# Brief Observation of an Extreme Rare Event

## Great East Japan Earthquake and Tsunami

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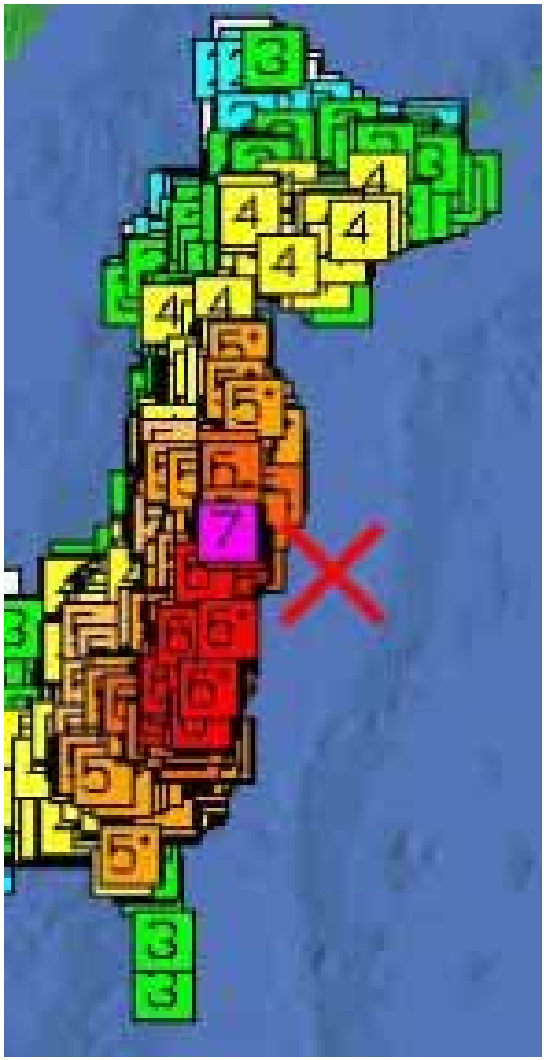
# Features of the disaster

- Hazard scale that highly exceeds preliminary prediction / an extreme event
- Vastness of disaster-hit area
- Compound disaster (co-occurrence of earthquake, tsunami, nuclear power plant incident)

A question is posed:

**How should we face such risk?**

# Outline of the Disaster



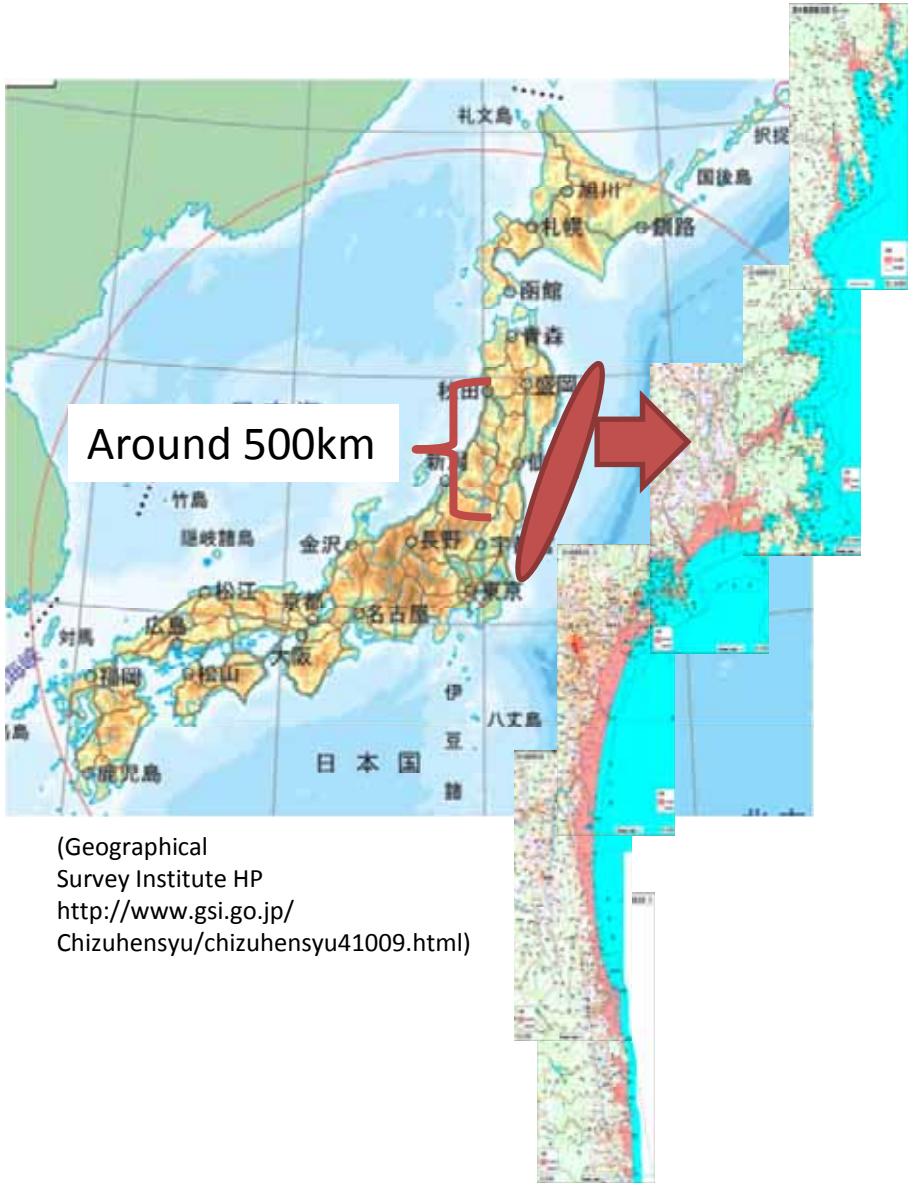
・Great East Japan Earthquake

Time: March 11, 2011
2:46 p.m.
Magnitude: 9.0(Estimated)
Depth: 24km
Japanese seismic intensity scale (Largest): 7

(MLIT HP in Japanese
http://www.mlit.go.jp/common/000139083.pdf)

(The Japan Meteorological Agency HP in Japanese
http://www.seisvol.kishou.go.jp/eq/shindo_db/db_map/201103/11/
A20110311144618120026038062100560142516600870237429590J84D5117002064_map.html)

# Outline of the Disaster




(Geographical
Survey Institute HP
http://www.gsi.go.jp/
Chizuhensyu/chizuhensyu41009.html)

