Asia-Pacific
Economic Cooperation

2011/EPWG/WKSP2/003

Earthquake and Tsunami Disaster in Japan – Experience and Lessons

Submitted by: Asian Disaster Reduction Center (ADRC)

APEC USA 2011

Workshop on Facing Abnormal Flood Disaster: New Vision for APEC Economies
Da Nang, Viet Nam
28-29 July 2011

Earthquake and Tsunami disaster in Japan – Experience and Lessons

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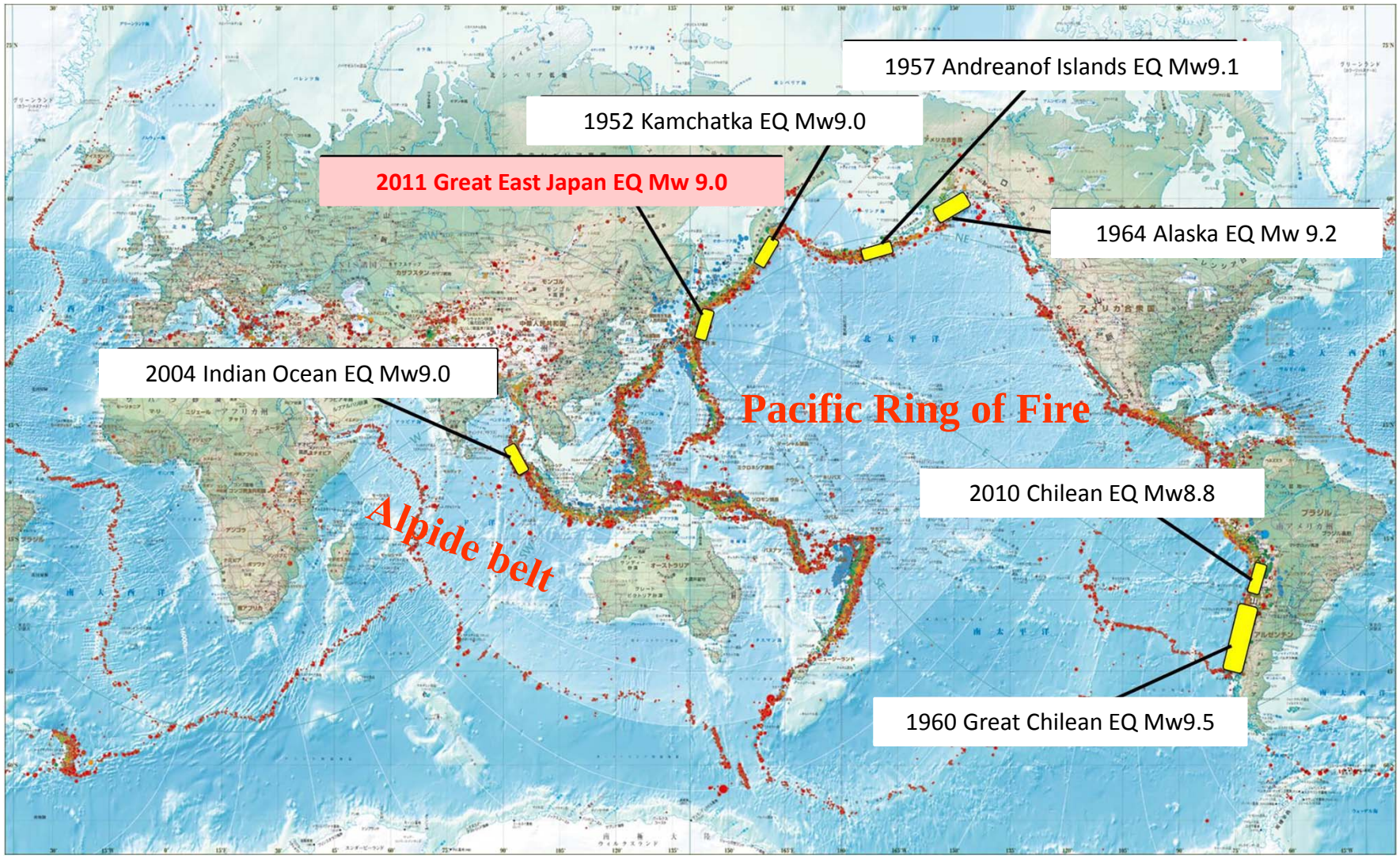
Asian Disaster Reduction Center

