

1. Damages caused by the Great East Japan Earthquake

2. MLIT's emergency response to the Great East Japan Earthquake

3. Recent policy changes regarding tsunami disaster countermeasures

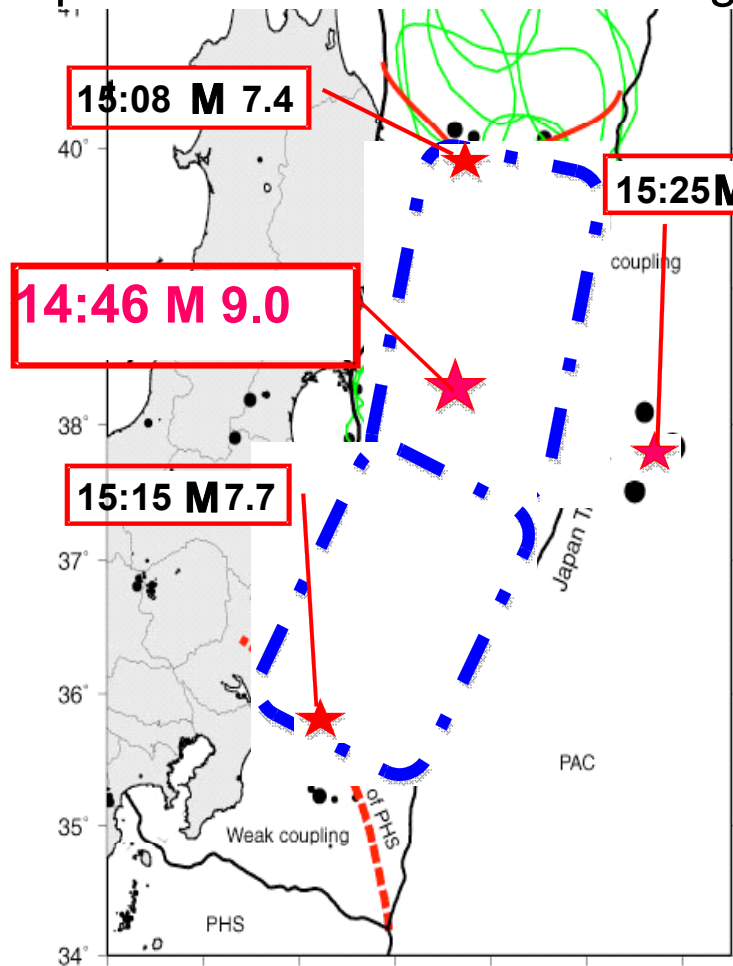
Overview of Earthquake & Tsunami

- On March 11 a massive earthquake of magnitude 9.0 occurred off Sanriku coast. Strong shocks were widely observed.
- Focal region ranged over in the rectangle of around 450km long and 200km wide*.
- The earthquake caused massive tsunami from Hokkaido to Kanto.
- The scale of tsunami was equal to or larger than that of the Jogan Tsunami (869). The return period is estimated to be 500 to 1000 years.

