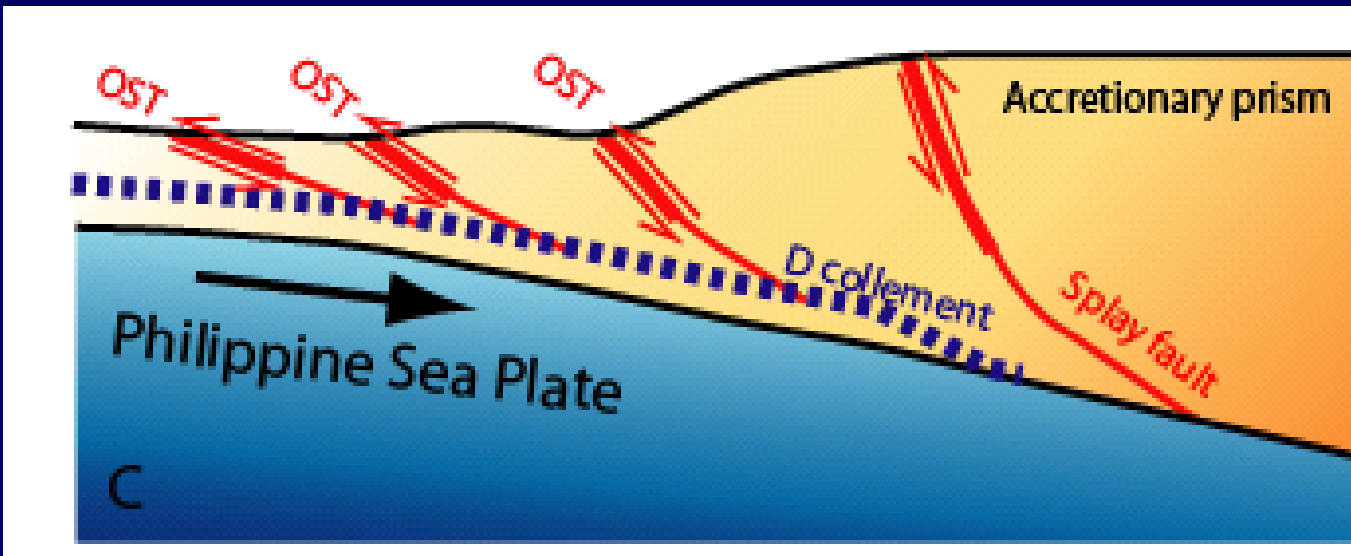
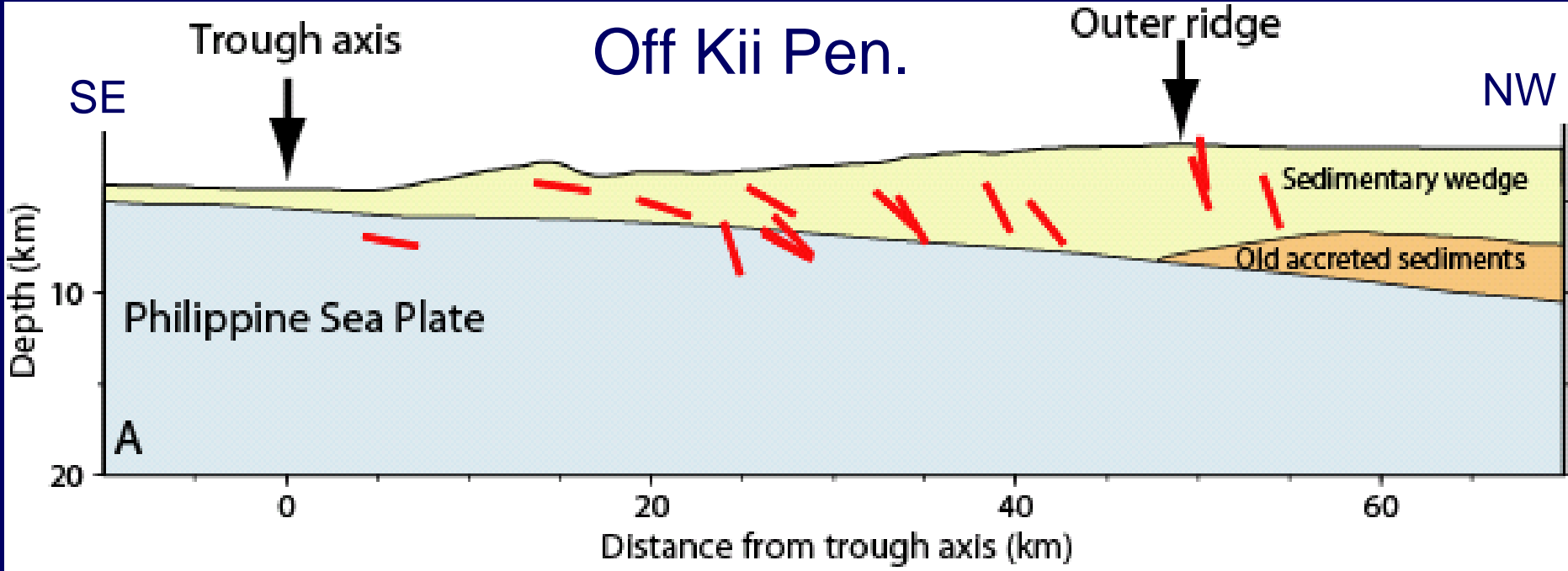
Epicentral distribution of VLF (2003-2004)



CMT solution of VLF earthquakes



Cross section of fault plane of VLF earthquake



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1-4. Hi-net (KiK-net): High sensitivity seismograph network with two sets of strong motion seismometer