World's Mega Earthquakes in History



Earthquake Research Institute, University of Tokyo

The earthquake and Tsunami

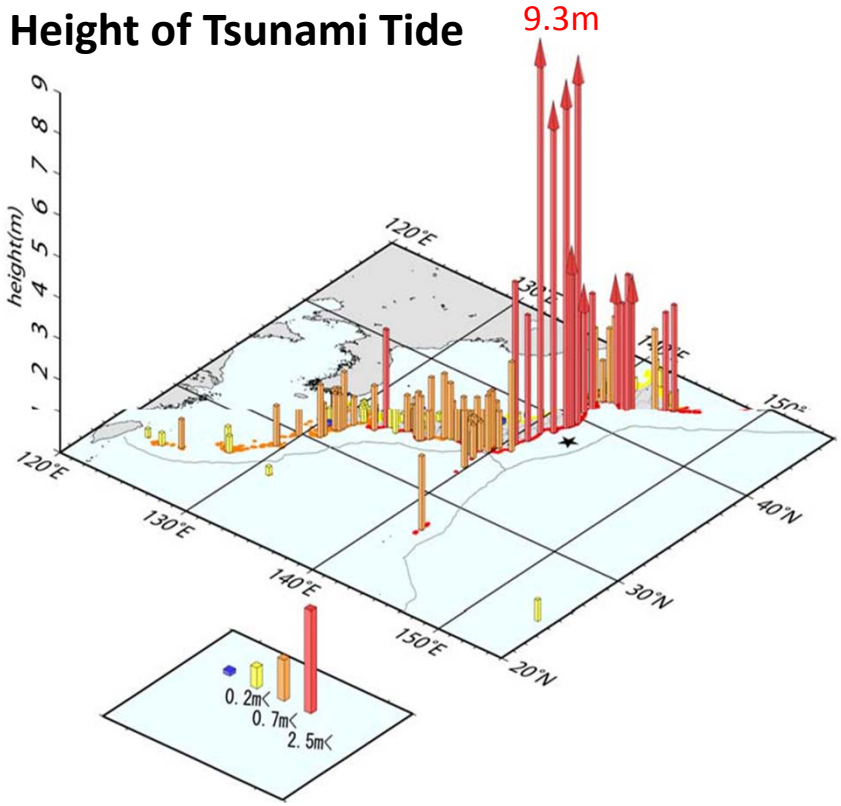
Date and Time:

11 March 2011 at 14:46 JST (5:46 GMT)

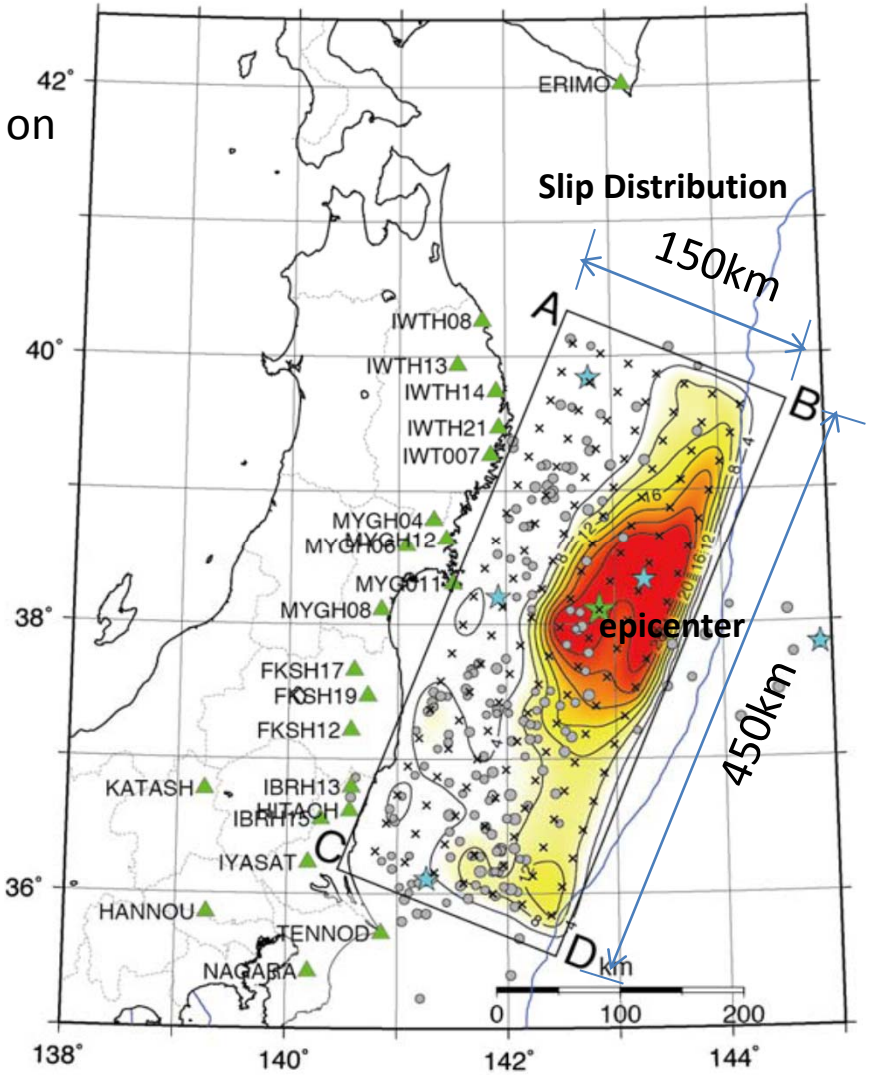
Type of earthquake:

Plate-boundary thrust-faulting earthquake on or near the Japan Trench subduction zone

Height of Tsunami Tide



※Maximum Run-up height 40.5m

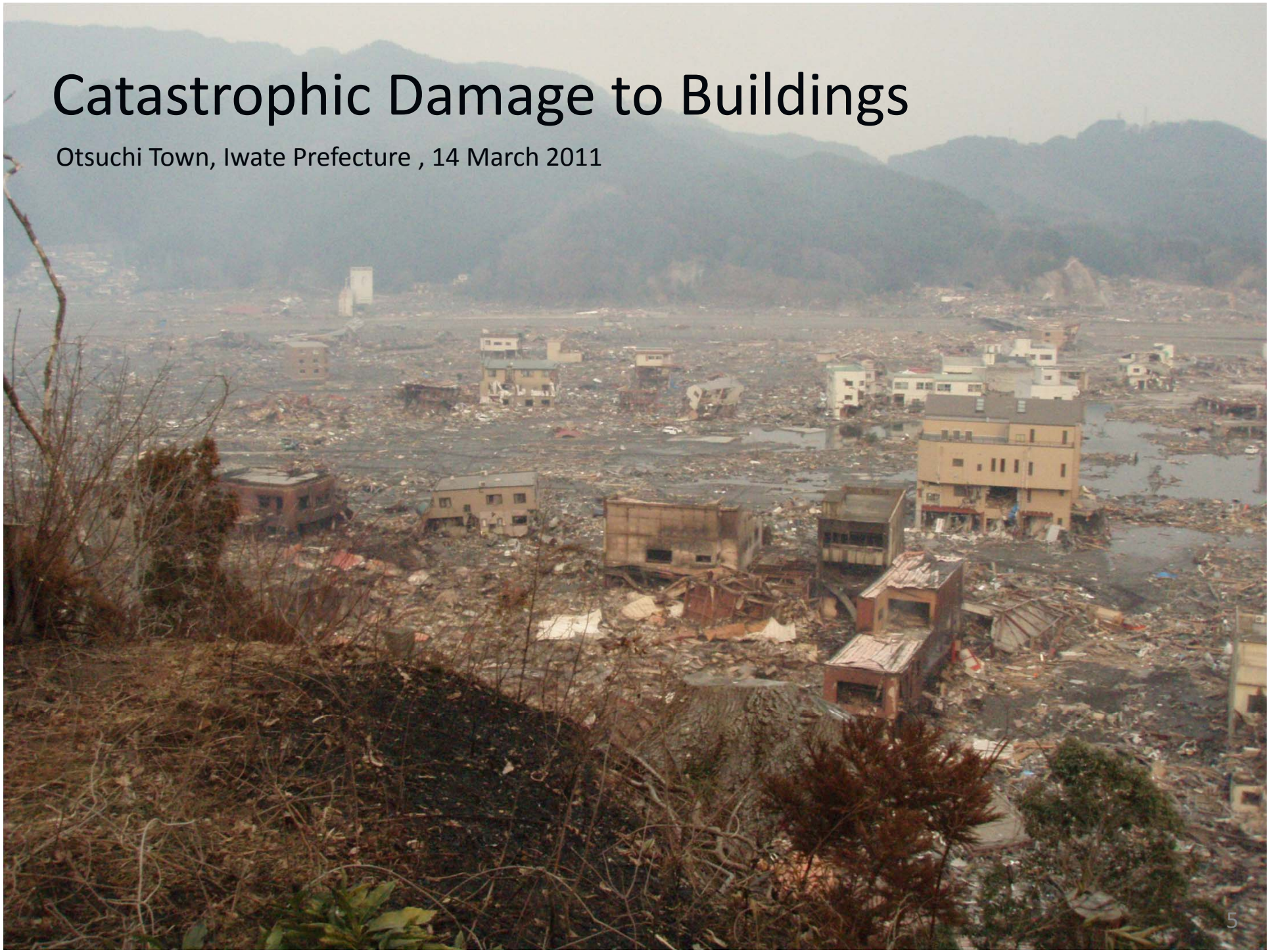


The Tsunami Surpassed Dykes

Miyako City, Iwate Prefecture, 11 March 2011

Photo Taken at Miyako City, Miyagi Prefecture
Courtesy of Tarocho Fisheries Cooperative Association