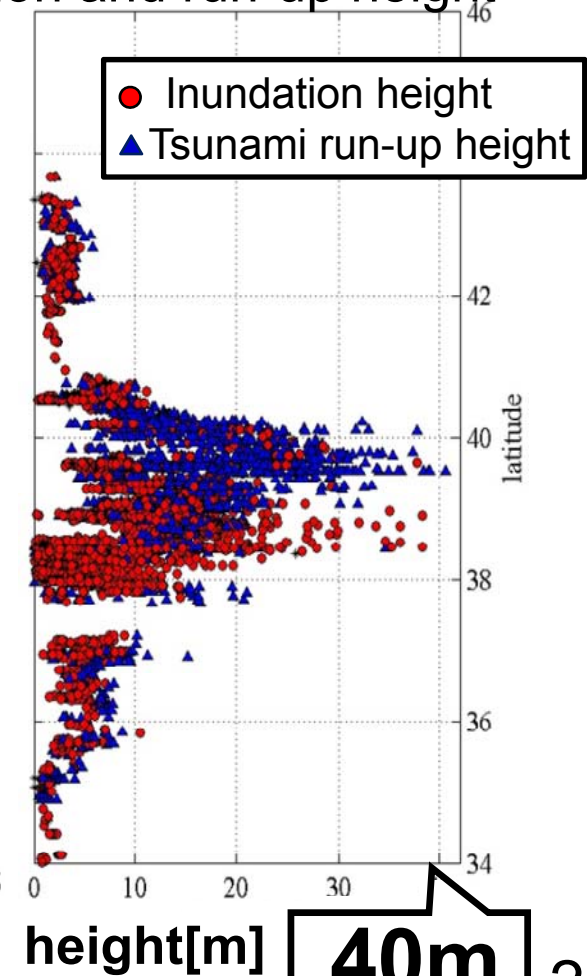
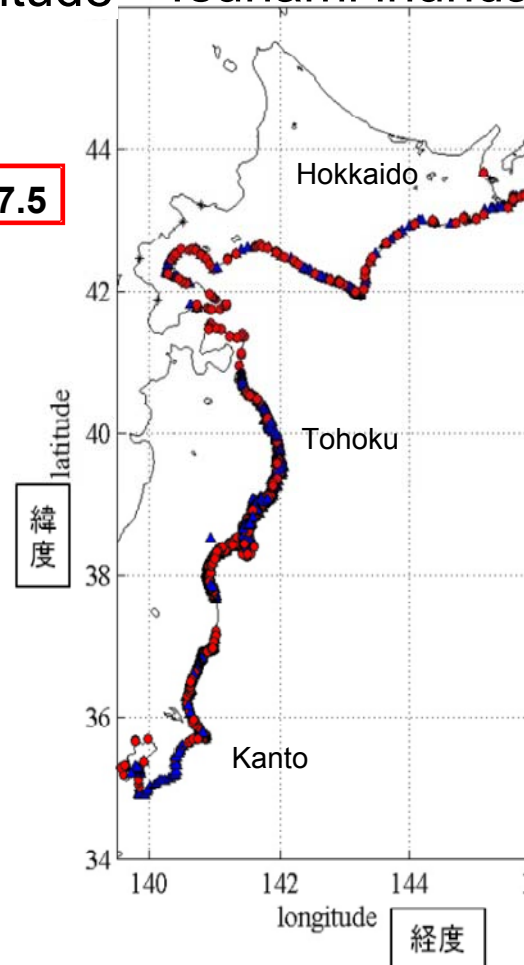
※White Paper on Disaster Management 2011, Cabinet Office, Government of Japan