1-5. F-net: Broadband seismograph network

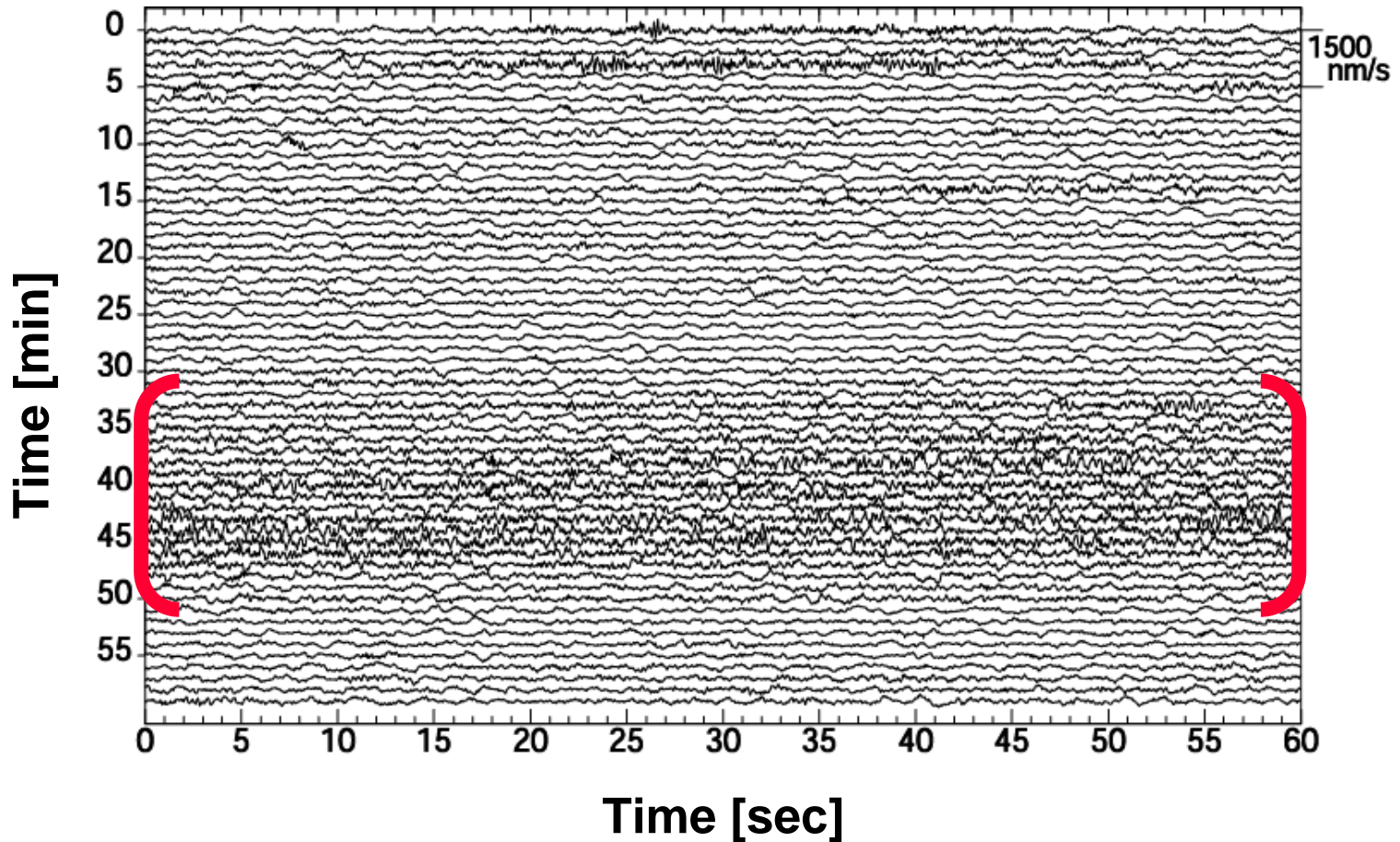
2. Recent significant result : Slow earthquakes

2-1. Shallow very low frequency earthquake

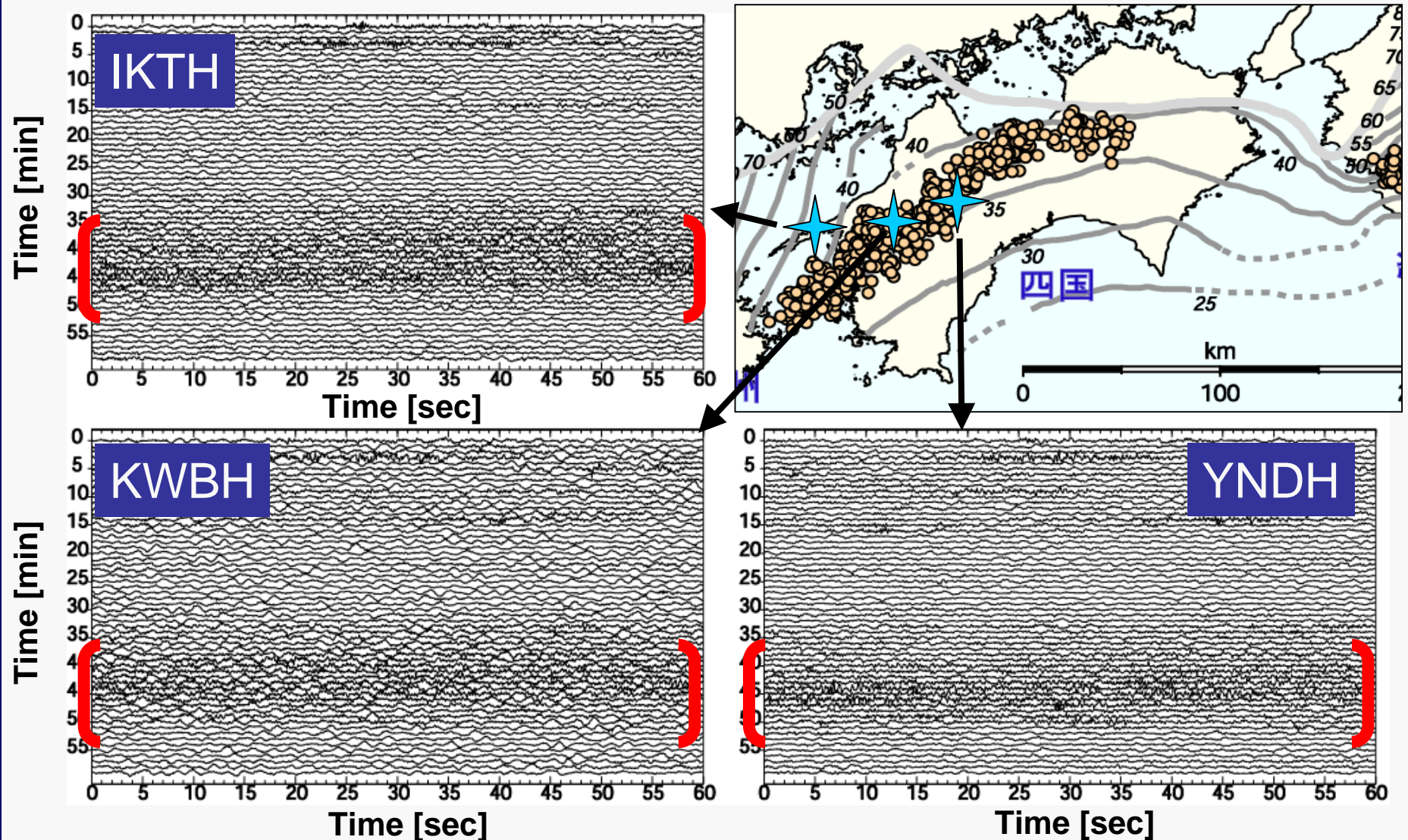
2-2. Nonvolcanic deep low-frequency tremor