Catastrophic Damage to Buildings



Otsuchi Town, Iwate Prefecture , 14 March 2011

Widespread Inundation

Aerial Photo around Iwate Prefecture, 12 March 2011

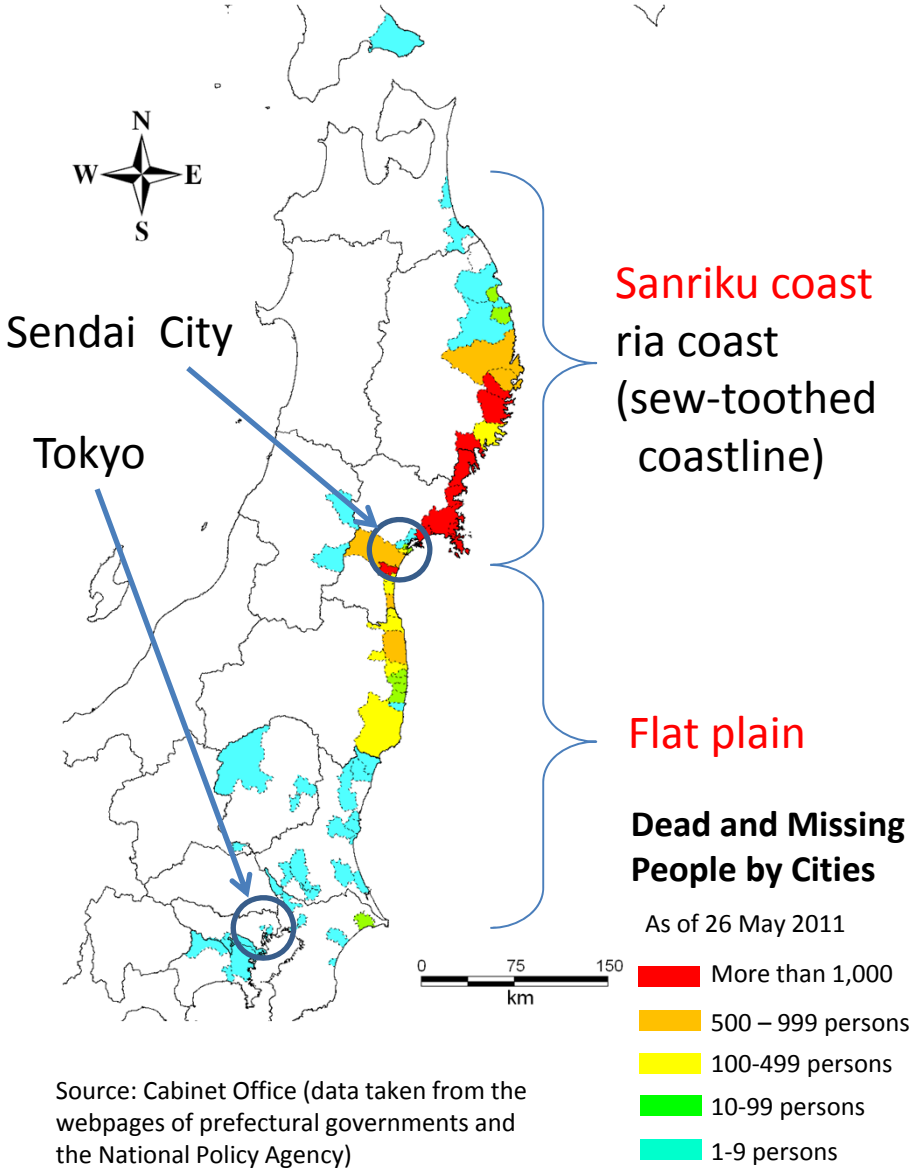
Casualties and Damages

As of 5 July 2011

- 15,534 people confirmed dead and 7,092 people missing