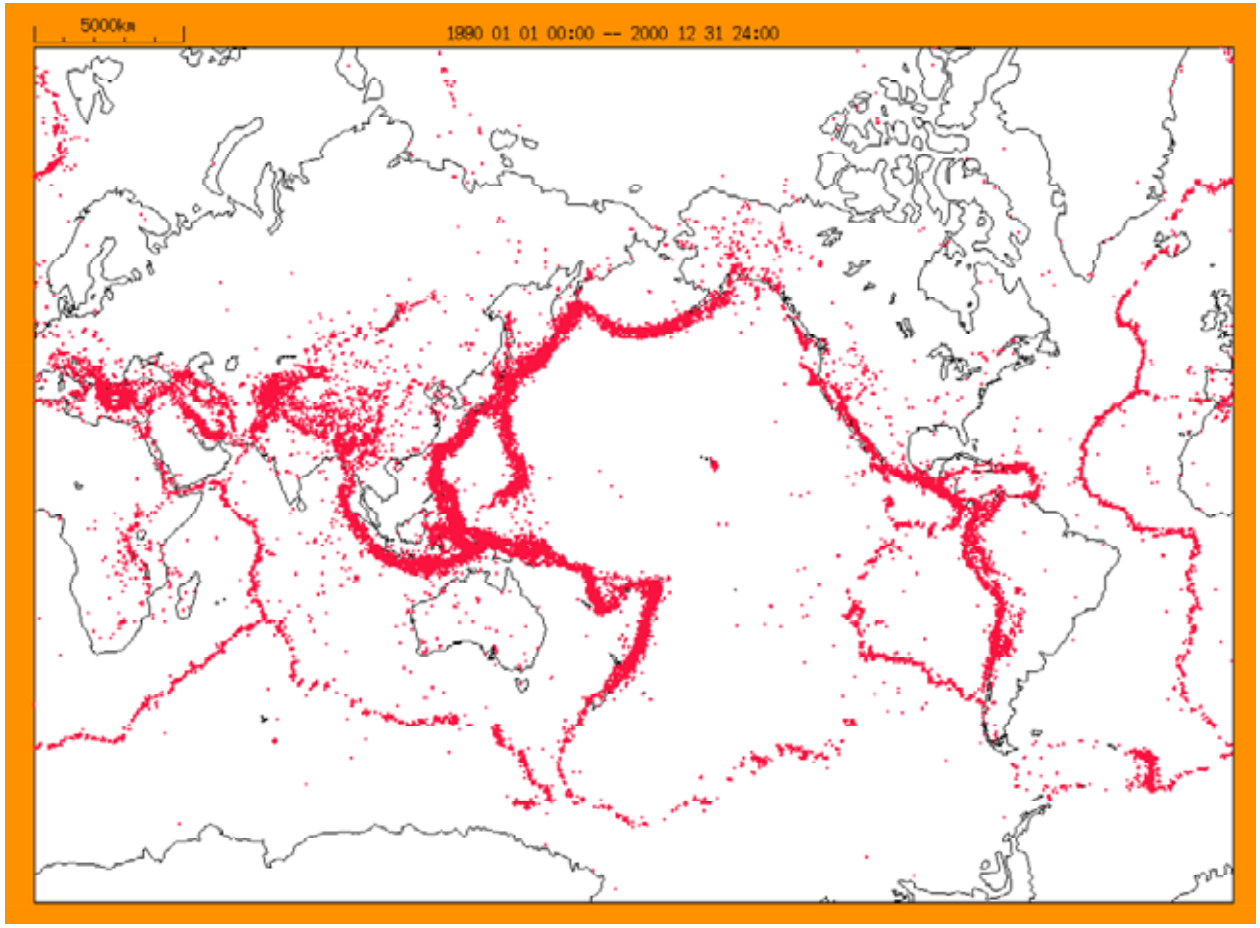
- Damage by the Earthquake

Dead: 12,875
Missing: 12,555
Injured: 5,022
Evacuee: 190,445
Damaged House:
Totally Damaged: 43,919
Partially Damaged: 185,286
(As of 11 April including other related earthquakes)
Inundated area: 507km$^2$ (estimated)

(Fire Defense Agency HP in Japanese
http://www.fdma.go.jp/bn/2011/detail/691.html
Geographical Survey Institute HP in Japanese
http://www.gsi.go.jp/kikaku/kikaku60004.html)

# Earthquake and Tsunami Risks in Japan

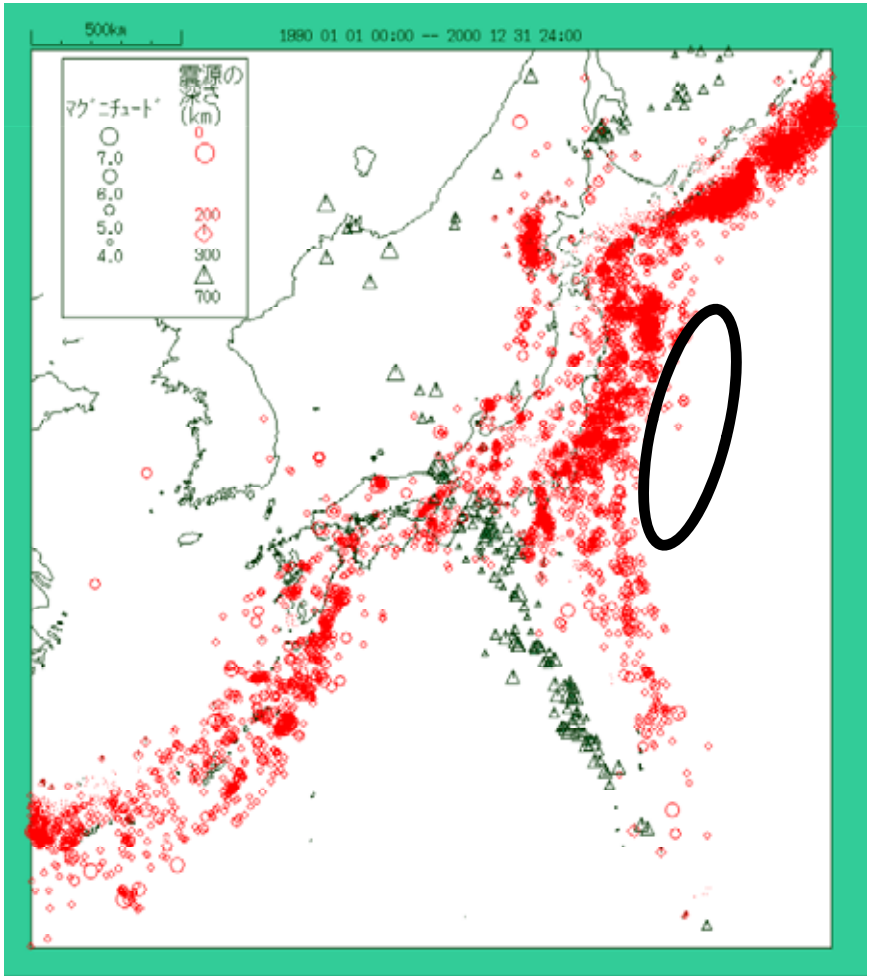
- Japan – a country with high earthquake risk




(Epicenter distribution map of the World between 1990 to 2000)