2-3. Short-term slow slip event

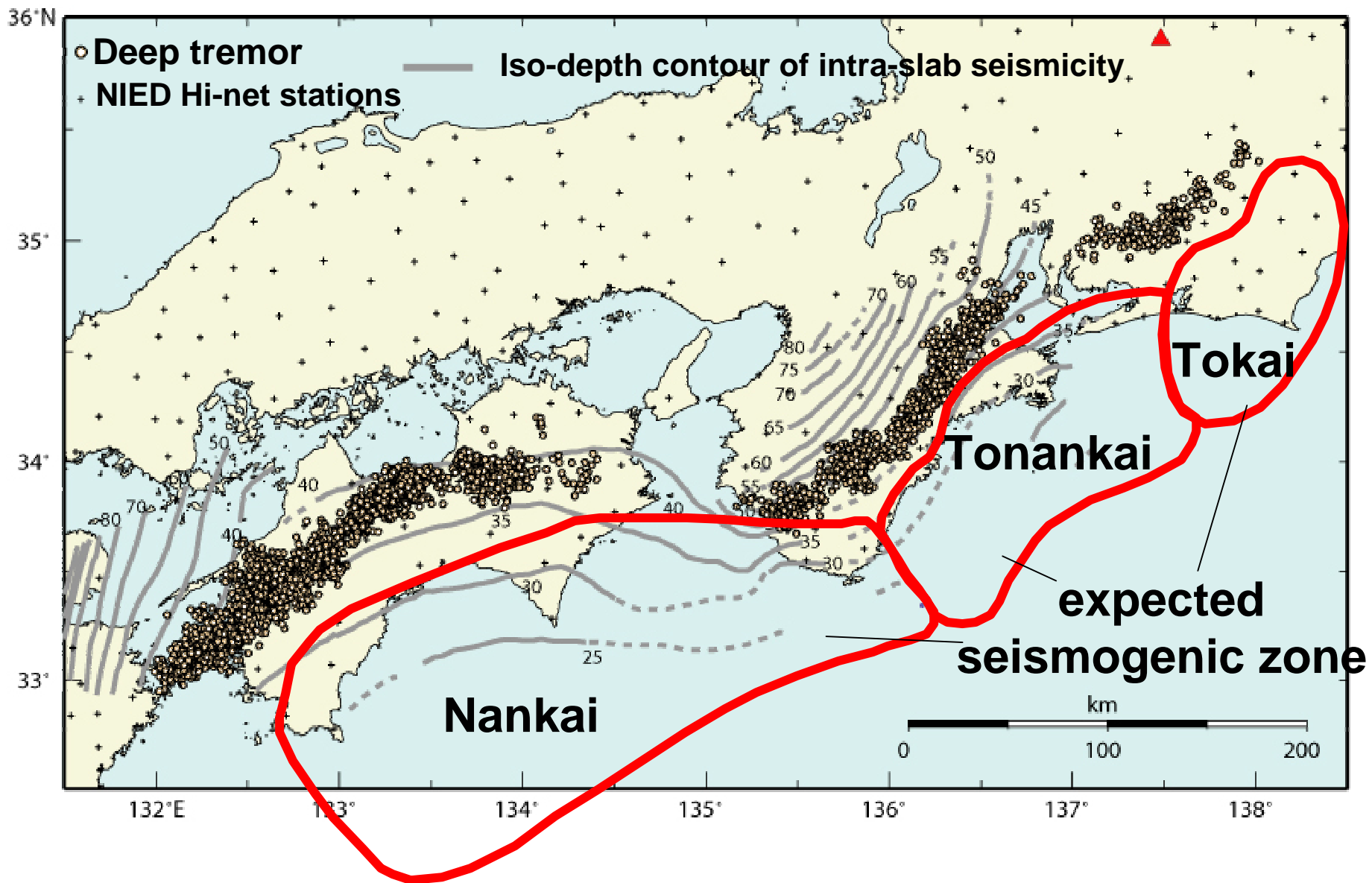
1 hour continuous seismograms observed at station IKTH in the western part of Shikoku (4 am, 17 August 2001)