- 111,044 buildings completely destructed, approx. 400 thousand buildings half or partially destroyed
- 561 square kilometers inundated
- Damages to stock in 7 prefectures estimated: 17 trillion JPY (211 billion US$)

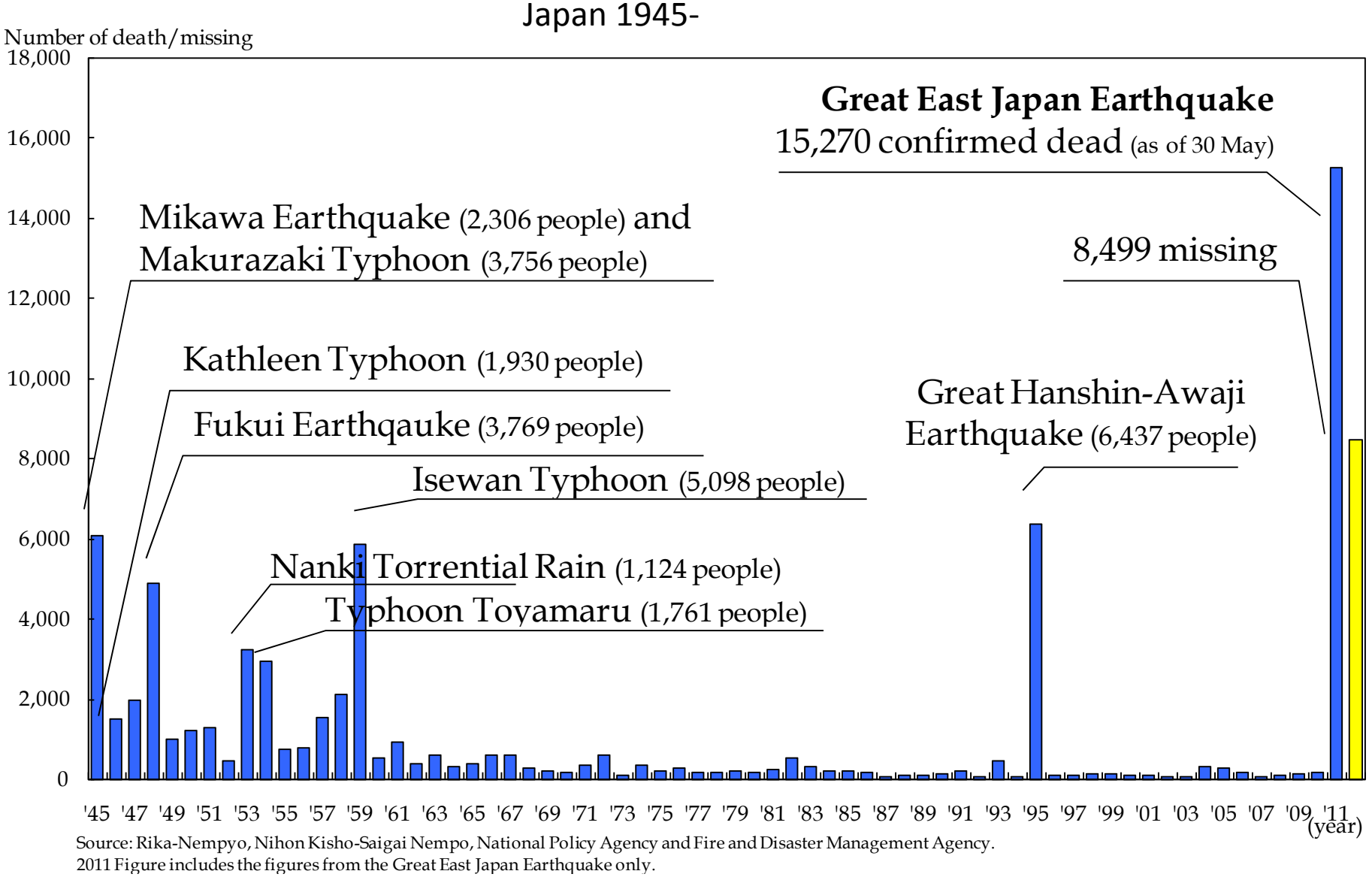
  c.f. Hurricane Katrina 125 billion US$