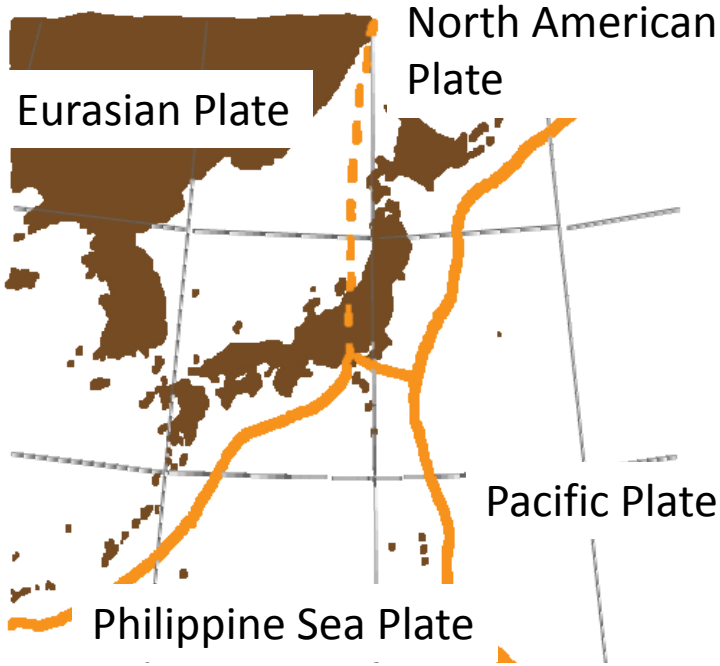
(Japan Meteorological Agency HP in Japanese
http://www.jma.go.jp/jma/kishou/know/whitep/2-1.html)

# Earthquake and Tsunami Risks in Japan




(Epicenter distribution map
in Japan between 1990 to 2000)

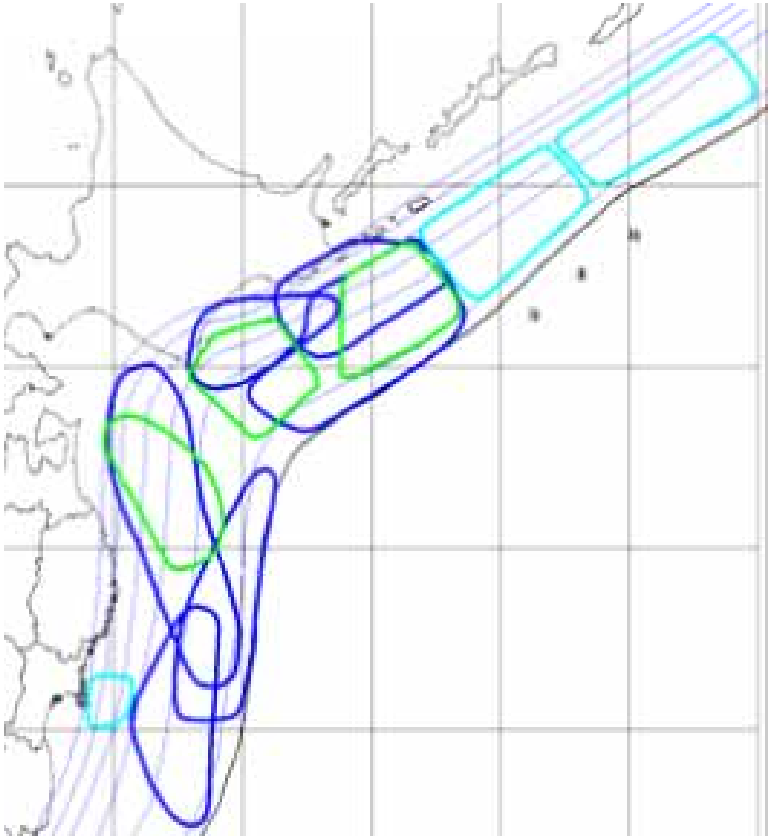
(The Japan Meteorological Agency HP in Japanese
http://www.jma.go.jp/jma/kishou/know/whitep/2-1.html)




Although the country covers only 0.25% of the land area on the earth, the number of earthquakes is quite high. (20.5% of earthquakes over magnitude 6 occur in Japan)

(The Cabinet Office HP in Japanese
http://www.bousai.go.jp/hakusho/h22/bousai2010/html/honbun/2b_1s_1_01.htm)

# Earthquake and Tsunami Risks in Japan (Tohoku Area)



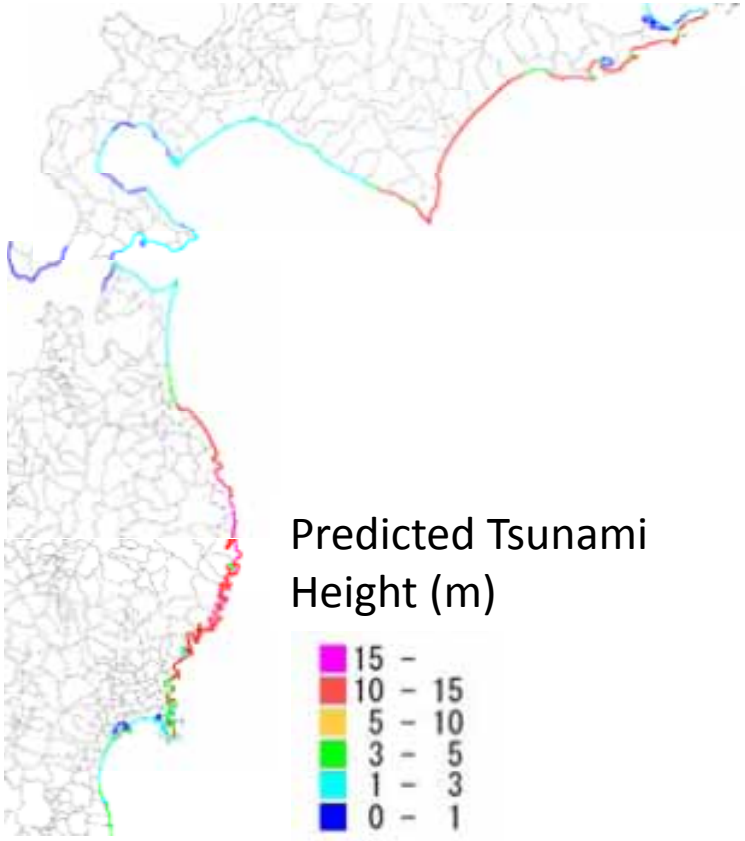
Study by Committee on countermeasures for the Trench-type Earthquakes in the Vicinity of the Japan and Chishima Trenches under the Central Disaster Management Council
(2003-2006)

Six types of Earthquakes and
Eight types of Tsunami Disaster
were considered.

