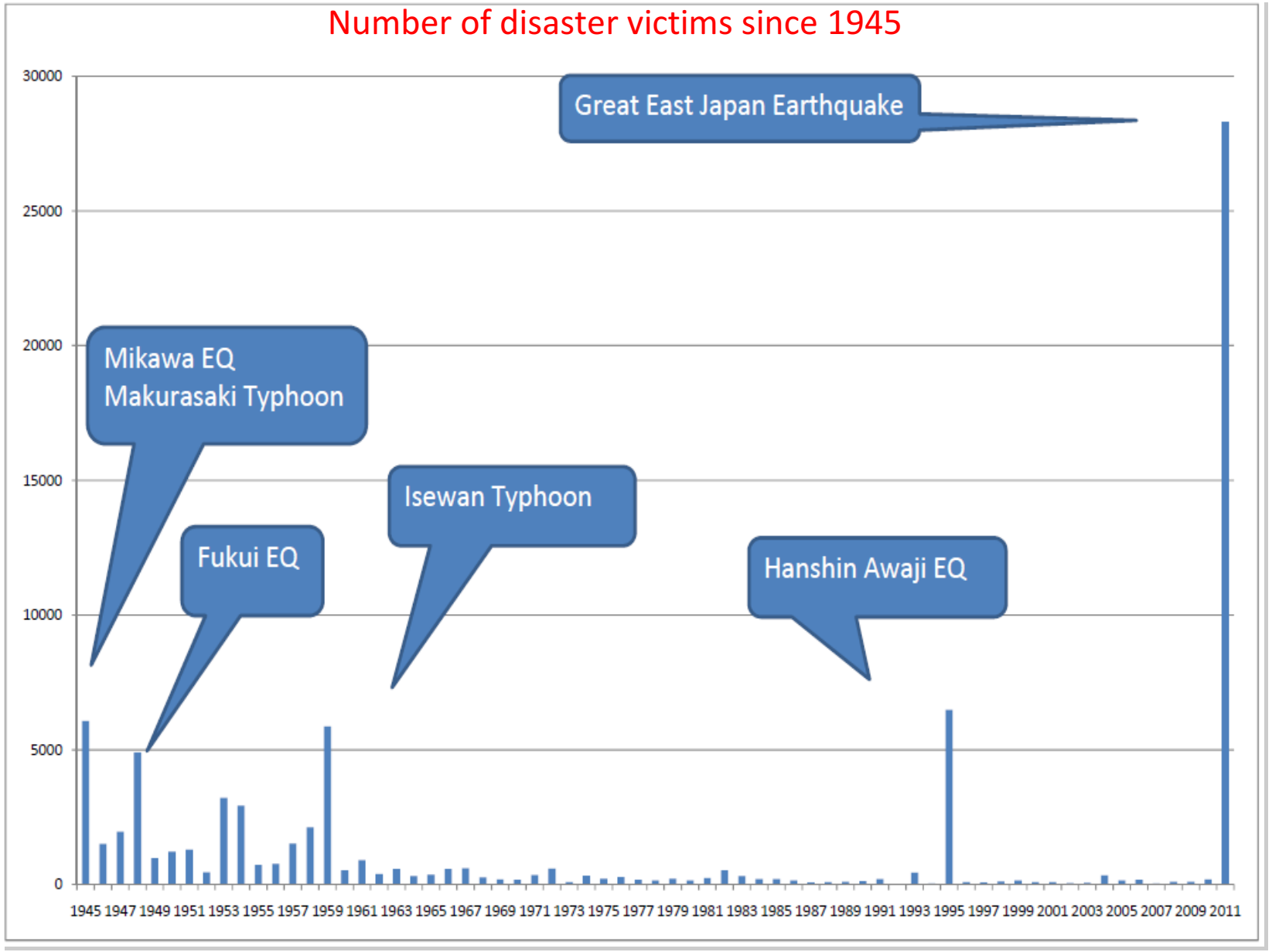

Great East Japan Earthquake
Atsushi Koresawa
Asian Disaster Reduction Center

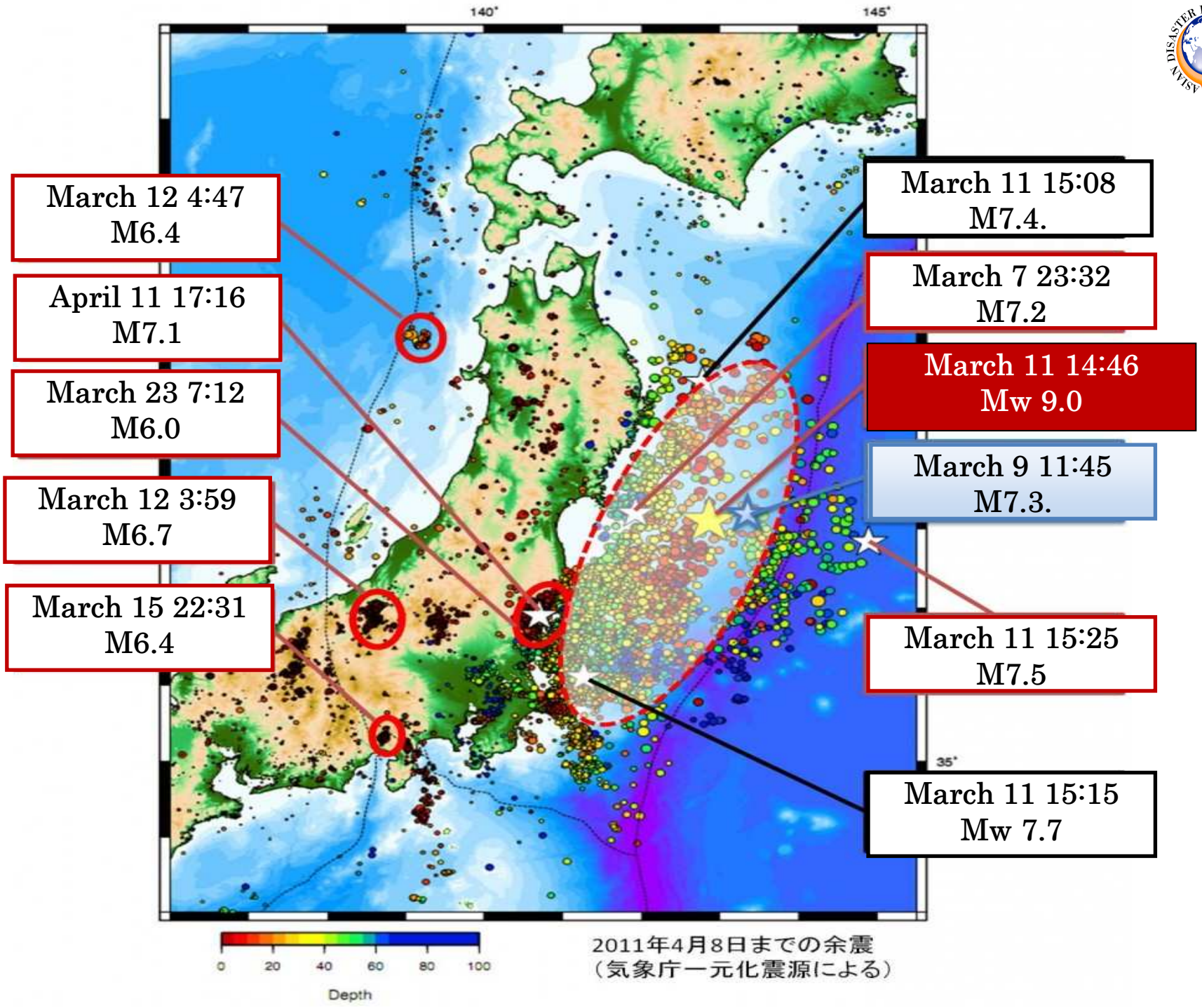
The worst disaster in Japan



March 11 earthquake

Date and Time:	11 March 2011 at 14:46 JST (5:46 UTC)
Type of earthquake:	Plate-boundary earthquake on or near the Japan Trench subduction zone between the Pacific and North America plates
Hypocenter:	130km off the Pacific coast of the Tohoku region, 24 km deep
Magnitude:	Mw 9.0 (interim value, the fourth largest in the world since 1900 and largest in Japan since recording started 130 years ago)