Epicenter distribution and magnitude

Tsunami inundation and run-up height



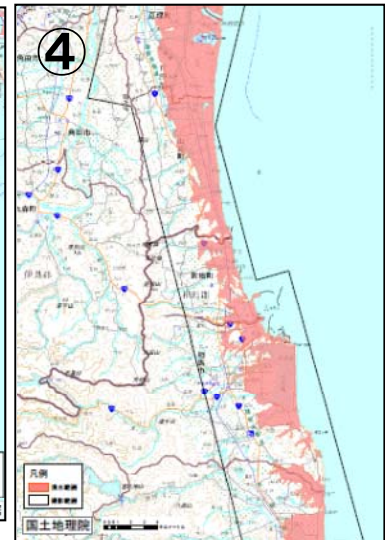
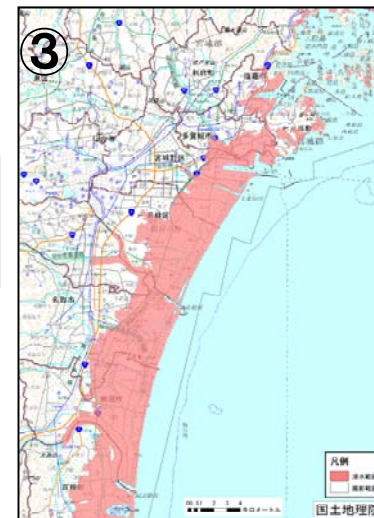
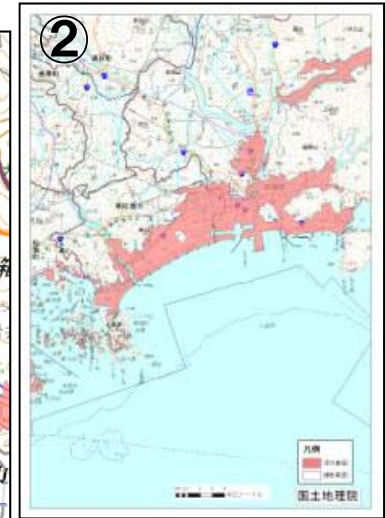
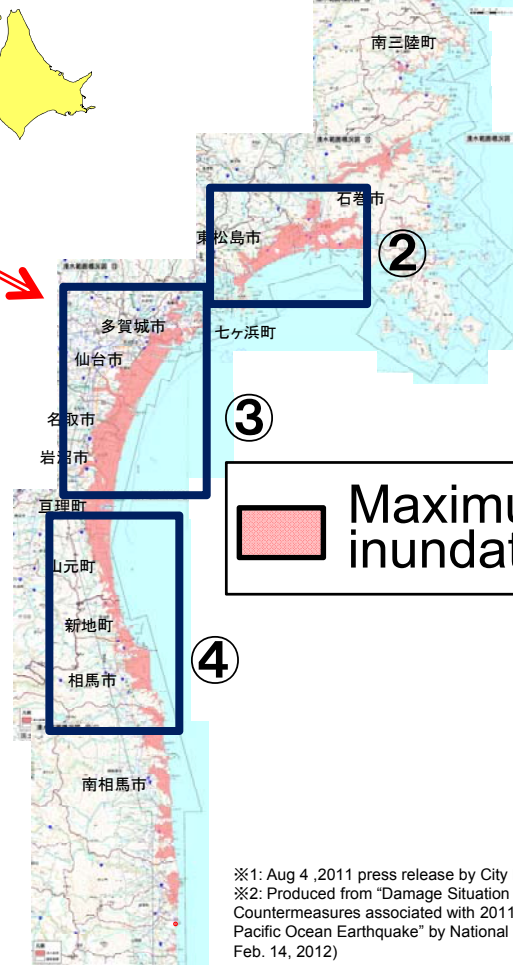
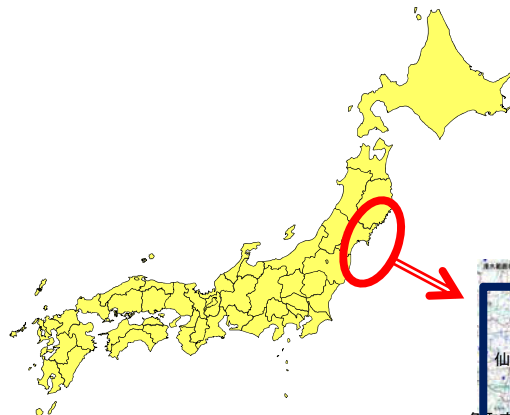
Research Center for Prediction of Earthquakes and Volcanic Eruptions, Tohoku University
http://www.aob.geophys.tohoku.ac.jp/info/topics/20110311_news/index.html



The 2011 Tohoku Earthquake Tsunami Joint Survey Group report (As of July 5, 2011)
<http://www.coastal.jp/tjt/>

Damages caused by Tsunami (1/2)

- 535km² of land was inundated by tsunami in Tohoku and Kanto region. Approx. 10% (119km²※1) of urban area was inundated.
- Approx. 129,000 buildings were destroyed, fatalities were around 15,850 and missing persons were around 3,282. ※2



※1: Aug 4, 2011 press release by City Bureau
 ※2: Produced from "Damage Situation and Police Countermeasures associated with 2011 Tohoku district - off the Pacific Ocean Earthquake" by National Police Agency (As of Feb. 14, 2012)

Produced from "Inundation Condition Map" by Geospatial Information Authority

Damages caused by Tsunami (2/2)

- In Rikuzentakata city 13km² was inundated※1.
90% of the urban area (2.9 km²) in Rikuzentakata city was inundated※2.
- 3,159 buildings were destroyed, fatalities were 1,656 and missing persons were 72※3.