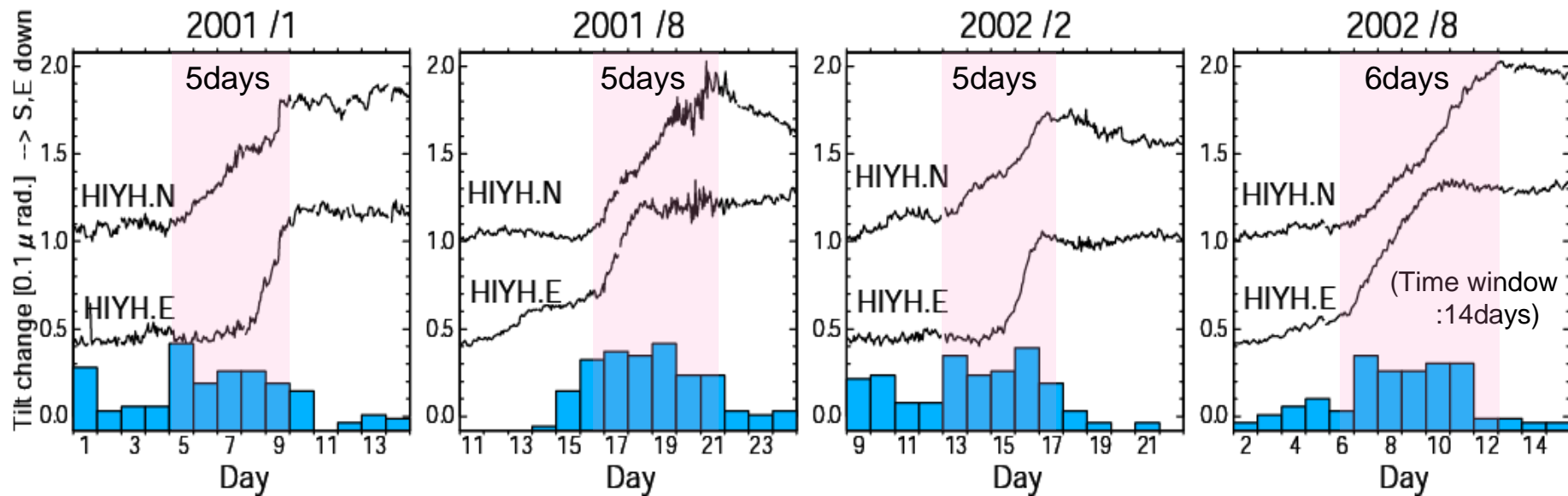
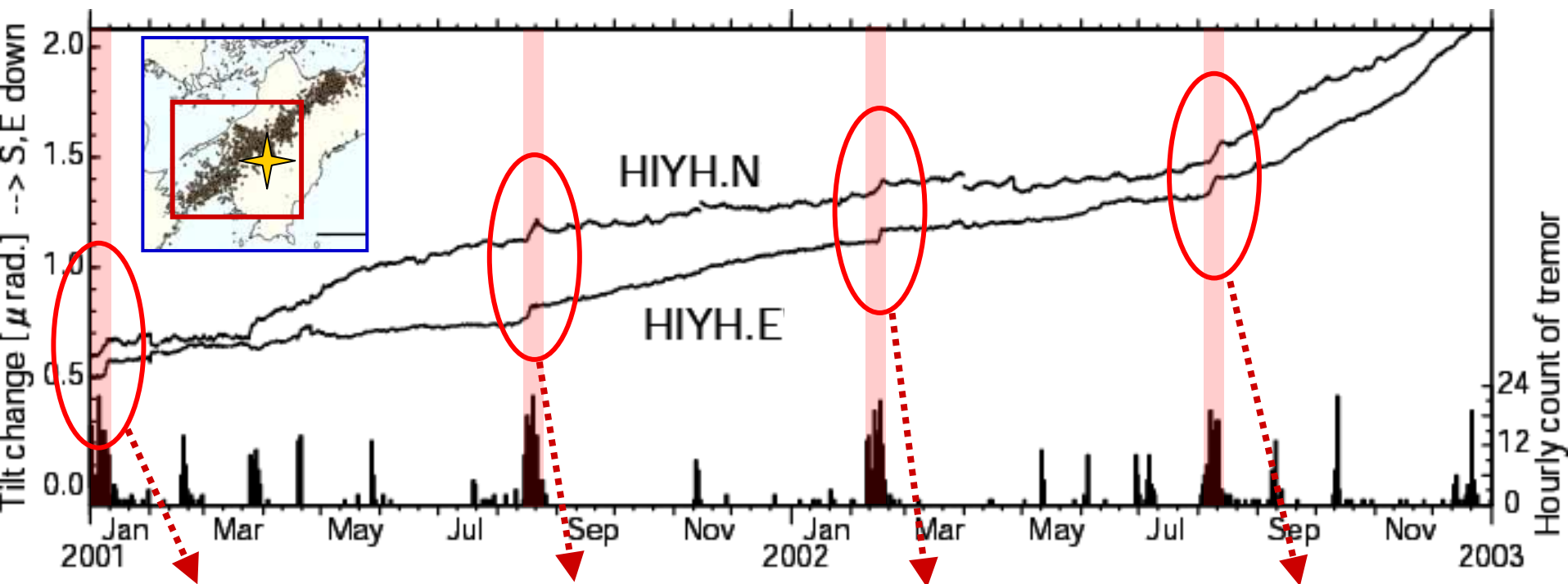
1 hour continuous seismograms observed at 3 stations in the western part of Shikoku (4 am, 17 August 2001)