  Kobe earthquake 100 billion US$



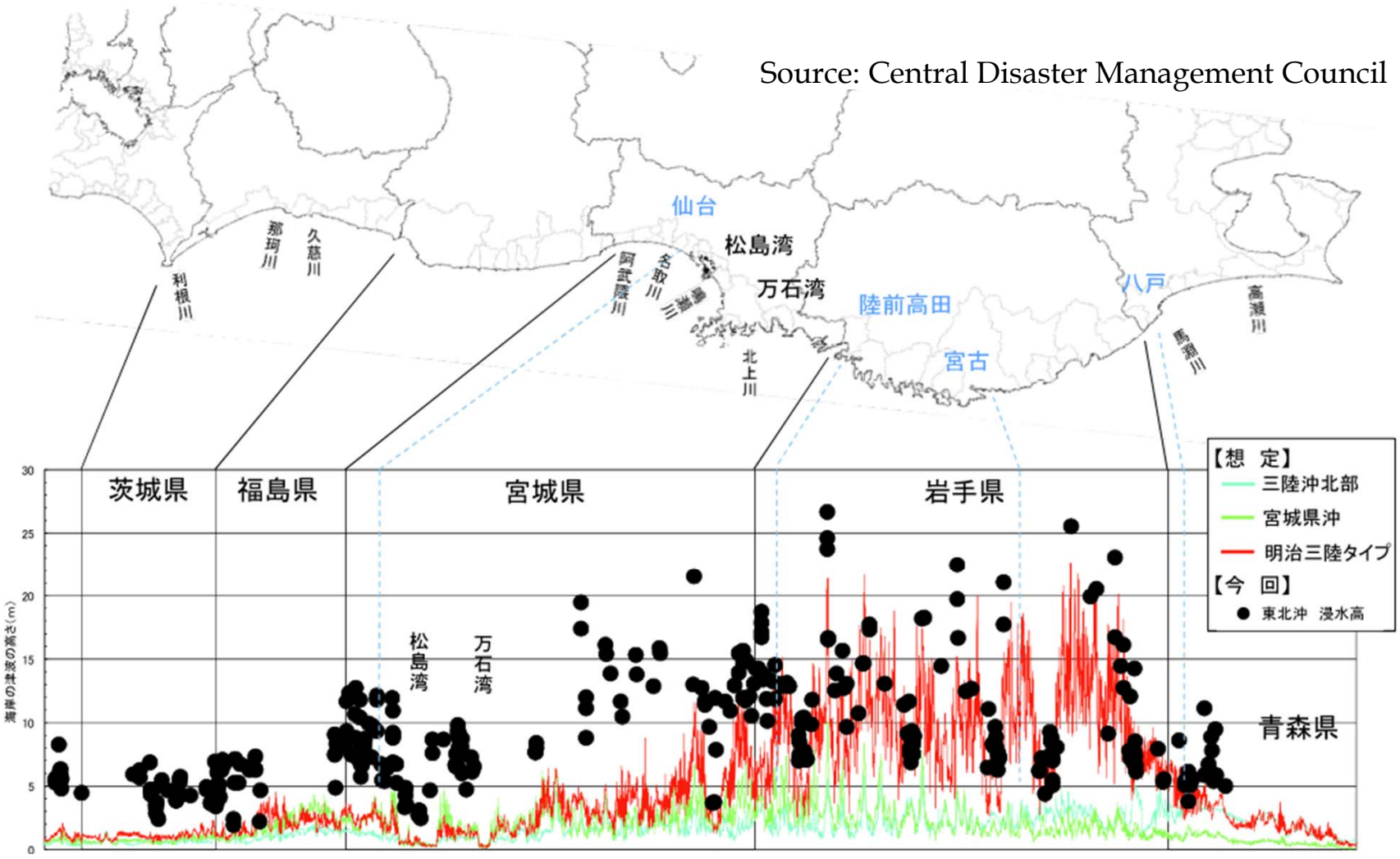
Source: Cabinet Office (data taken from the webpages of prefectural governments and the National Policy Agency)

The Death Toll Diminishes Past Disasters



Source: Rika-Nempyo, Nihon Kisho-Saigai Nempo, National Policy Agency and Fire and Disaster Management Agency.
2011 Figure includes the figures from the Great East Japan Earthquake only.