Cf. 1960 Chile Earthquake Mw9.5
1964 Alaska Earthquake Mw9.2
2004 Sumatra Earthquake Mw9.2


140°
145°
35°
March 12 4:47
M6.4
April 11 17:16
M7.1
March 23 7:12
M6.0
March 12 3:59
M6.7
March 15 22:31
M6.4
March 11 15:08
M7.4.
March 7 23:32
M7.2
March 11 14:46
Mw 9.0
March 9 11:45
M7.3.
March 11 15:25
M7.5
March 11 15:15
Mw 7.7
0
20
40
60
80
100
Depth
2011年4月8日までの余震
（気象庁一元化震源による）

March 11
at Kamaishi City in Iwate Prefecture

Photos provided by Mr. Kozo Sawada

March 11 15:21 at Kamaishi City, photo by Mr. Kozo Sawada

March 11 15:21

March 11 15:21

March 1115:21

March 1115:21

March 1115:21

March 1115:21

March 1115:21

March 1115:21

March 1115:21

March 1115:21

March 11 15:32

March 1115:21

March 1115:21

March 1115:21

March 1115:21

March 1115:21

March 1115:21

March 1115:21

March 1115:21

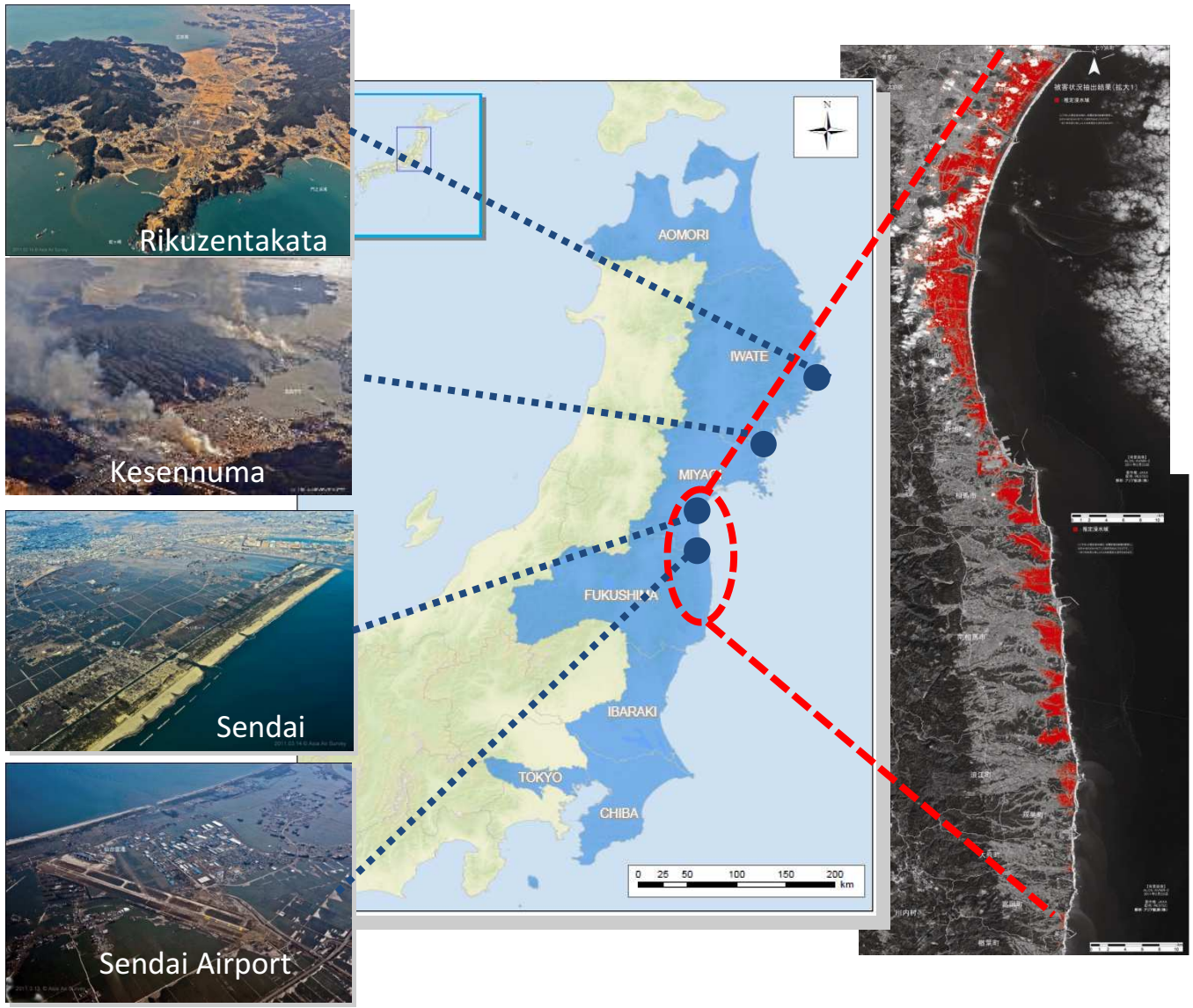
March 11 15:32

March 11 16:05

March 11 16:11

March 22 8:11

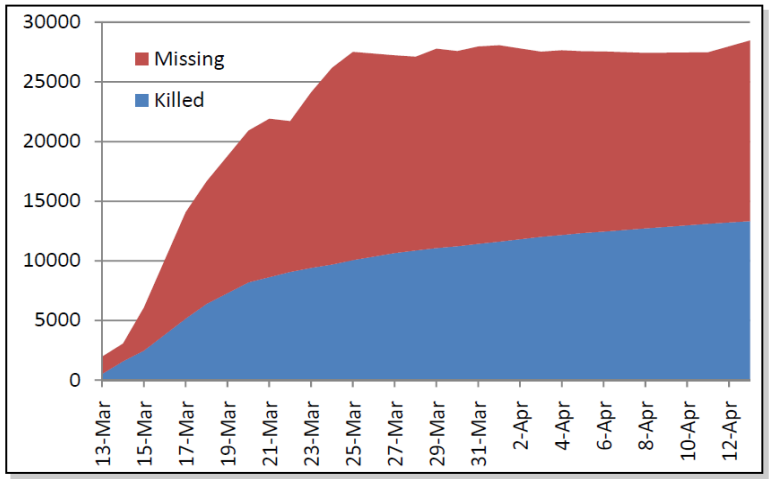
Tsunami affected coastal areas

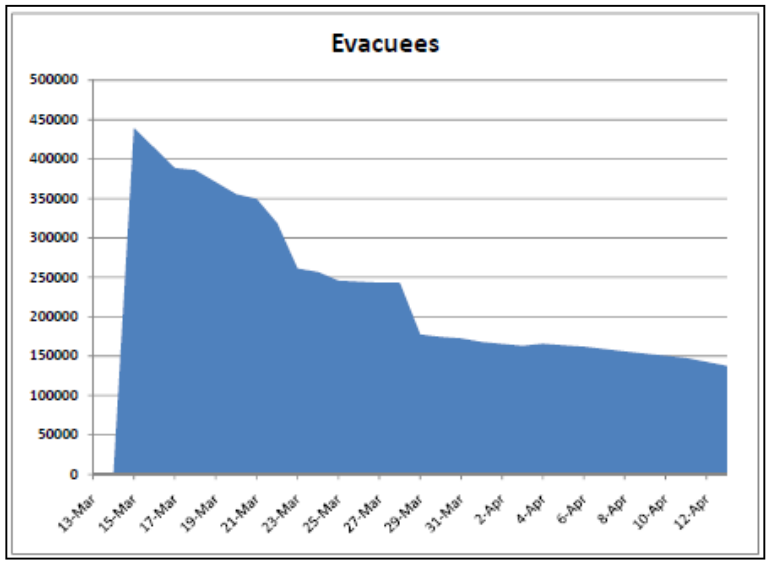


Human casualties

As of April 27

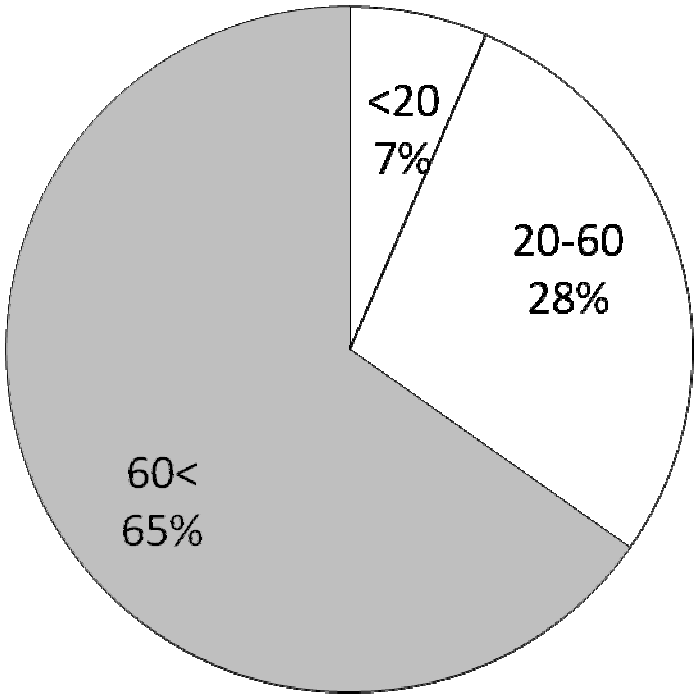
Prefecture	Killed	Missing	Evacuees
Iwate	4,234	3,479	41,521
Miyagi	8,745	6,694	40,701
Fukushima	1,455	1,275	26,429
Others	63	4	21,494
Total	14,508	11,452	130,145



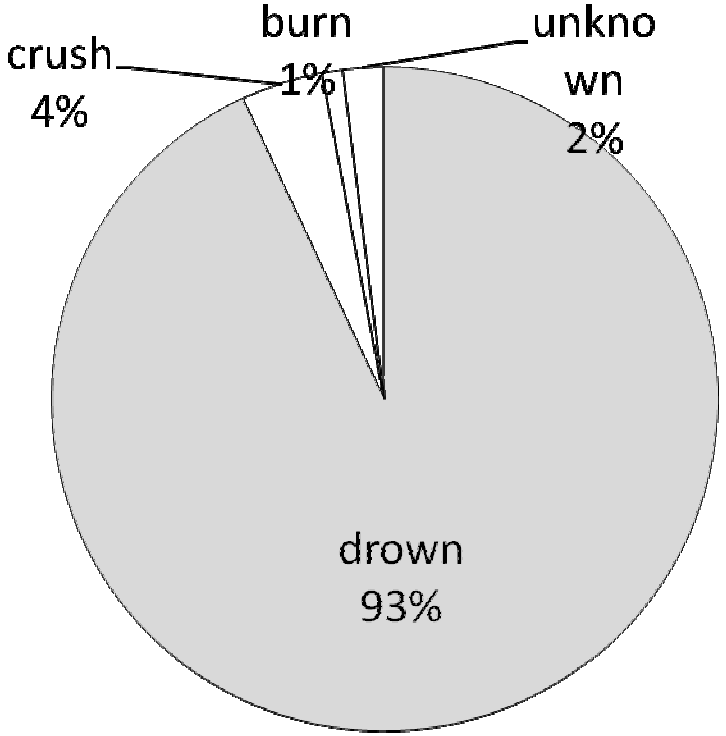


Human casualties

Casualties by age group



Casualties by cause of death