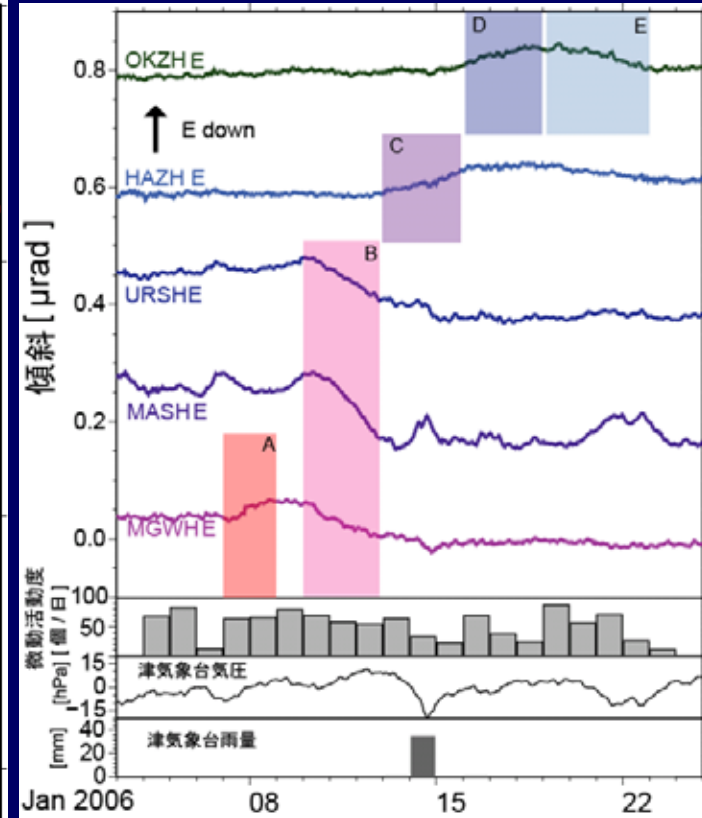
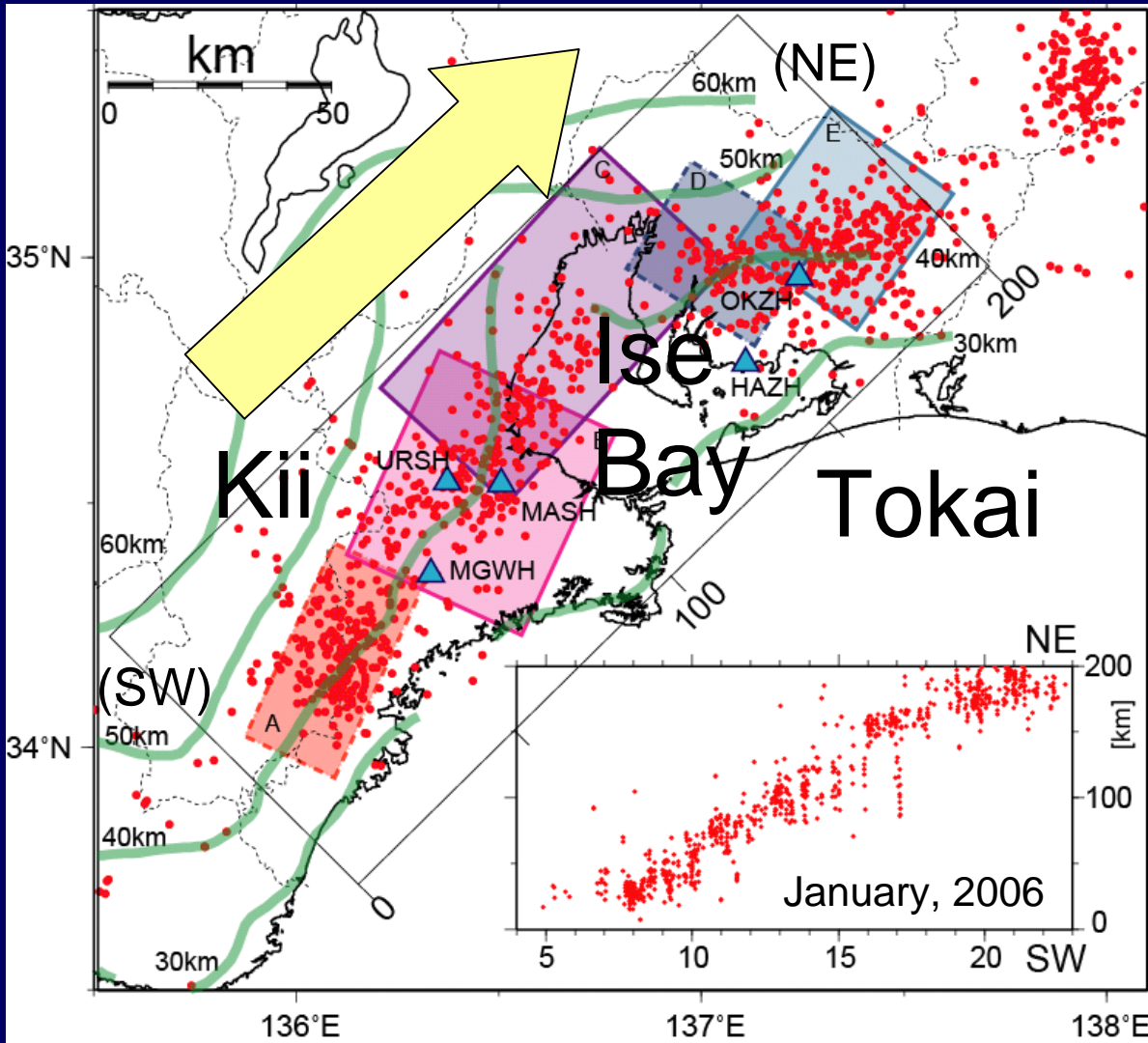
Epicentral distribution of tremor