※1 : Aug 4 2011 press release by City Bureau, MLIT

※2 : Date source from City Bureau, MLIT

※3 : Produced from Rikuzentakata City HP (As of Jun. 30, 2011)



Looking at Rikuzentakata from the sea side (After tsunami)



Before tsunami (Oct. 18 and 29, 2010)



After tsunami (Mar. 13, 2011)

Produced from 4th meeting of The Reconstruction Design Council in response to the Great East Japan Earthquake (Oct. 5 2011)




Levee height and Tsunami trace height

[Basic concept of levee design height]

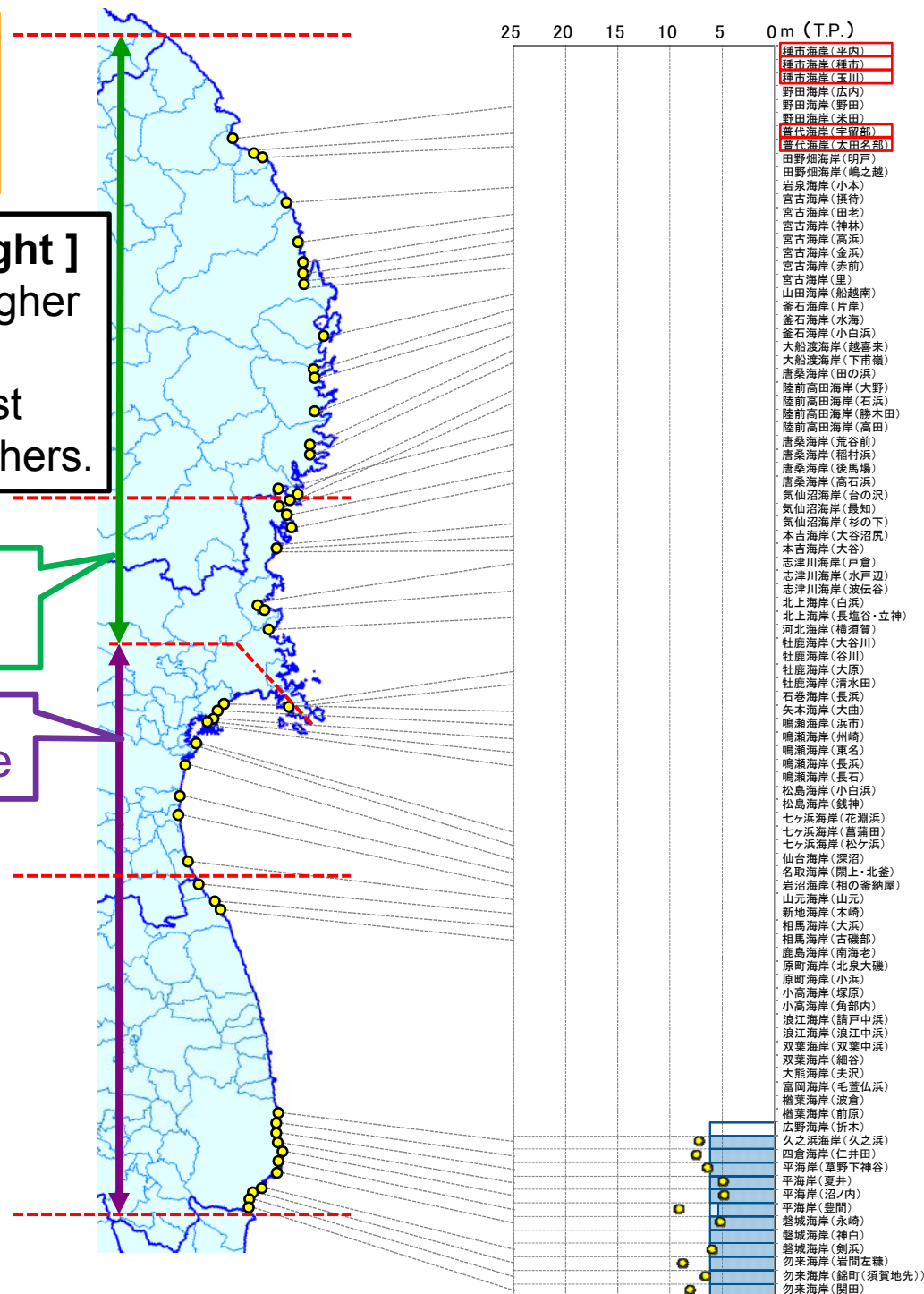
- Height of levee is decided by the higher of either storm surge or tsunami.
- Tsunami height is used for rias coast and storm surge height is used for others.