Economic damages

Cabinet Office estimate:

Damage of houses, factories and infrastructures in 7 prefectures

➡ **16 – 25 trillion JPY**

These figures do not cover the whole damage, such as damages to agricultural and fishing industries, lost profit due to disruption in supply chain, etc.

Prefecture		Damage (Billion JPY)	Damages/total assets (%)
Iwate	Inland areas	754	2.9
	Coastal areas	3,522	47.3
	Total	4,276	12.6
Miyagi	Inland areas	1,595	5.1
	Coastal areas	4,897	21.1
	Total	6,492	11.9
Fukushima	Inland areas	1,270	3.7
	Coastal areas	1,859	11.7
	Total	3,129	6.2
Ibaraki	Inland areas	993	2.1
	Coastal areas	1,483	6.8
	Total	2,476	3.6
Total	Inland areas	4,612	3.3
	Coastal areas	11,761	17.2
	Total	16,373	7.9

Typology of disaster affected areas

Type 1: *Functions are not severely affected*. These are cities or towns that suffered extensive damage but mostly in their coastal areas. Thus, the entire city or town can function relatively well;

Type 2: *Functions are partly paralyzed*. These are cities or town centers that were heavily damaged and their functions were partly paralyzed;

Type 3: *Functions are totally paralyzed*. These are cities or towns that were almost entirely devastated. Thus, their functions were totally paralyzed. Cities or towns of this type include those located in rather narrow land areas along sawtooth (ria) coastline.