Assumption
Maximum Magnitude: 8.6

(Cabinet Office HP in Japanese
http://www.bousai.go.jp/jishin/chubou/taisaku_kaikou/kaikou_top.html)

# Earthquake and Tsunami Risks in Japan (Tohoku Area)




Study by Committee on countermeasures for the Trench-type Earthquakes in the Vicinity of the Japan and Chishima Trenches under the Central Disaster Management Council (2003-2006)

Predicted Damage (Worst Condition)

Dead: Predicted 2,700

March 2011 12,875

(Missing 12,555)

Totally Damaged House:

Predicted 21,000

March 2011 43,919

Tsunami: Predicted Over 20m (Highest)

(As of 11 April including other related earthquakes)

(Cabinet Office HP in Japanese
http://www.bousai.go.jp/jishin/chubou/taisaku_kaikou/kaikou_top.html)
Fire Defense Agency HP in Japanese
http://www.fdma.go.jp/bn/2011/detail/691.html

# Sanriku, a tsunami-prone area

Historical Record of Tsunami Disaster in the Sanriku region

| Date | Magnitude | Nuber of Dead and Missing |
|---|---|---|
| July 13, 869 | 8.3 | 1,000 |
| ~~~ | ~~~ | ~~~ |
| December 2, 1611 | – | 3,000 |
| April 13, 1677 | 8 | – |
| February 17, 1793 | – | – |
| August 23, 1856 | – | – |
| June 15, 1896 | 7.1 | 21,959 |
| March 3, 1933 | 8.3 | 3,064 |
| May 23, 1960 | Chilie Earthquake | 142 |
| March 11, 2011 | 9.0 | Dead 12,290<br>Missing 12,607 |

(Cabinet Office HP in Japanese
http://www.bousai.go.jp/jishin/chubou/kyoukun/index.html)

# Preventive Structural Measures

## Taro Tsunami Barrier


Height: 10m

Total Length: 1,350m

Completion: March, 1958

Location: Taro, Miyako city, Iwate Prefecture

**But the tsunami overtopped the huge barrier.**

(MLIT HP in Japanese
http://www.pa.thr.mlit.go.jp/kamaishi/bousai/b01_02.html)

# Tsunami-stricken area

## Taro area

Before Disaster, 1977

After Disaster,
13 March, 2011

(Geographical Survey Institute HP in Japanese
http://saigai.gsi.go.jp/h23taiheiyo-hr/index.html)

# Structural Measures

(Mie Prefecture)

Tsunami Evacuation Tower

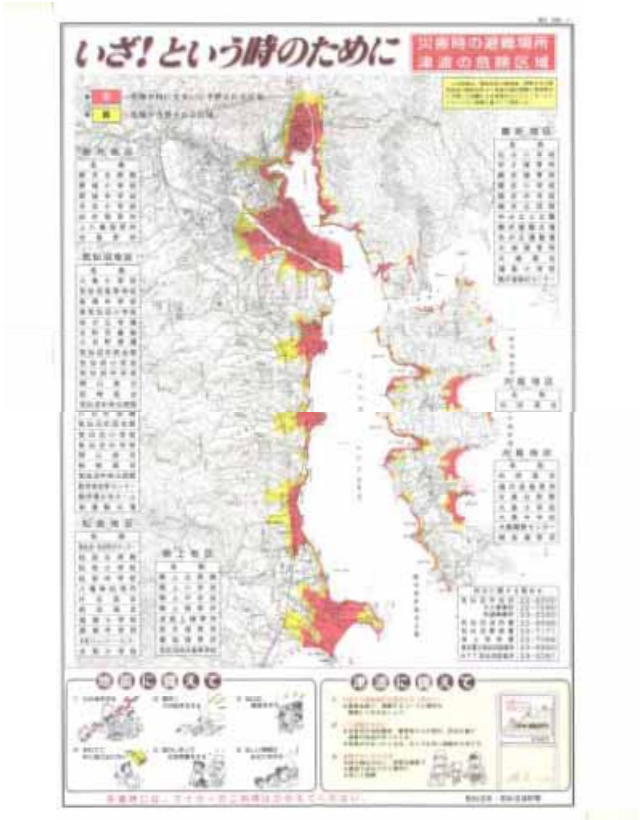
(Wakayama Prefecture)

Tsunami Evacuation Building

Private Buildings are designated as temporary tsunami evacuation facilities.

(Cabinet Office HP in Japanese
http://www.bousai.go.jp/oshirase/h17/tsunami_hinan.html)

# Non-structural Measures




(Kesennuma City, Miyagi Prefecture)

(MLIT HP in Japanese
http://www.mlit.go.jp/kowan/hazard_map/1/sankou2.pdf)

## Tsunami Hazard Map

(349 municipalities make maps)

(Shizuoka City, Shizuoka Prefecture)

(The MLIT HP in Japanese
http://www.mlit.go.jp/river/basic_info/yosan/gaiyou/yosan/h22budget/print.pdf)

## Tsunami Evacuation Drill

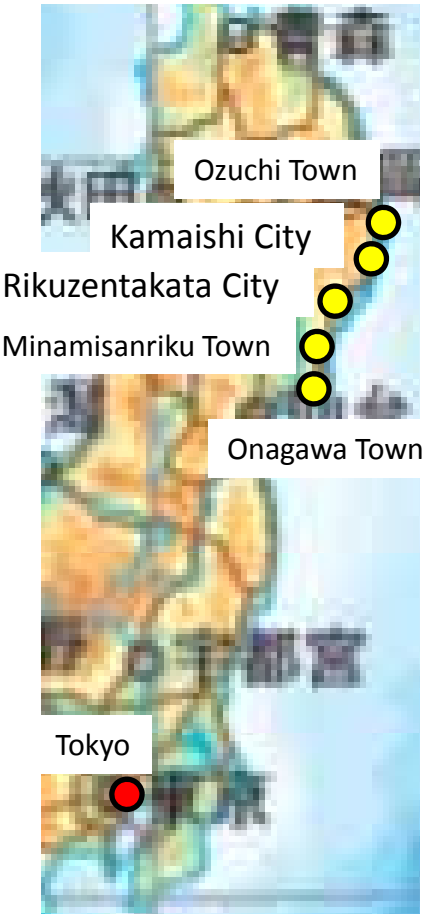
(MLIT holds drill every year)

(Cabinet Office HP in Japanese
http://www.bousai.go.jp/hakusho/h22/bousai2010/html/honbun/2b_2s_3_02.htm)

**But water reached far beyond the predicted inundation areas.**

# Damage to Municipality Offices

Municipalities forced to move the offices by tsunami




- Municipality Offices were expected to be the first responder to the regional damage.
- Some municipalities offices bordering the Pacific Ocean were damaged by Tsunami.
- A Town Mayor died by Tsunami.

(Miyagi Prefecture HP in Japanese
http://www.pref.miyagi.jp/sichouson/gyou1/ sityouson-renrakusaki.pdf
Iwate Prefecture HP in Japanese http://www.pref.iwate.jp/view.rbz?cd=31583)

# Damage to Infrastructure

Electricity, Water, Sewage, and Gas were damaged severely in wide areas.

Electricity: Outage around 240,000 houses
Water: Cut-off at least 220,000 houses
Sewage: Broken Sewage Treatment Plant 19 Places
unidentified 10 Places
Gas: Outage around 160,000 houses

(as of 11 April)

(METI HP in Japanese http://www.meti.go.jp/press/2011/04/20110412002/20110412002-1.pdf
MLIT HP in Japanese http://www.mlit.go.jp/common/000139083.pdf
MHLW HP in Japanese http://www.mhlw.go.jp/stf/houdou/2r98520000018sey-img/2r98520000018sgz.pdf)

# Evacuation Shelters

## Scattered in wide areas

(Fukushima Prefecture HP in Japanese
http://wwwcms.pref.fukushima.jp/pcp_portal/
PortalServlet?DISPLAY_ID=DIRECT&
NEXT_DISPLAY_ID=U000004&CONTENTS_ID=23515Fuku)

Number of Evacuees

| | |
|---|---|
| Aomori | 226 |
| Iwate | 49,006 |
| Miyagi | 55,423 |
| Fukushima | 84,937 |
| Ibaragi | 355 |
| Tochigi | 5 |
| Saitama | 1 |
| Chiba | 263 |
| Nagano | 229 |
| Total | 190,445 |

(As of 11 April including other related earthquakes)

( Fire Defense Agency HP in Japanese
http://www.fdma.go.jp/bn/2011/detail/691.html)

# PM, 11 March

2:46 p.m. : The earthquake occurred (Seismic intensity in Tokyo: 5+)

2:46 p.m. : The Major Disaster Management Headquarters in MLIT was established

2:50 p.m. : Cabinet Countermeasure Center was established
The whole ministry changed to Disaster Response Mode.