Levee design height is decided by tsunami

Levee design height is decided by storm surge

-  Current levee height
-  Levee design height
-  Tsunami trace height
(Plotted tsunami trace height were observed close to the coast)

 little or no damages caused

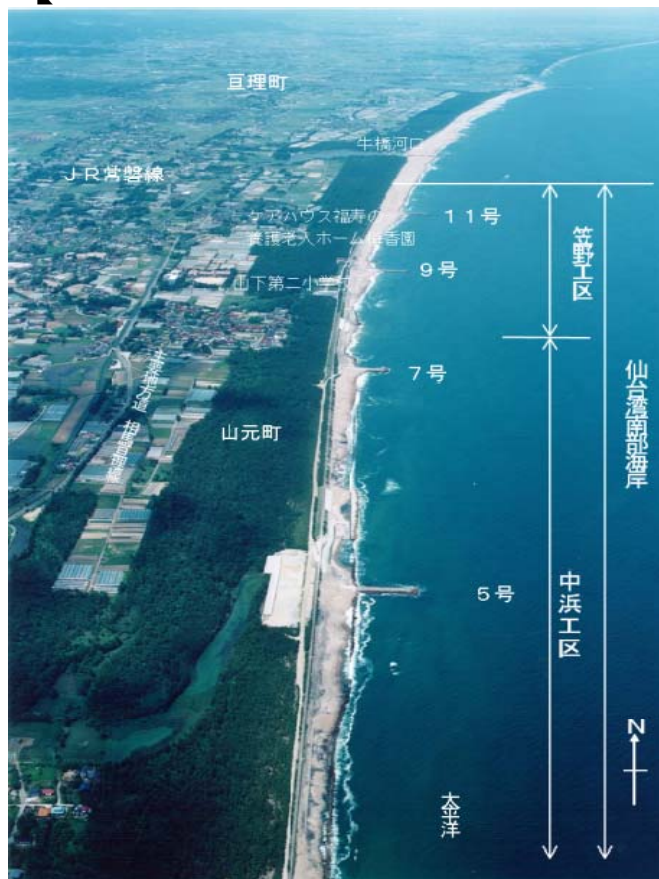


※The 2011 Tohoku Earthquake Tsunami Joint Survey
Group report (As of May 3) (<http://www.coastal.jp/tjtj/>)

Damages to the Coastal Levees

- Along the 1,700km coast of Iwate, Miyagi & Fukushima prefectures, there were 300km of coastal levees.
- 190km of the levees were fully or half destroyed.

【Sendai Gulf Southern Coast】



Before

【Kasano District】



After

Photo on March 12, 2011

Damages to Rivers

- River levees in Tohoku and Kanto regions were washout/failure, subsidence, slope failure, etc.
- 2,115 sites were identified to be damaged, a little less than half were caused by liquefaction in Kanto region.