Wakabayashi Ward, Sendai city
March 22

Ishinomaki City and Higashi-Matsushima City
March 22

Onagawa Town
March 22

Minami-Sanriku Town
March 22

Kamaishi City

Provided by Prof. Takashi Onishi, University of Tokyo

Kamaishi City

Provided by Prof. Takashi Onishi, University of Tokyo

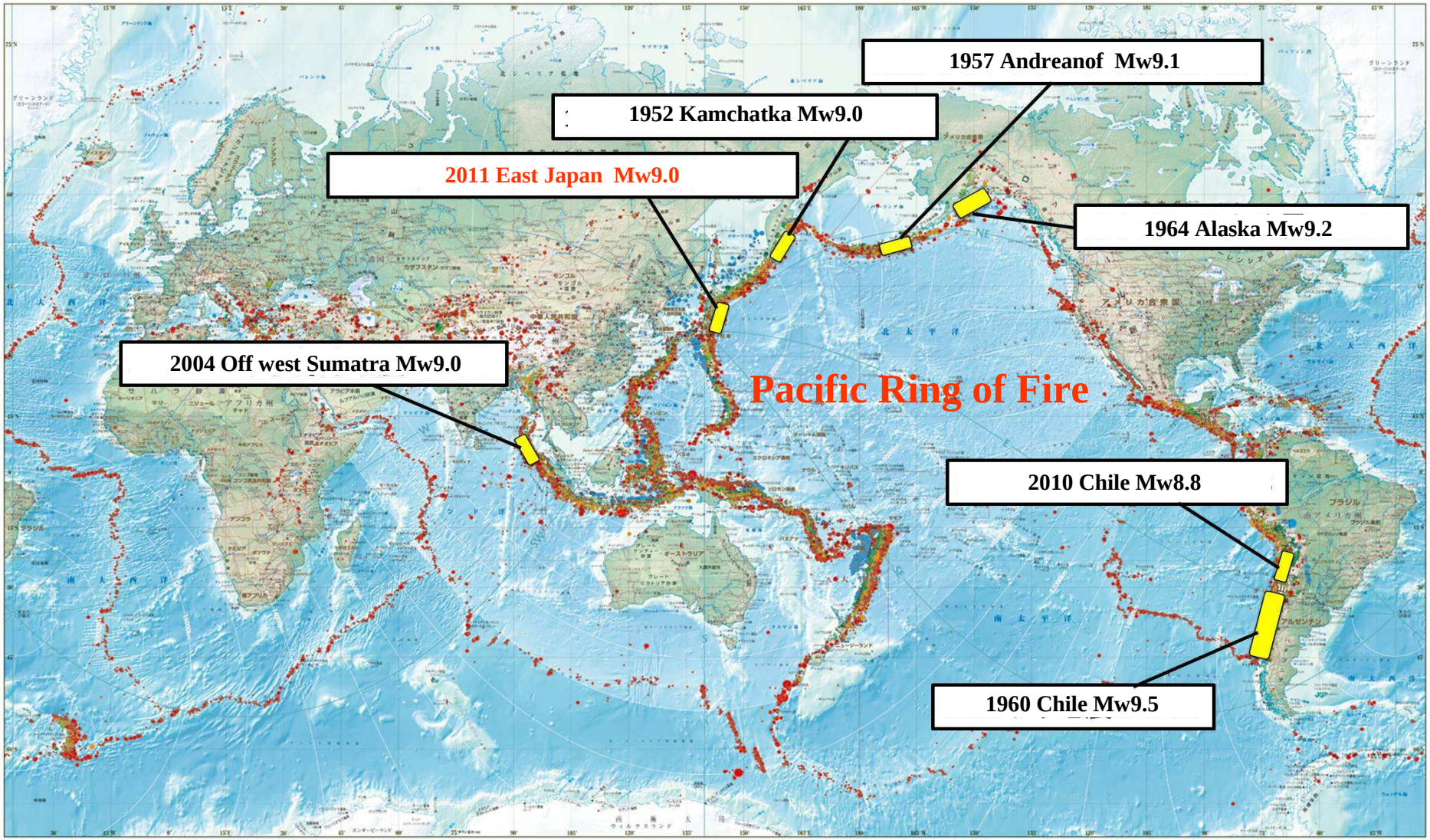
Rikuzen-Takata Town

Provided by Prof. Takashi Onishi, University of Tokyo

Rikuzen-Takata Town

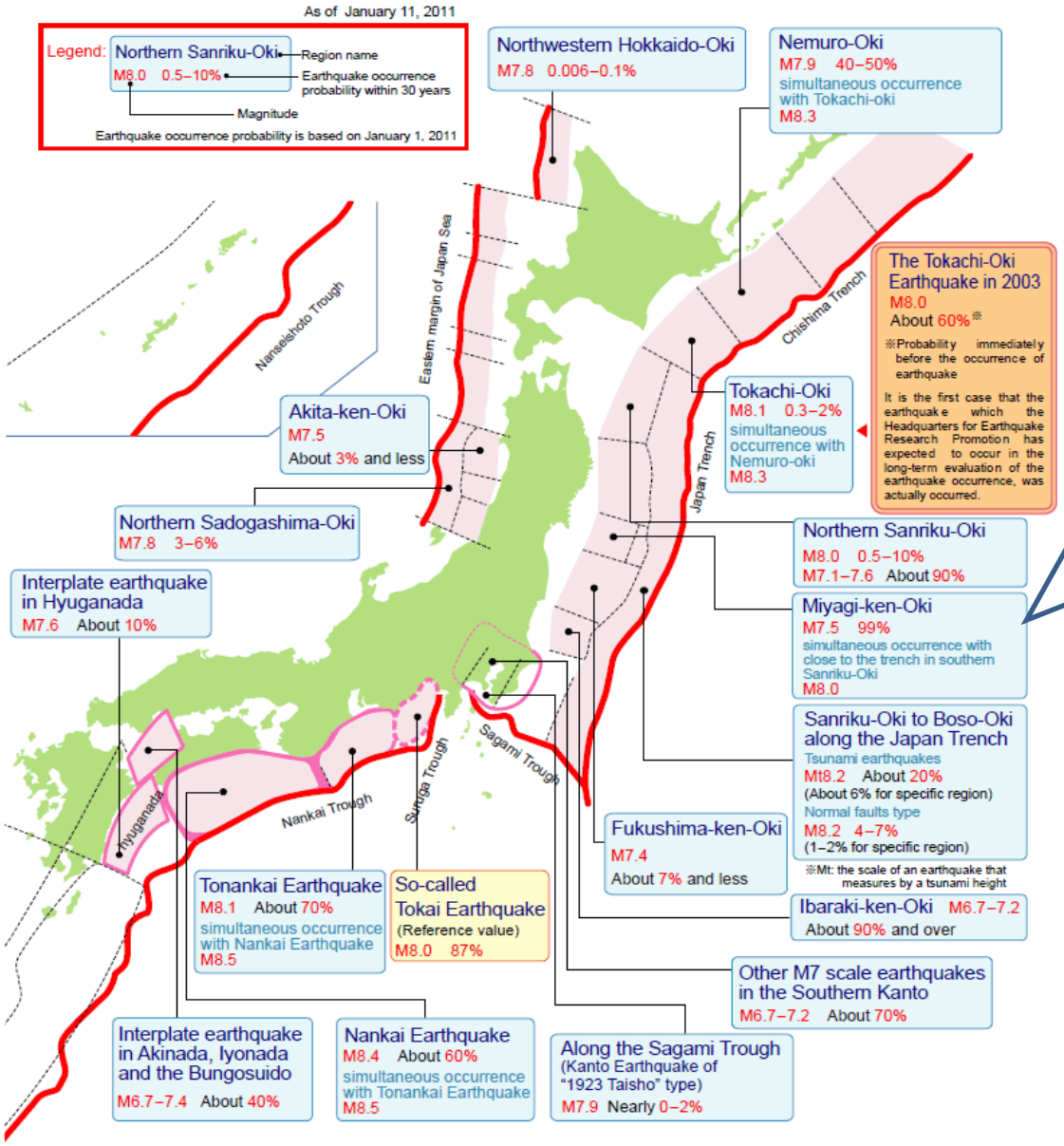
Provided by Prof. Takashi Onishi, University of Tokyo