3:15 p.m. : The Extreme Disaster Management Headquarters, was established in MLIT.

3:37 p.m. : The first Extreme Disaster Management Headquarters, headed by the Prime Minister Kan, was held in the Cabinet Office

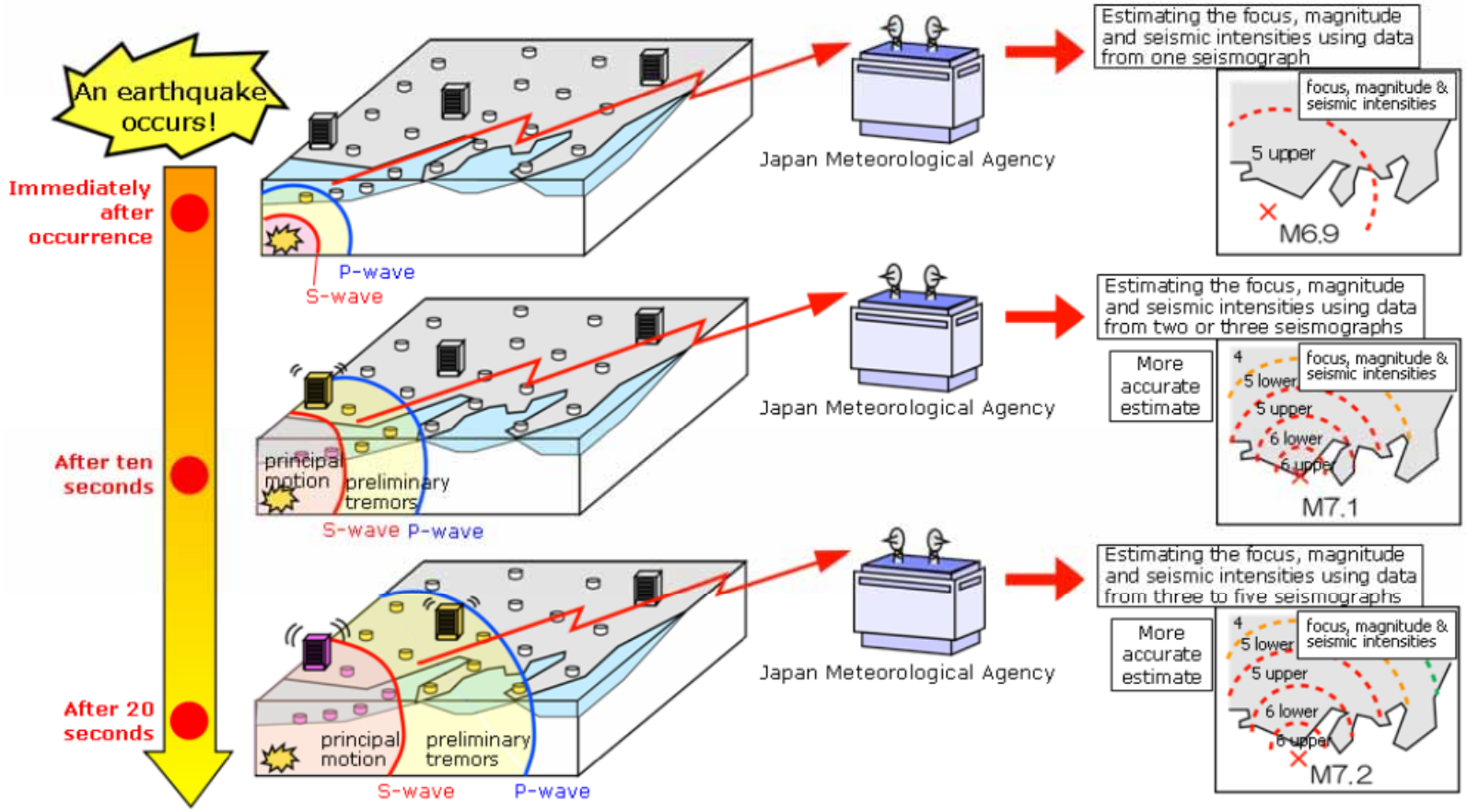
3:45 p.m. : The first Extreme Disaster Management Headquarters, headed by the Minister Ohata, was held in MLIT.

(It has been held for 37 times by April 8.)

The first Extreme Disaster Management Headquarters

(Cabinet Office HP in Japanese
http://www.kantei.go.jp/jp/kan/actions/201103/11touhoku_jisin.html
MLIT HP in Japanese