Levee washout/failure

Kitakami River 【Ishinomaki City】



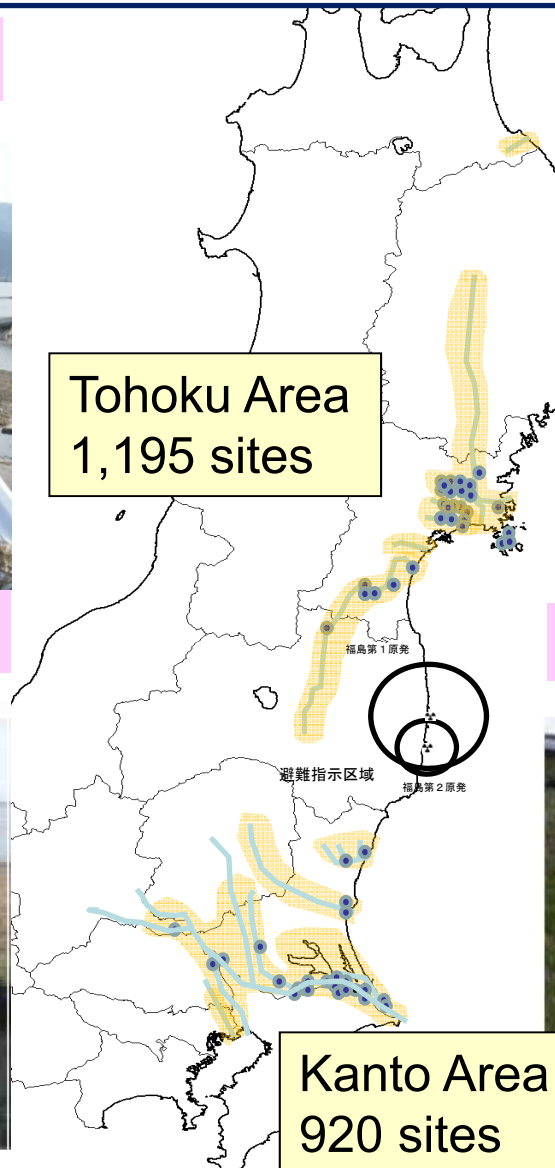
Damaged Gates

Kitakami River (Kamaishi Gate)
【Ishinomaki City】



Levee Sinkage

Kasumigaura Lake 【Inashiki City】



Levee slope failure

Edo River 【Satte City】

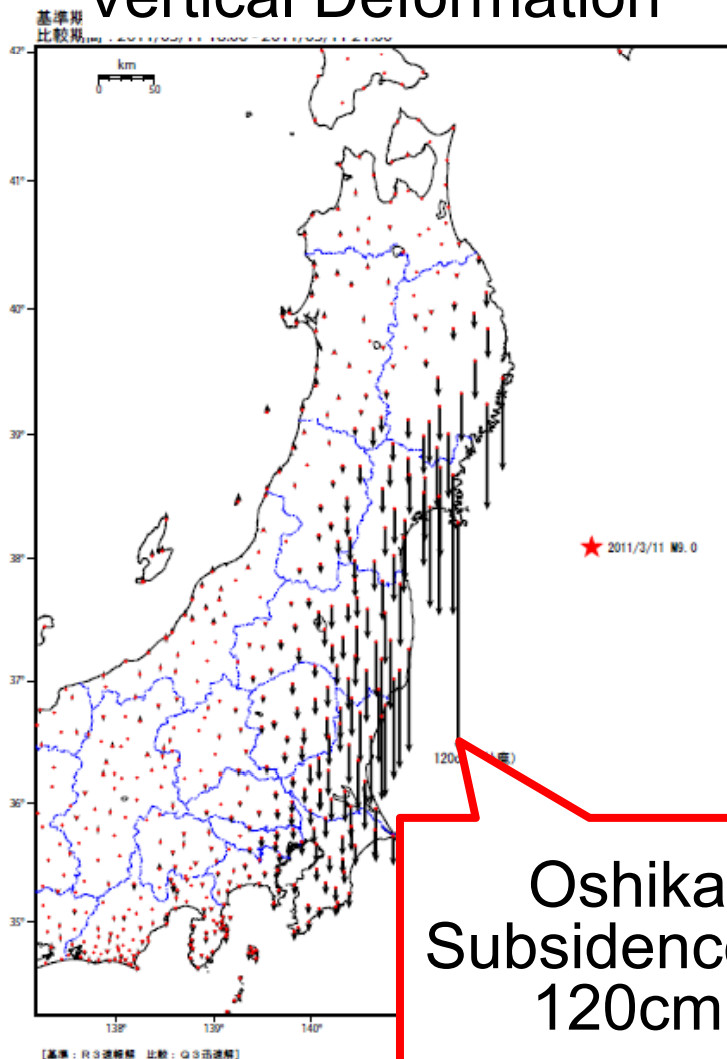


Deformation caused by the Earthquake

Deformation occurred over a large area due to the Tohoku Earthquake.