Seismicity of the world



Source) ERI, University of Tokyo

Evaluation of subduction earthquakes

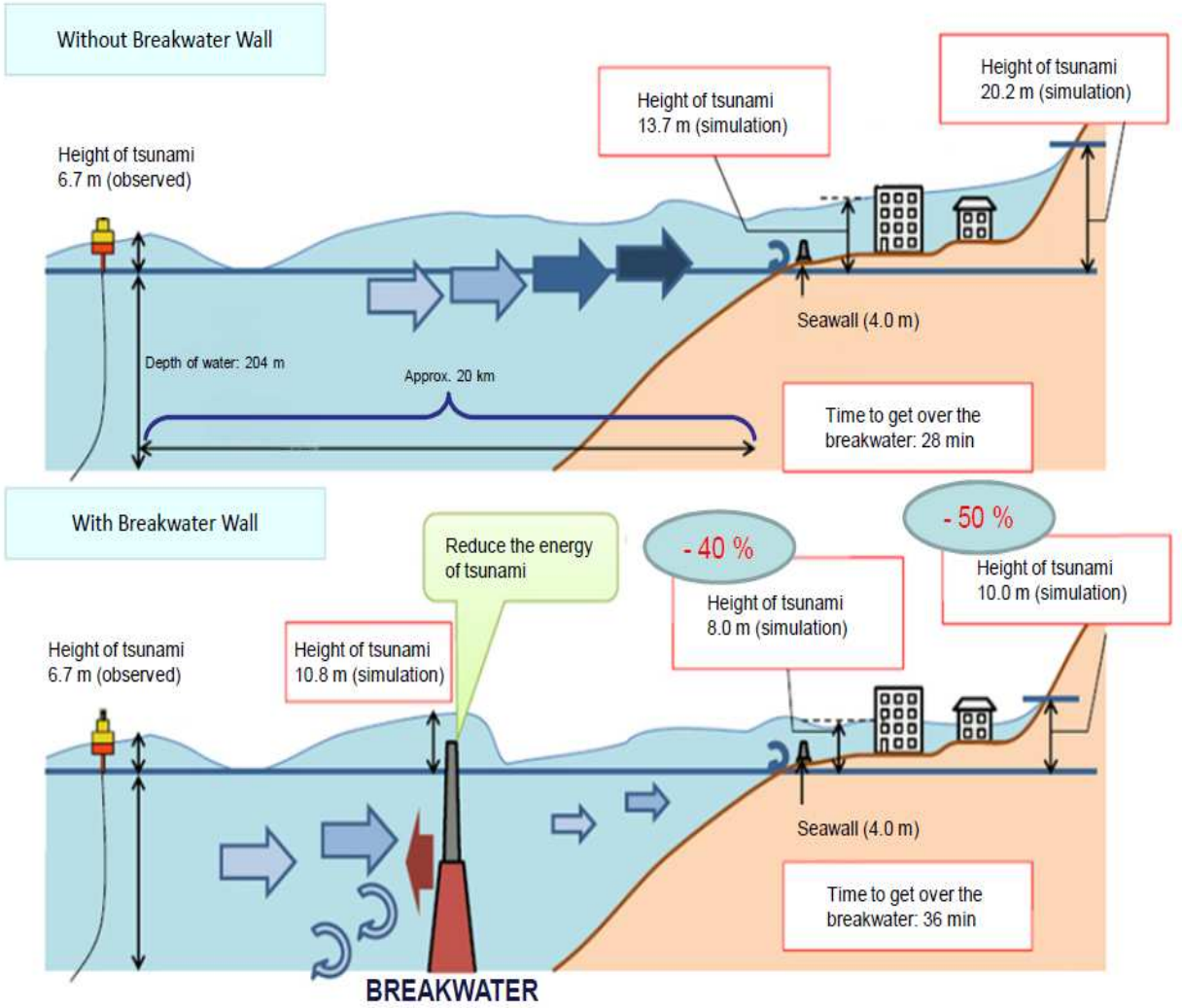


Miyagi-ken-Oki
M7.5 99%
simultaneous occurrence with the trench in southern Sanriku-Oki
M8.0

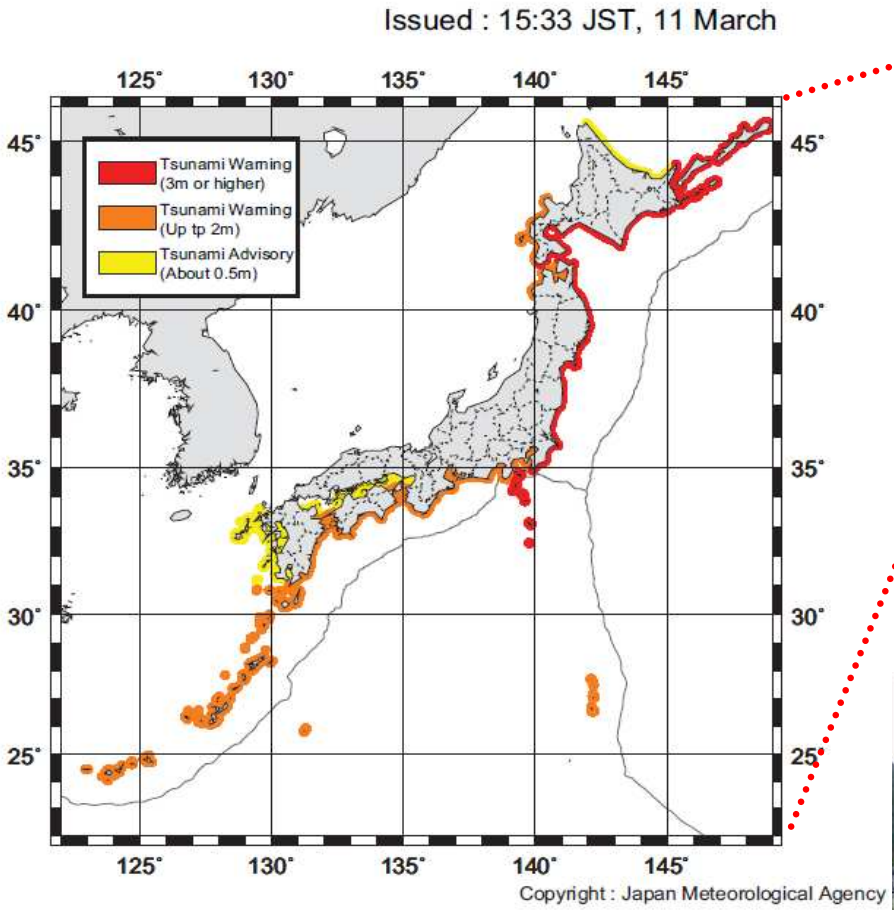
Structural measures
Evacuation building

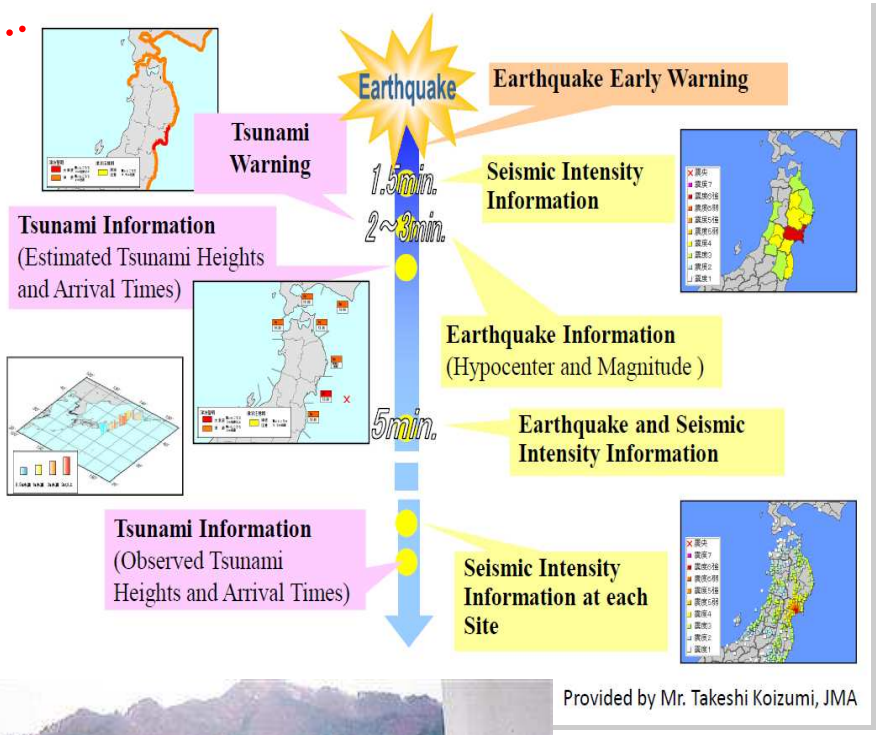
Structural measures
seawall, dyke, breakwater