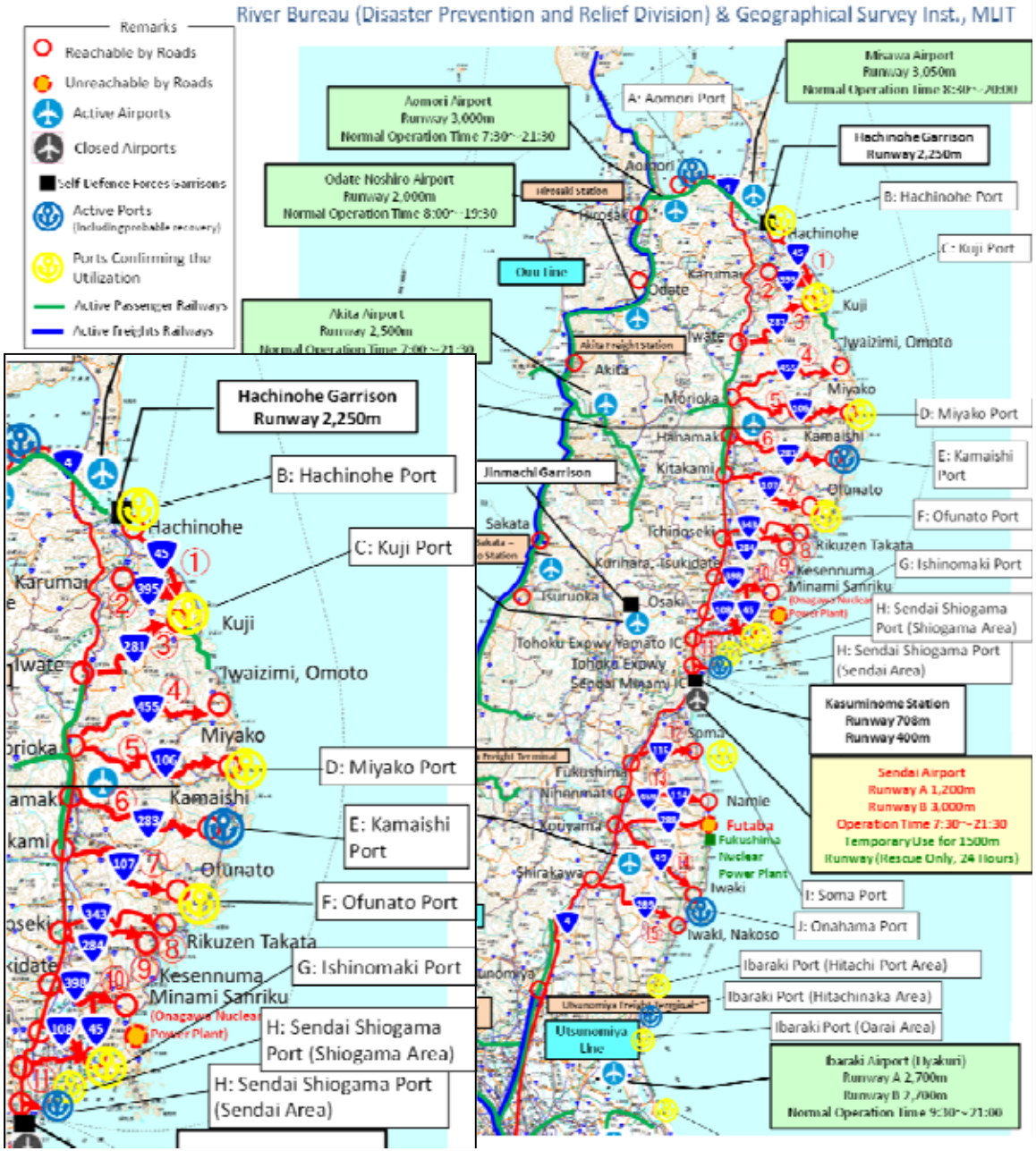
# Earthquake Early Warning (Kinkyu Jishin Sokuho)




March 11: After 8.6 seconds Earthquake Early Warning was alerted.

(Japan Meteorological Agency HP in English
http://www.jma.go.jp/jma/en/Activities/eew1.html
Japan Meteorological Agency HP in Japanese
http://www.jma.go.jp/jma/press/1103/11b/201103111600.html)

# Response by MLIT



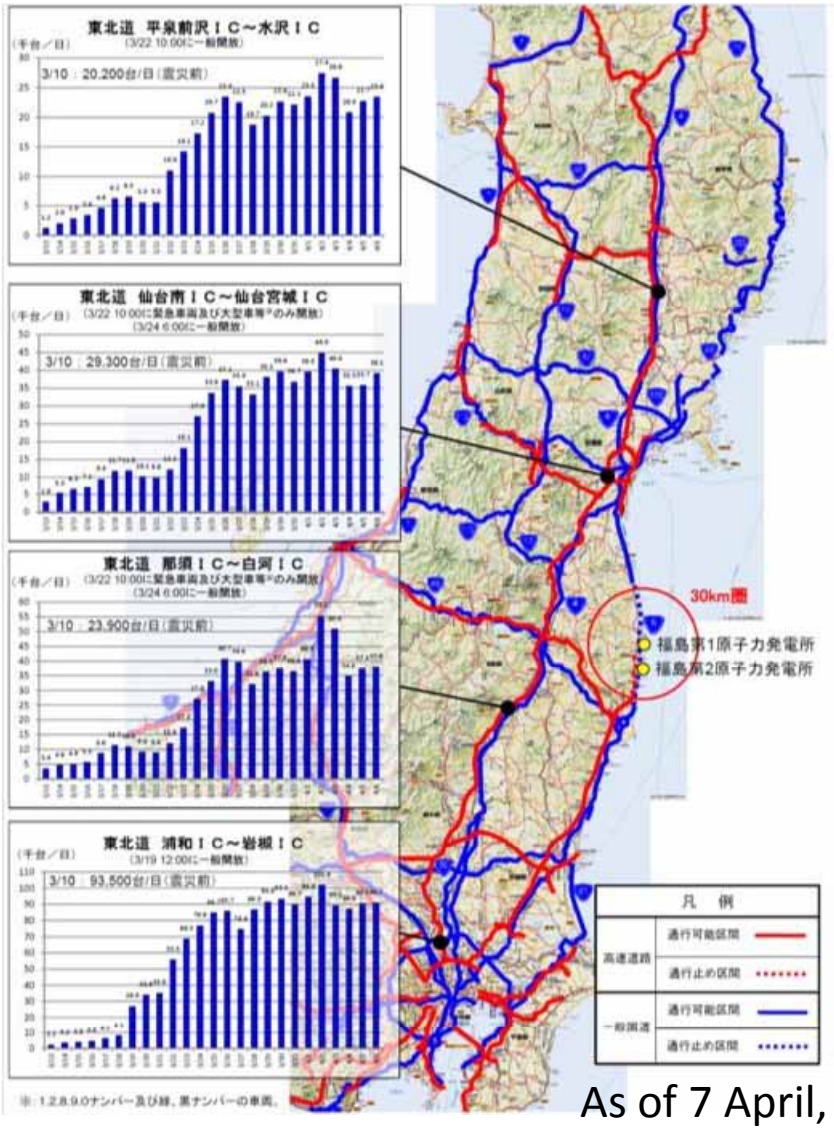

Restoration of traffic networks were the most pressing.

Accessibility to Damaged Areas, Ports, Airports

As of 17 March, 2011

(MLIT)