Tremor and Tilt change in the western part of Shikoku



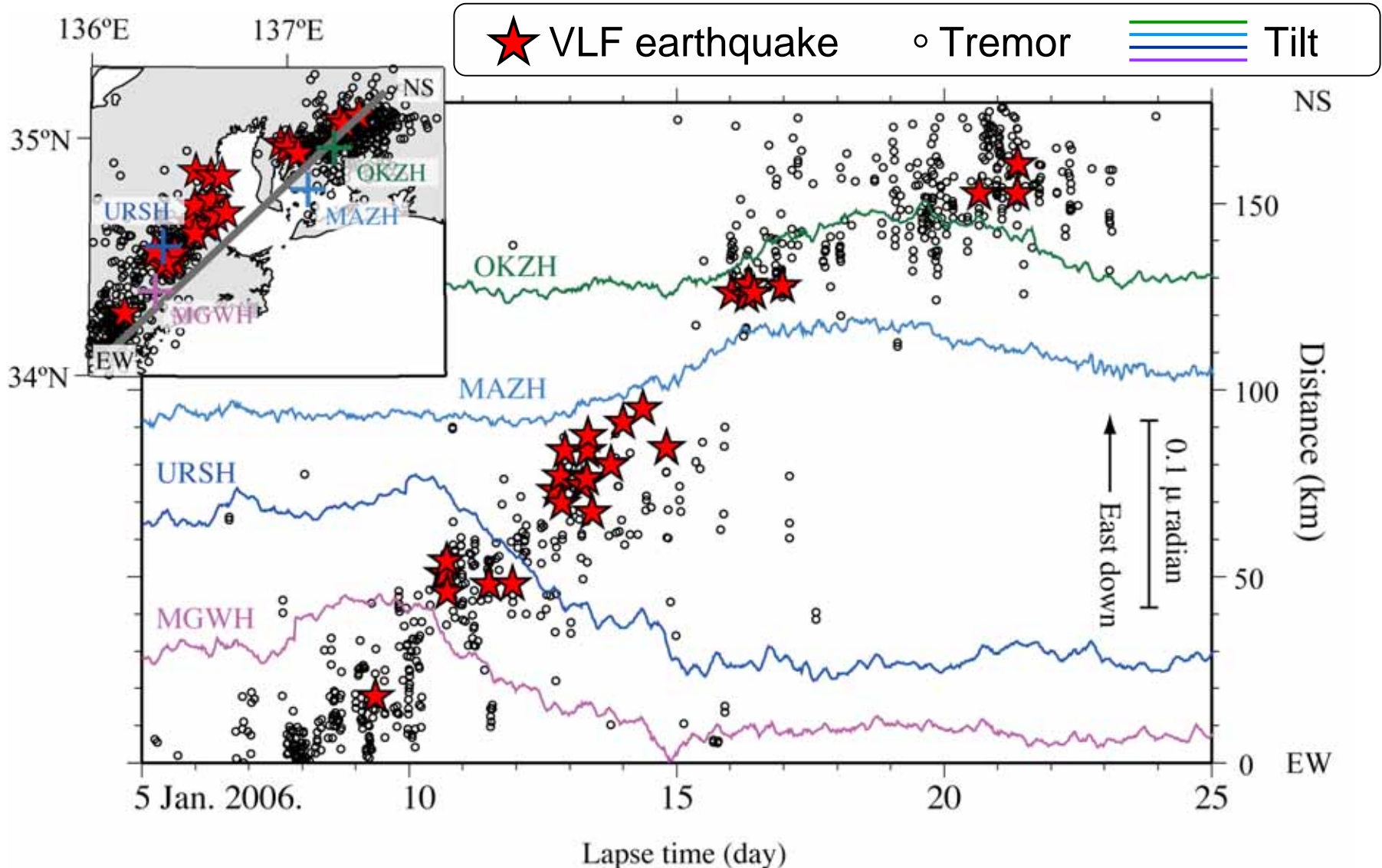
Migrating tremor and slow-slip event in Tokai and Kii area, January 2006



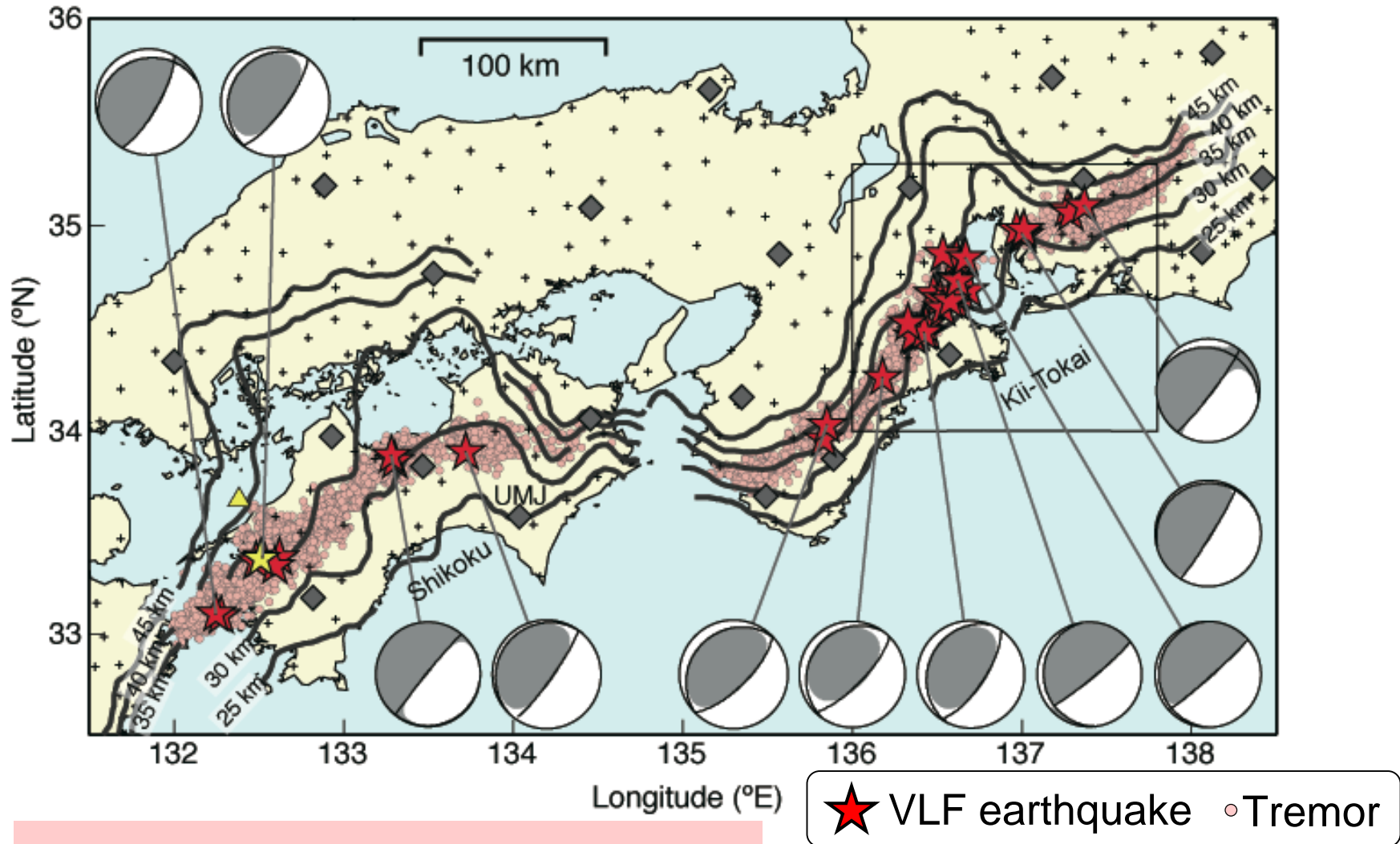
Vel.=10km/day

Total Mw ~ 6.2

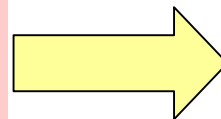
Deep VLF earthquakes with tremor and slip of episode 2006 in Tokai and Kii area