Breakwater



Non-structural measures warning





Recovery and reconstruction

Evacuation centers
School gyms, community centers used for first 2,3 weeks

Temporary housing
Prefabricated houses build by government on public land for 2,3 years

Permanent housing
Public rental houses for those who have lost their homes

Alternatives

- Relocation to unaffected areas
- Hotels
- Public houses
- Private rental houses

Response to Great East Japan Earthquake

- The Parliament passed the first supplementary budget proposal of some 4 trillion JPY to the Diet on May 2.
- Prime Minister posted his message on newspapers overseas

"The government will dedicate itself to demonstrating to the world its ability to establish the most sophisticated reconstruction plans for East Japan, based on three principles: first, create a regional society that is highly resistant to natural disasters; second, establish a social system that allows people to live in harmony with the global environment; and third, build a compassionate society that cares about people, in particular, the vulnerable."

Response to Great East Japan Earthquake

The Extreme Disaster Management Headquarters established at 15:14 on March 11

The Nuclear Disaster Management Headquarters established on March 11

The Reconstruction Design Council was established to "deliver a blueprint for the reconstruction plan around the time of June" established on April 11

The Headquarters for Earthquake Research Promotion at MEXT (the Ministry of Education, Culture, Sports, Science and Technology)

To promote research into earthquakes with the goal of strengthening disaster prevention measures, particularly for the reduction of damage and casualties from earthquakes .

The Central Disaster Management Council at Cabinet Office

To promote comprehensive disaster countermeasures including deliberating important issues on disaster reduction according to requests from the Prime Minister or Minister for Disaster Management

Extreme Disaster Management Headquarters

Issues to be dealt with

✓Measures to assist the lives of disaster victims

✓Recovery in the affected areas;

✓The legal aspects regarding disaster waste disposal;

✓Facilitation of disaster waste disposal

✓The promotion of employment and job creation for disaster victims

✓The promotion of supplying houses for disaster victims

平成23年宮城県沖を震源とする地震緊急災害対策本部

平成23年宮城県沖を震源とする地震緊急災害対策本部で発言をする菅総理1

The Headquarters for Earthquake Research Promotion

地震調査研究推進本部
The Headquarters for Earthquake Research Promotion

Go to Japanese Page

March 11, 2011
Earthquake Research Committee,
Headquarters for Earthquake Research Promotion

The 2011 off the Pacific Coast of Tohoku Earthquake

* On March 11 at 14:46 (JST), there was a M8.8 (preliminary) earthquake at a depth of approximately 25km, off-shore of Sanriku. This event had a maximum seismic intensity 7 observed in Miyagi prefecture. This earthquake caused large tsunamis on the Pacific coast from the Hokkaido, Tohoku and Kanto regions, with tsunami heights over 7.3m in Soma, of 4.2m in Oarai, and over 4.1m in Kamaishi.

* The focal mechanism showed a reverse fault with a compression axis in a WNW-ESE direction. This event occurred on the boundary between the Pacific and the continental plates.

* The maximum aftershock was a M7.5 (preliminary) one that occurred at 15:08 on March 11, as of 18:00 on March 11. There were three earthquakes of M7.0 or over, off-shore of the Pacific coast from Iwate through Ibaraki prefectures.

* According to the GPS data, crustal movements associated with this event were observed and there were movements of approximately 4m toward the east-southeast at the Kahoku observation point (Miyagi prefecture).

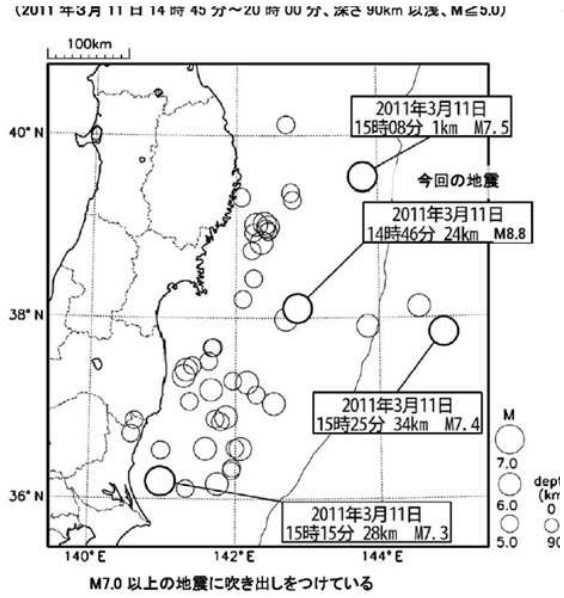
* The magnitude of the main shock, M8.8, is the largest in Japan. There is fear that large aftershocks will hereafter occur.

* It is thought that the hypocenter area extends widely from the region off-shore of Iwate to Ibaraki prefectures. The Earthquake Research Committee evaluated earthquake motion and tsunami for the individual region off-shore of Miyagi prefecture, to the east off-shore south of Sanriku along the trench, and to the south off-shore of Ibaraki prefecture, but occurrence of the earthquake that is linked to all of these regions is out of hypothesis.

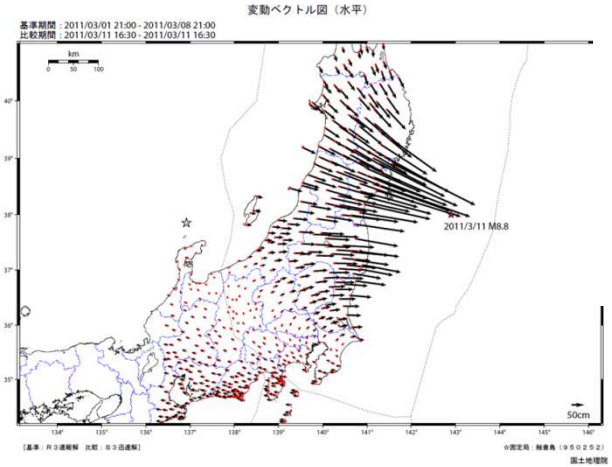
- Aftershock Distribution
- Seismic Intensity
- Distribution of Tsunami Heights
- The Focal Mechanism (CMT solution) for the 2011 off the Pacific Coast of Tohoku Earthquake
- Deformation Vectors (Horizontal Components)
- Deformation Vectors (Horizontal Components)
- Deformation Vectors (Vertical Components)
- Deformation Vectors (Vertical Components)
- Regions Off-shore North of Sanriku to Off-shore of Boso-Peninsula Associated with Evaluation by the Earthquake Research Committee