# Response by MLIT

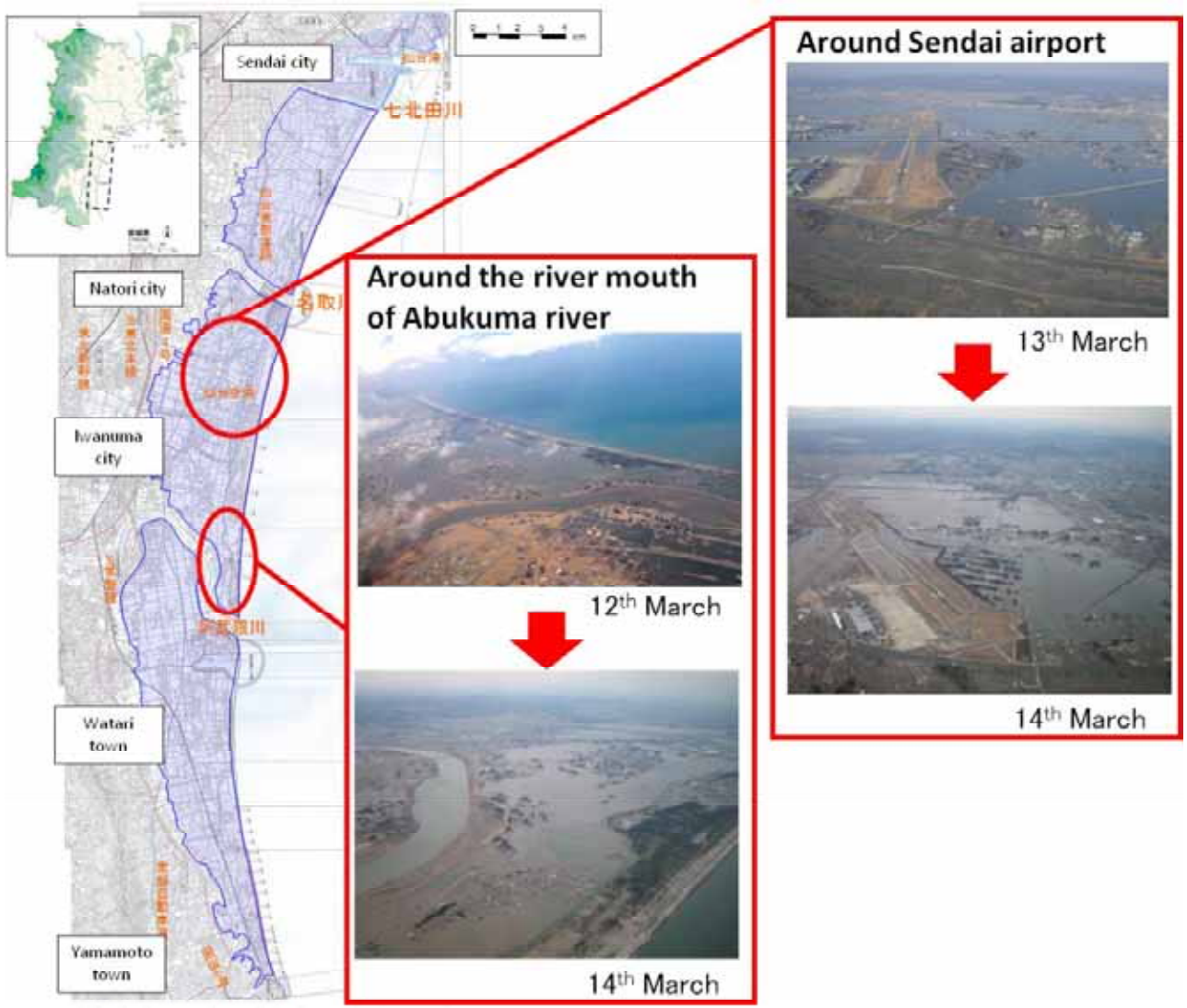



As of 7 April, 2011

(MLIT HP in Japanese http://www.mlit.go.jp/road/bosai/infolist3.html)

## Major arterial roads have already been restored

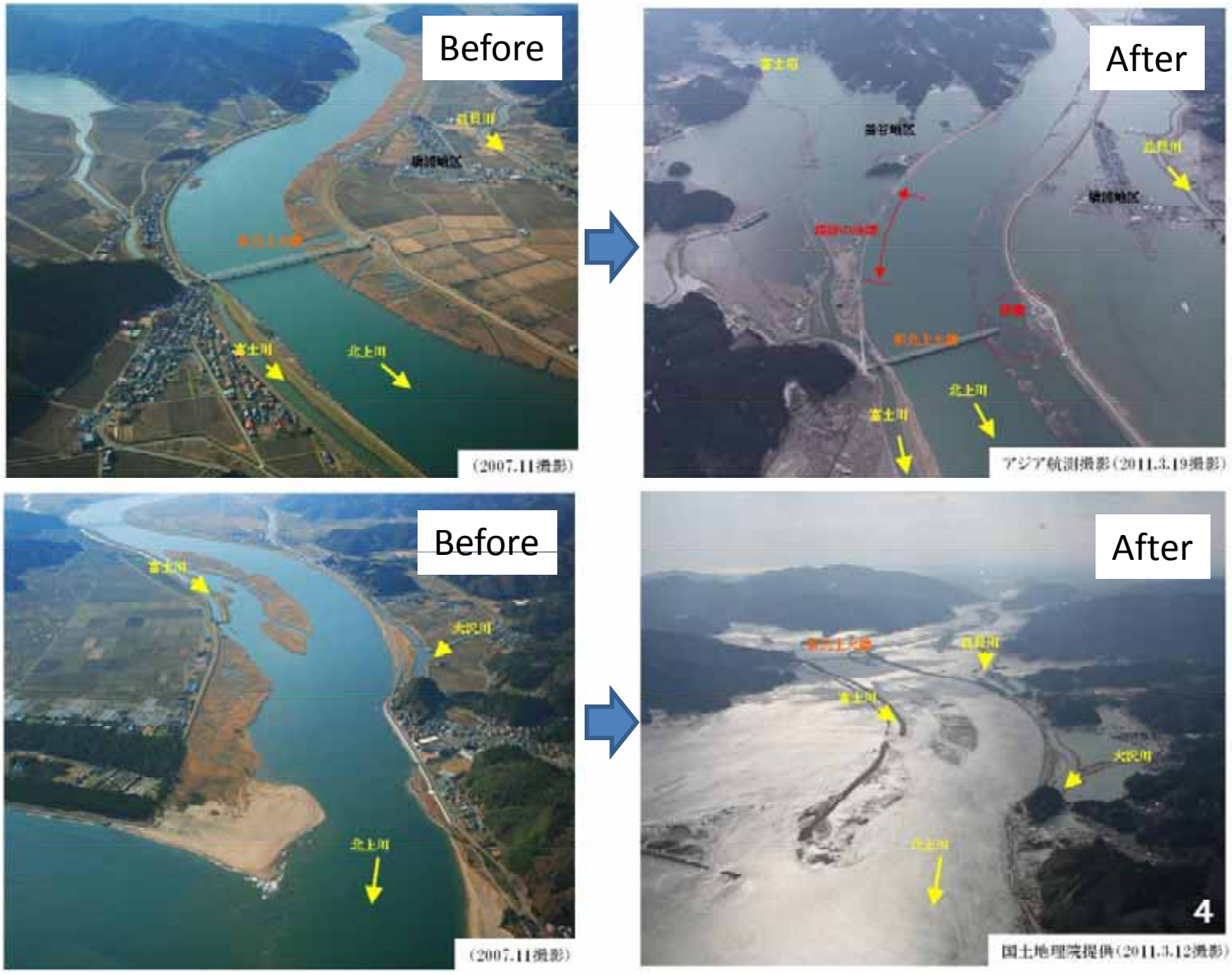
# Brief survey from the air conducted by the Tohoku regional bureau




Shaded area : inundated area by tsunami
Based on a brief survey from the air. The result may be changed by further investigation.

( MLIT)

# Tsunami stricken area (Kitakami river estuary)




(MLIT)

# Response by MLIT

## Recovery of River Facilities (Total Damaged sites : 1,828)

As of 11 April, 2011


Damaged site: Kitakami River
Miyagi Prefecture

Damaged site: Naka River
Ibaraki Prefecture

Damaged site: Edo River
Saitama Prefecture

Recovery works are ongoing to prepare for the next flood season.

(MLIT)

# Response by MLIT

13 March, 2011

27 March, 2011

(Sendai airport)

Estimated Inundation Volume :
112 million $m^3$ (13 March)
15 million $m^3$ (7 April)

MLIT pumps have drained 28 million $m^3$ (7 April)

Pumping cars for drainage have been dispatched from all over Japan.