CMT solution of VLF earthquakes in 2006



Focal mechanism = Thrust type
Focal depth = 30~40km

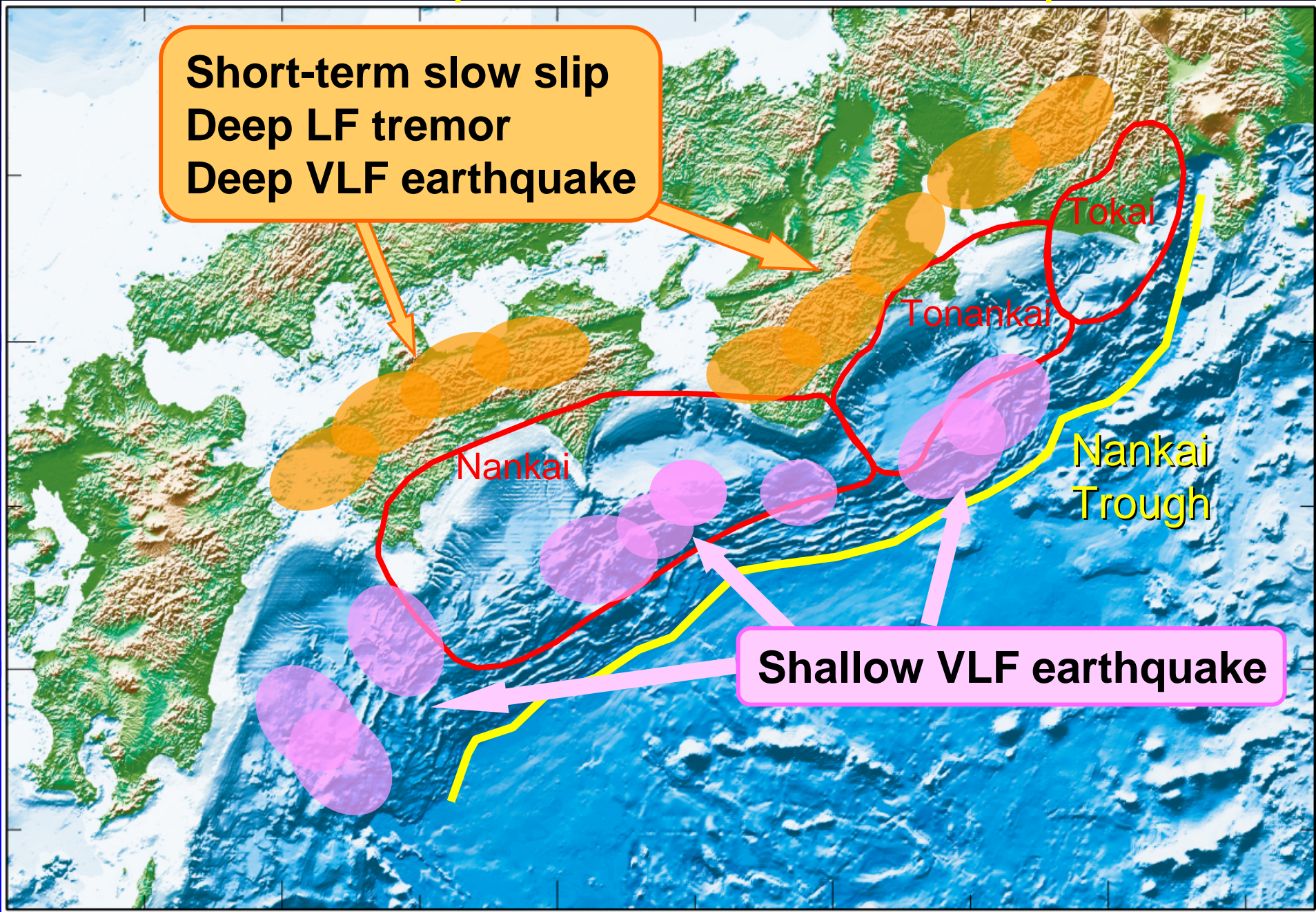


Slab surface

Slow earthquakes in southwest Japan

Short-term slow slip
Deep LF tremor
Deep VLF earthquake

Shallow VLF earthquake



Slow Earthquake Families in Nankai Zone

Shallow Very Low Frequency Earthquake

Seismic slip in accretionary prism

Short-term Slow Slip Event