The Headquarters for Earthquake Research Promotion

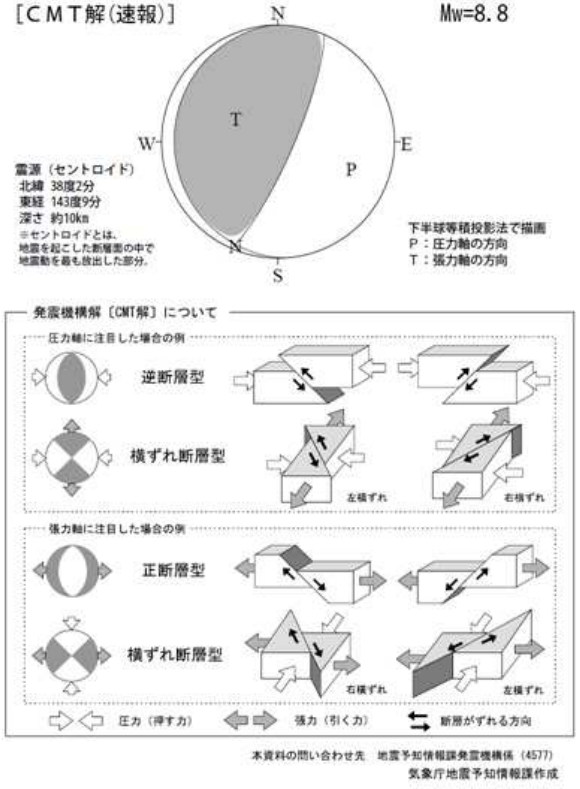
Aftershock Distribution



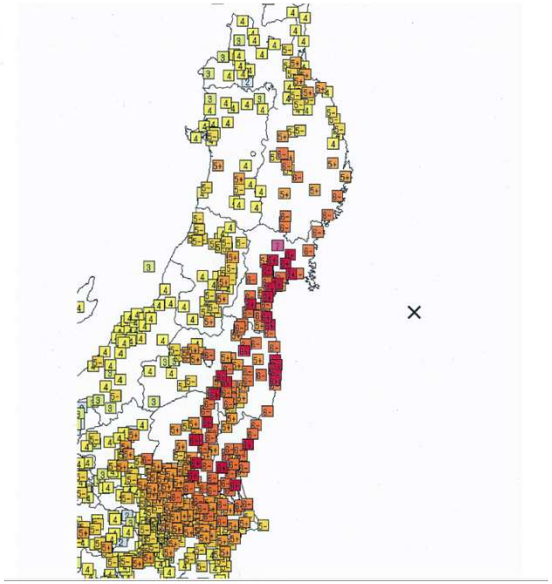
Deformation Vectors (Horizontal Components)

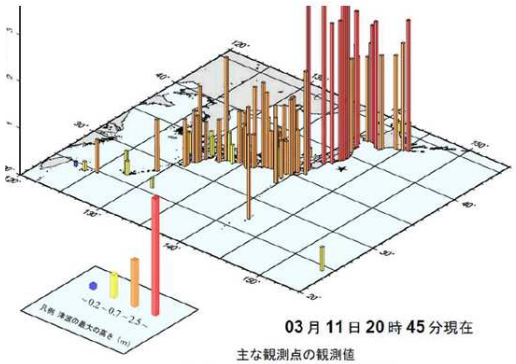


The Focal Mechanism (CMT solution) for the 2011 off the Pacific Coast of Tohoku Earthquake



Seismic Intensity





主な観測点の観測値

	第一波			最大波		
相馬	11日 14時 55分	押し	0.3m	11日 15時 50分	7.3m	以上
大洗	11日 15時 15分	押し	1.8m	11日 16時 52分	4.2m	以上
宮古	11日 14時 48分	押し	0.2m	11日 15時 21分	4.0m	以上
釜石	11日 14時 45分	引き	0.1m	11日 15時 21分	4.1m	以上
大船渡	11日 14時 46分	引き	0.2m	11日 15時 15分	3.2m	以上
石巻市鮎川	11日 14時 46分	押し	0.1m	11日 15時 20分	3.3m	以上
むつ市関根浜	11日 15時 20分	引き	0.1m	11日 18時 16分	2.9m	
根室市花咲	11日 15時 34分	引き	微弱	11日 15時 57分	2.8m	
浦河	11日 15時 19分	引き	0.2m	11日 16時 42分	2.7m	
宮小牧東港	11日 15時 40分	引き	0.2m	11日 16時 17分	2.5m	

気象庁作成

The Central Disaster Management Council

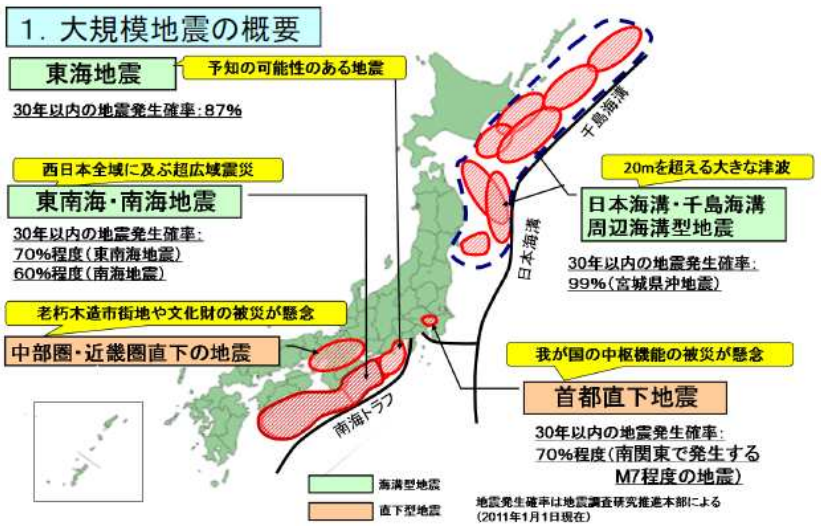
A meeting was held on 27 April and

Decided to establish a committee for technical investigation:

✓ to analyze the mechanism of the March 11 earthquake and resultant tsunami, and its impact;