(MLIT)

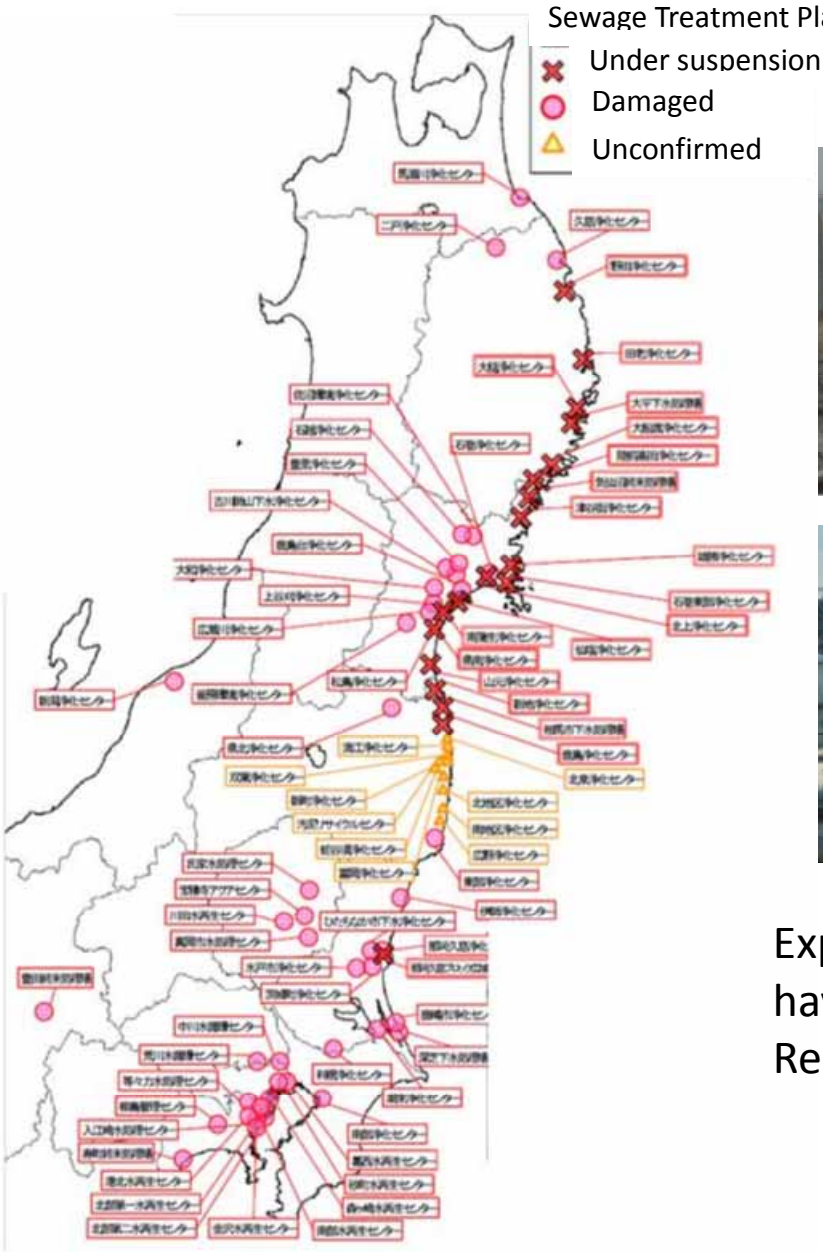
# Response by MLIT

## TEC-FORCE (Technical Emergency Control Force)


TEC-FORCE has been dispatched from 12 March, 2011.
180 persons (Total 10,027 person-days) (10 April, 2011)
Liaisons have been dispatched to prefectures and municipalities to collect information from 11 March.

(MLIT HP in Japanese
http://www.mlit.go.jp/common/000139083.pdf
http://www.mlit.go.jp/saigai/TEC100806.pdf)

# Response by MLIT



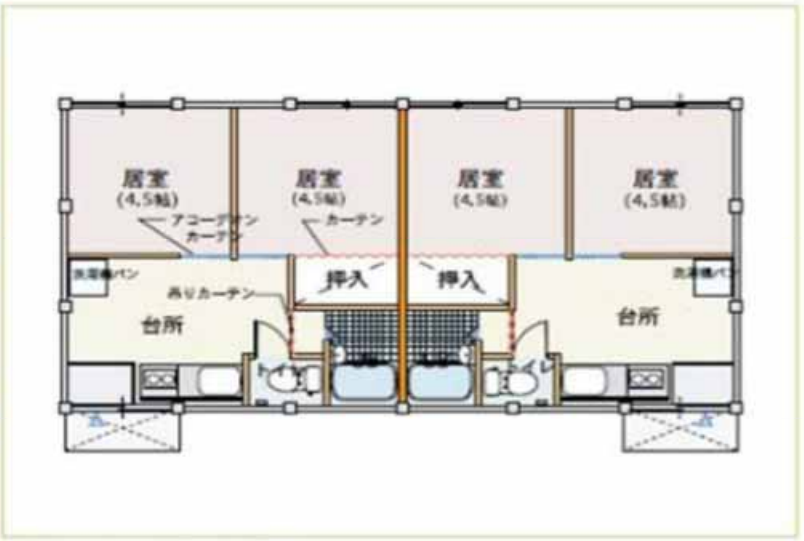

## Damage on sewage system

Experts from MLIT and other municipalities
have been dispatched from 12 March.
Recovery planning and works have been implemented.

(MLIT HP in Japanese
http://www.mlit.go.jp/crd/crd_sewerage_fr_000007.html)

# Response by MLIT

## Temporary Dwelling


標準平面図（組立ハウス　2DK）

Temporary Dwelling Construction has been started by prefectures from 19 March.

Construction started: 7,454 houses, 78 area
(Completed : 36 houses, 1 area)
Construction in Preparation : 2,825 houses, 43 area

(As of 11 April)

(MLIT HP in Japanese
http://www.mlit.go.jp/common/000140307.pdf
http://www.mlit.go.jp/common/000140307.pdf)

# Tasks before Us
# For Recovery in Future

- Care for the evacuees and victims
- Drainage of inundated area
- Provisional recovery of infrastructure
  (Including temporary levees)

How to dispose of huge debris?

How to reconstruct devastated cities?

# Revival from Ruins

## Great Kanto Earthquake

1 September, 1923

It hit Kanto area including the whole Tokyo area.

Magnitude: 7.9

Dead and missing: 105,385 person

Damaged house: 293,387 houses

Burnt area: around 4,500ha

(Center of Tokyo was burnt out.)

After the catastrophe revival plan was implemented.

- Land readjustment
- Arterial Road Construction
- Large and small Park Construction
- Modern Infrastructure Construction

(Ferro-concrete school building,
Steel bridge etc.)

(The Cabinet Office HP
http://www.bousai.go.jp/jishin/chubou/kyoukun/rep/bs1001.pdf
All rights of the pictures reserved)


Thank your very much!
• We, Japanese people feel grateful to your warm support and compassion.
• Together, let us rebuilt a more resilient society.