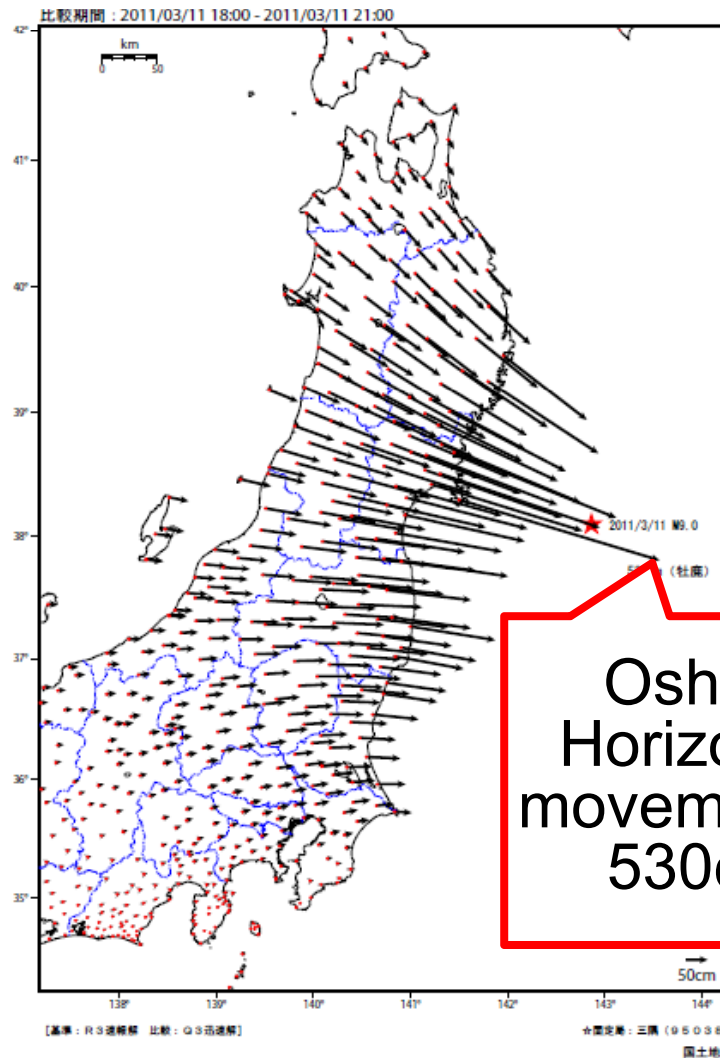
Vertical Deformation

資料 2



Oshika
Subsidence of
120cm

Horizontal Deformation

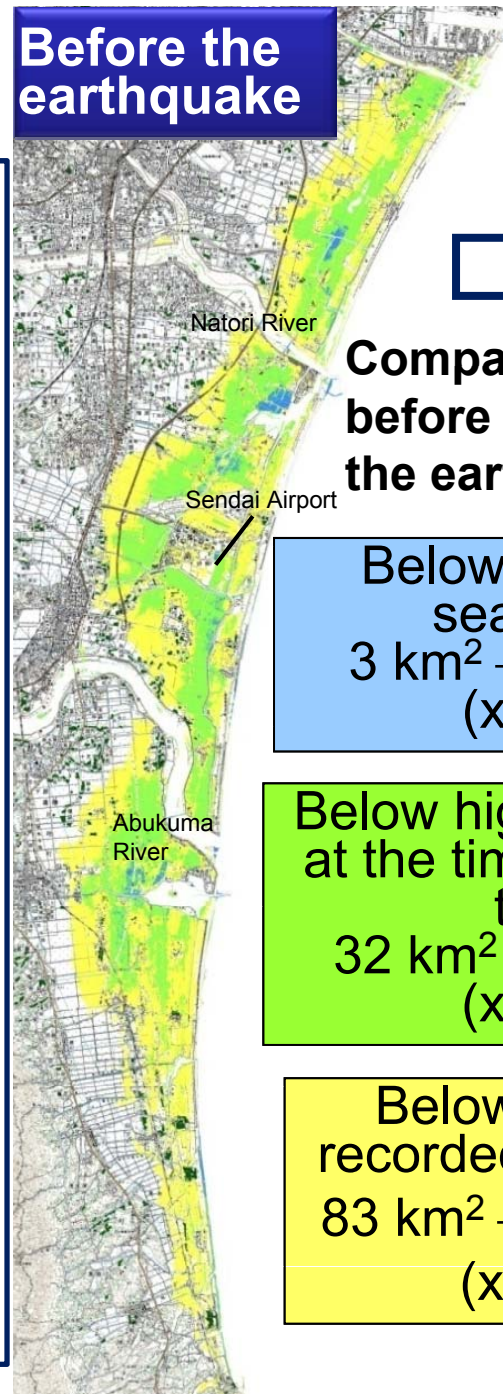


Oshika
Horizontal
movement of
530cm

Subsidence

- Earthquake deformation caused extensive subsidence in the Sendai plain.
- Announced the status of subsidence based on the Laser Profiling (LP) surveys.
- The extent of the area below the mean sea level increased by 5.3 times.
- Tsunami destroyed coastal levees along the entire coastline.
- Sendai plain's safety level against storm surges have been reduced significantly.