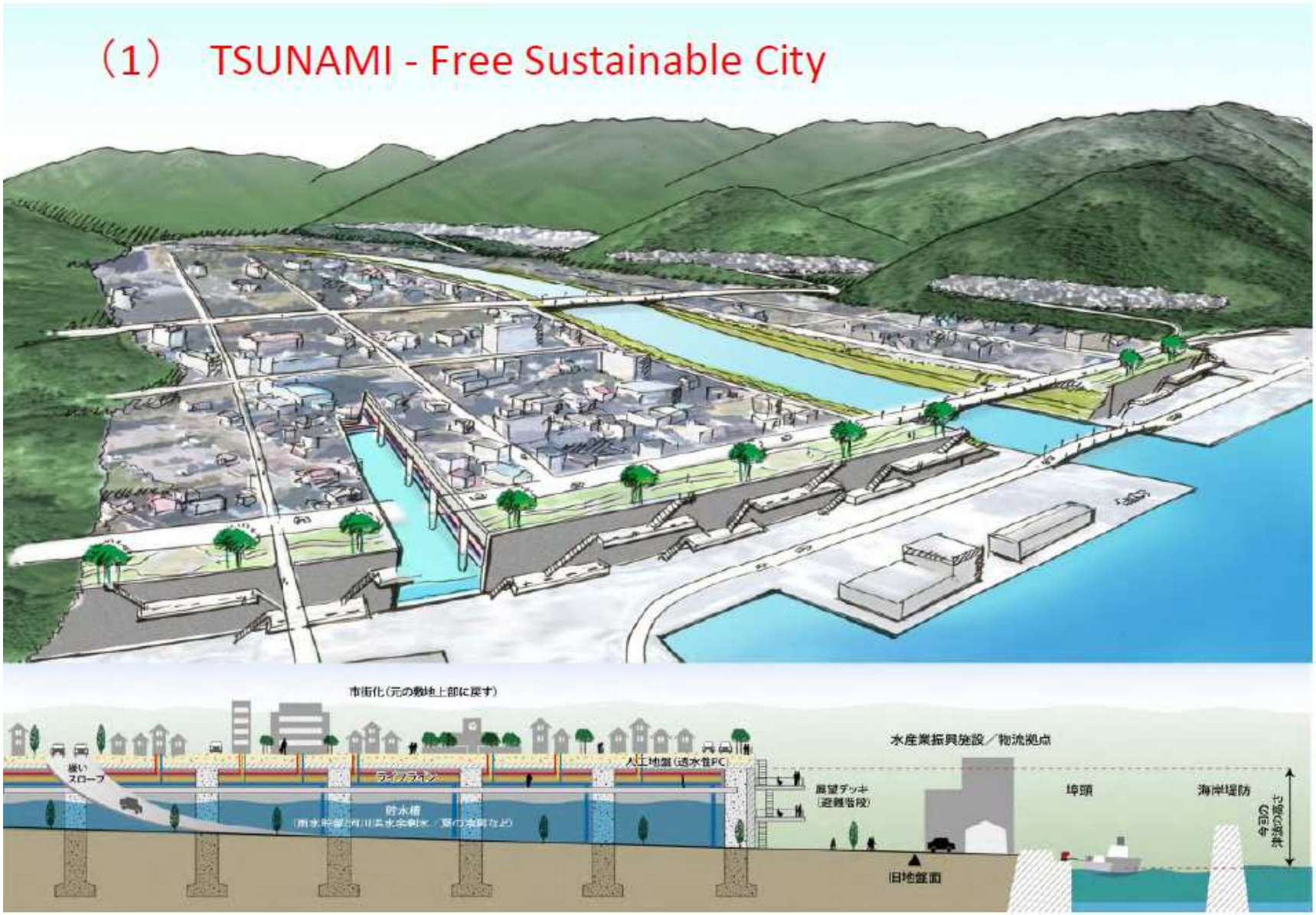
✓to investigate necessary measures for future mega disasters, in particular, (1) methods to estimate seismic activities, and: (2) methods to assess damages.

The result of investigation will be used to improve government's DM plans and policies



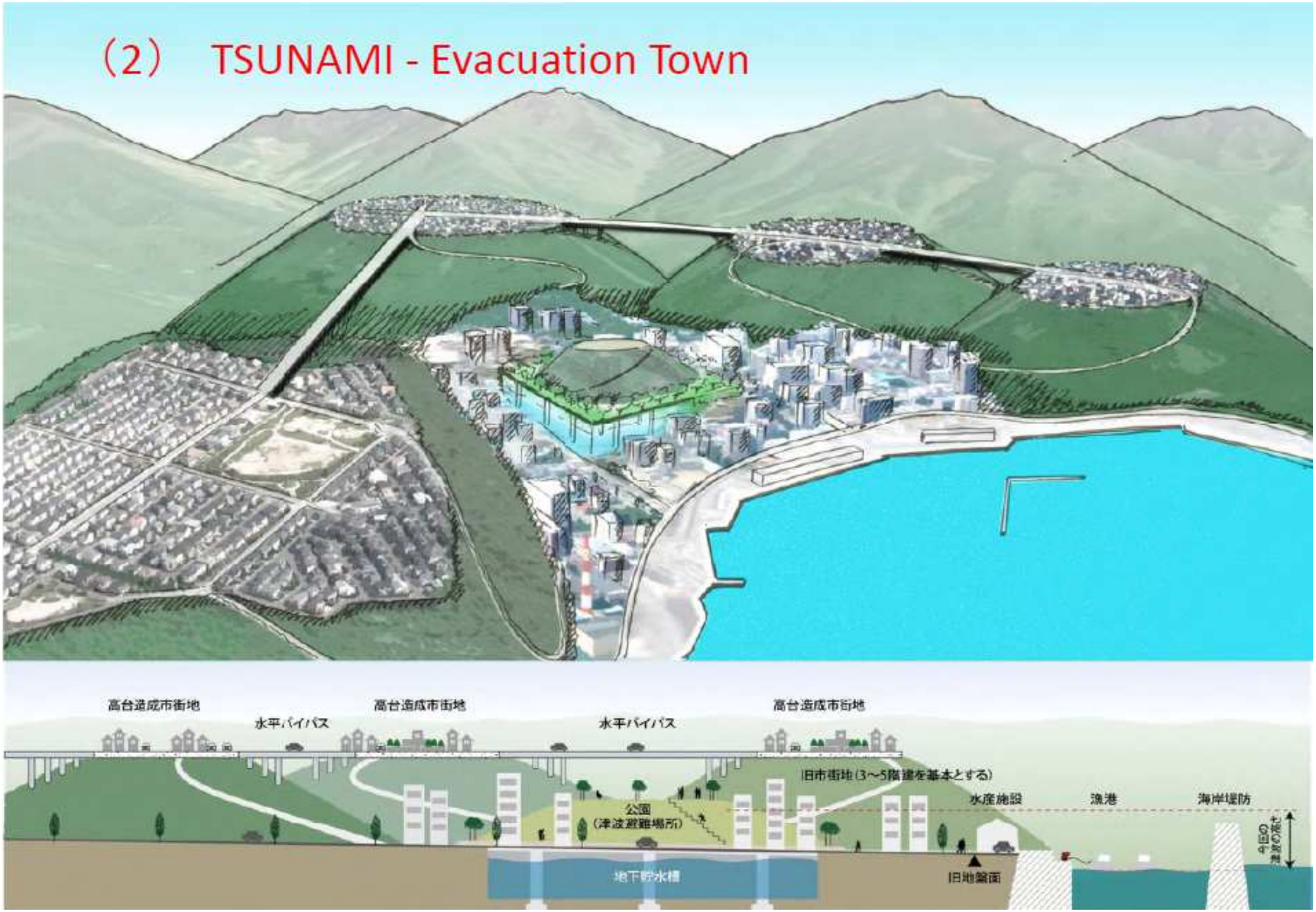
Reconstruction Image

presented by Prof. Yoshiaki Kawata, member of the Council



Reconstruction Image

presented by Prof. Yoshiaki Kawata, member of the Council



Reconstruction Image

presented by Prof. Yoshiaki Kawata, member of the Council

Way forward

- ✓ Provision of relief goods to the evacuees (e.g. food, clothing, toilets, medical treatment, bathing, etc.)
- ✓ To restore basic infrastructure and public services (e.g. local transport network, schools, electricity, fuel, etc.);
- ✓ Shelter, Jobs security and cash income
- ✓ Rebuilding disaster stricken areas and regeneration of indigenous industries and regional economy
- ✓ What worked and what did not, why?
- ✓ To prepare for the next, “unexpected” event

ADRC and IRP in cooperation with UN and other partners will organize an expert group meeting in Tokyo on May 30-31 back to back with a field visit on May 29

Thank you for your attention

For more details, please visit Japan booth
at the Market Place

Also, a brief report is available
at ADRC's web-site
http://www.adrc.asia/index.php

Also, a brief report is available at ADRC's web-site http://www.adrc.asia/index.php