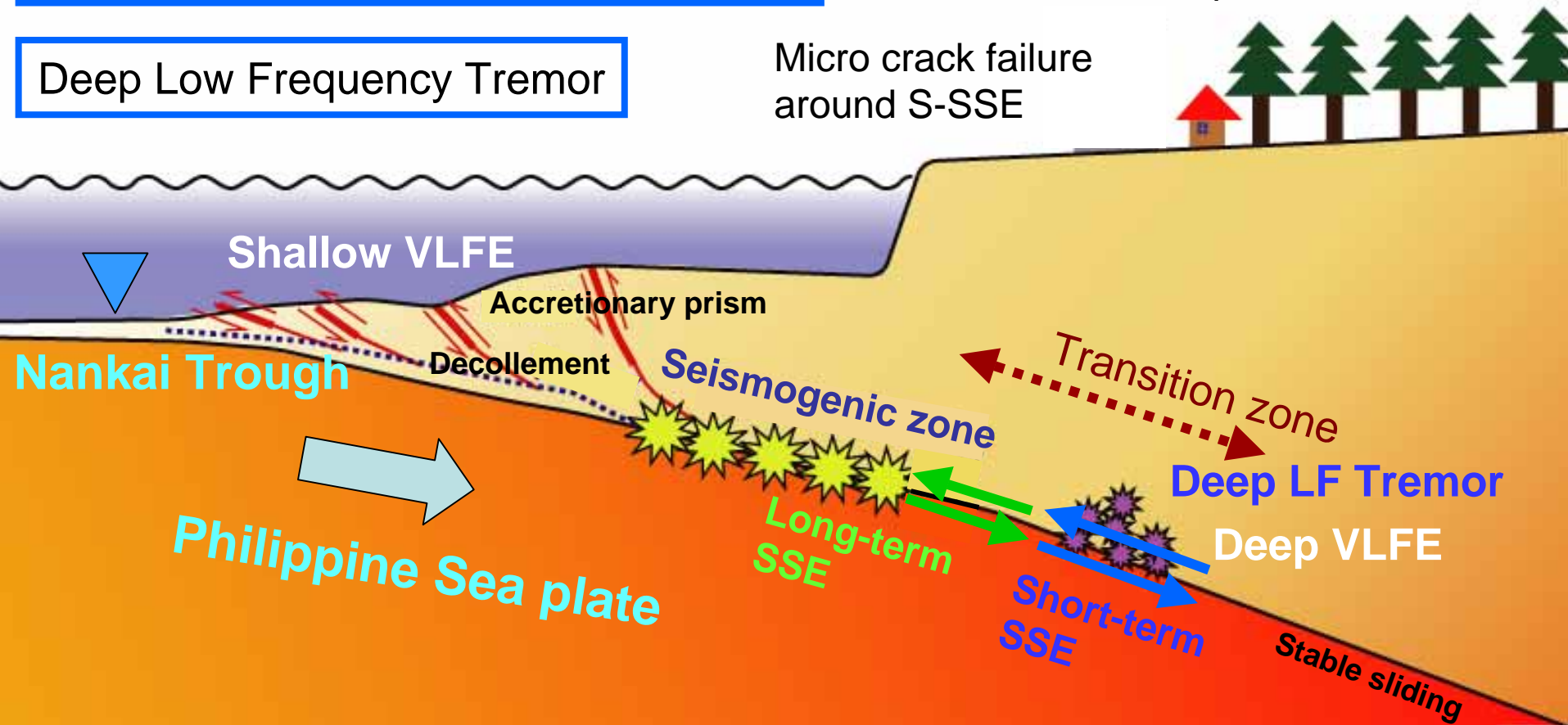
Aseismic stick-slip on the plate boundary

Deep Very Low Frequency Earthquake

Seismic slip of small patch on S-SSE fault plane

Deep Low Frequency Tremor

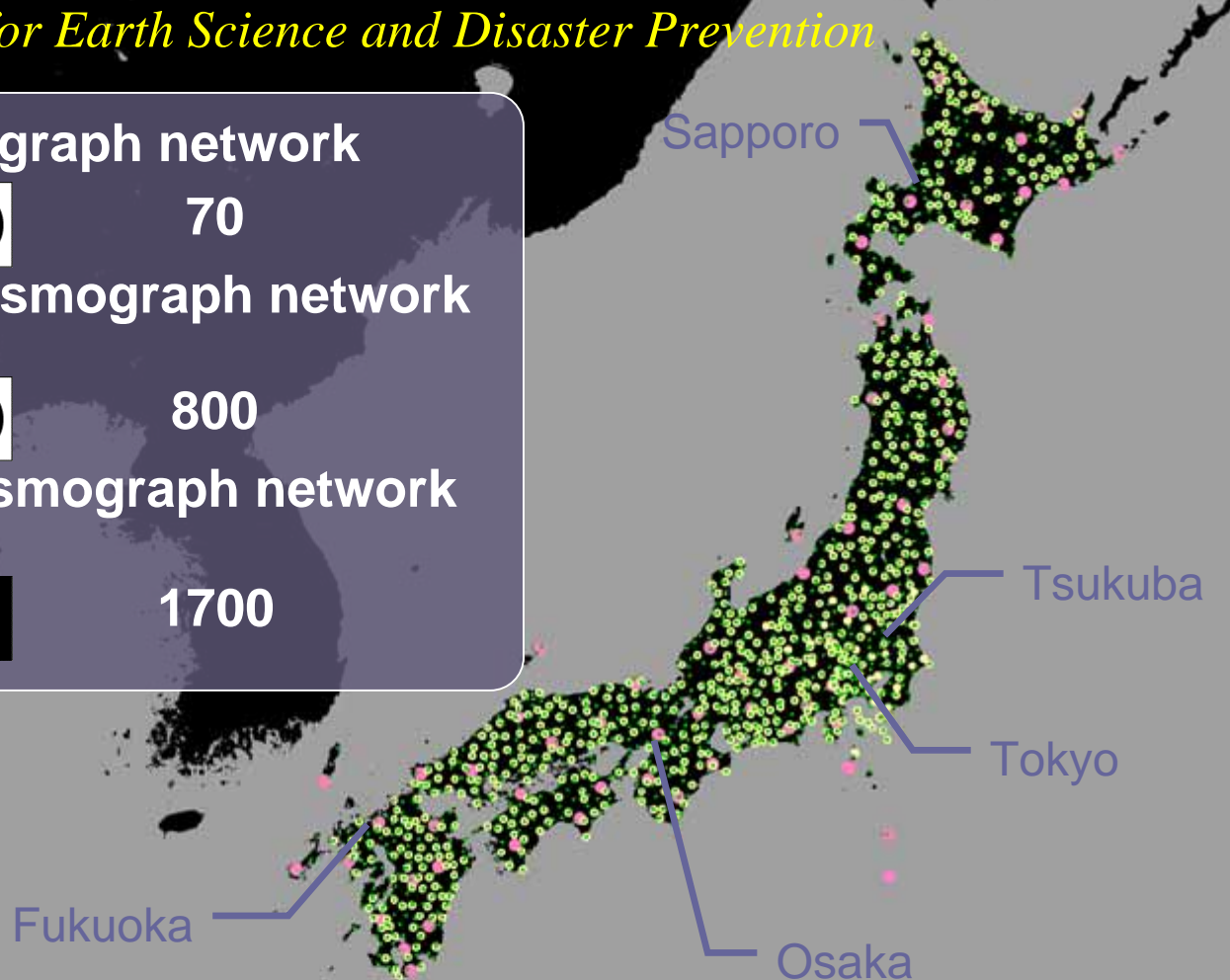
Micro crack failure around S-SSE



● Broadband seismograph network
F-net NIED 70

● High sensitivity seismograph network
Hi-net NIED 800

● Strong motion seismograph network
K-NET NIED Japan KIX 1700



END