- The flood forecast warning standards have been lowered accordingly.

Before the earthquake



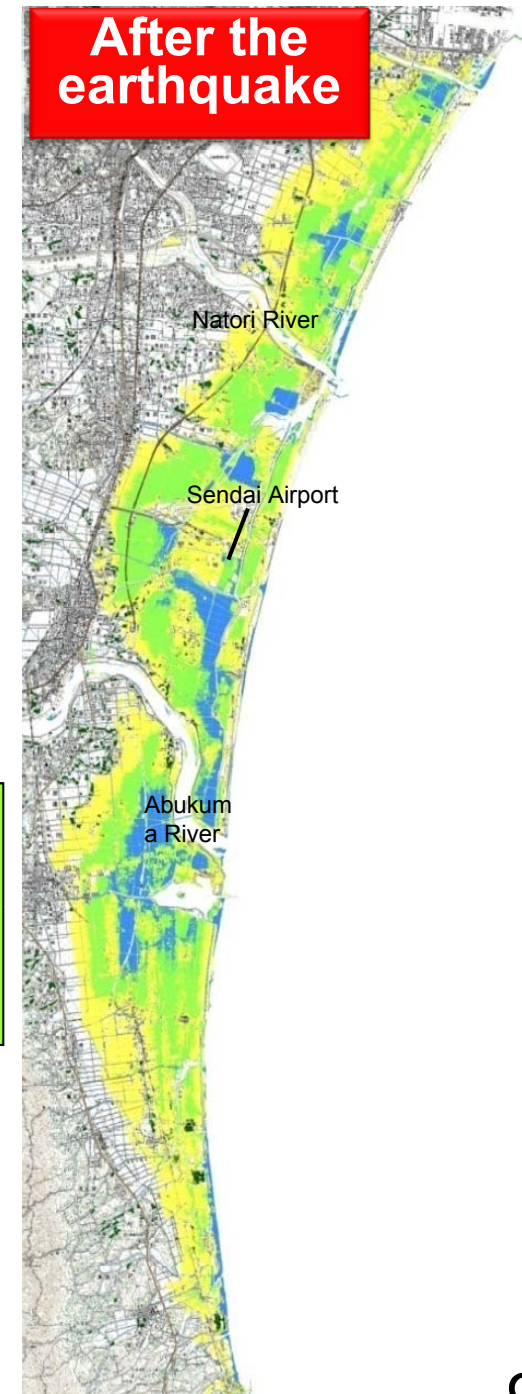
Comparing areas before and after the earthquake

Below average sea level
 $3 \text{ km}^2 \rightarrow 16 \text{ km}^2$
(x 5.3)

Below high tide level at the time of spring tide
 $32 \text{ km}^2 \rightarrow 56 \text{ km}^2$
(x 1.8)

Below largest recorded sea level
 $83 \text{ km}^2 \rightarrow 111 \text{ km}^2$
(x 1.3)

After the earthquake



Surveyed in 2005 and 2008

Surveyed in 2011