Review Damage Projections



Large difference in projected and actual height of tsunami

Structural measures
seawall, dyke, breakwater

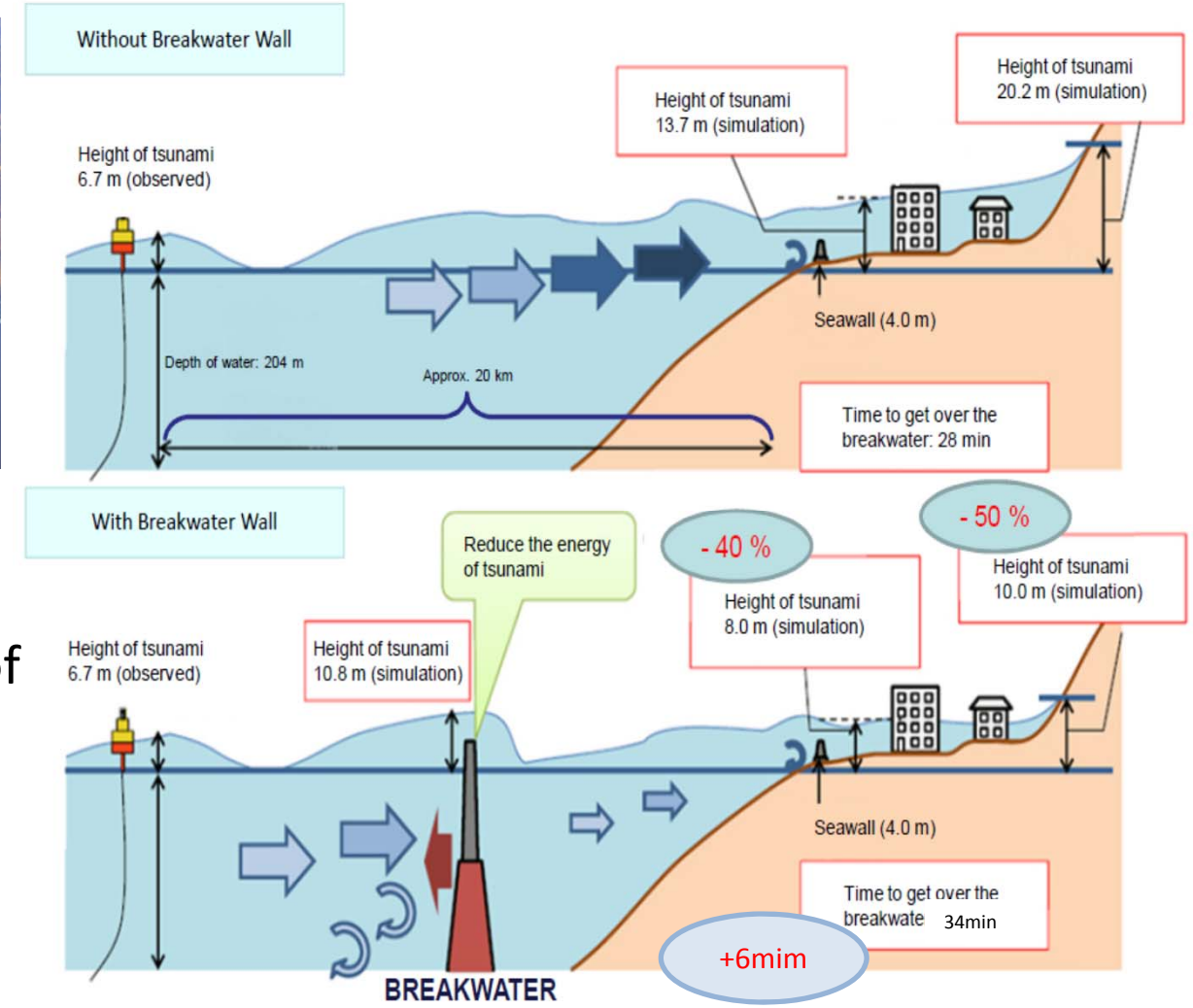
Hachinohe Port Breakwater

Shiogama Port Breakwater

Taneichi Seashore Dyke

Source: Central Disaster Management Council

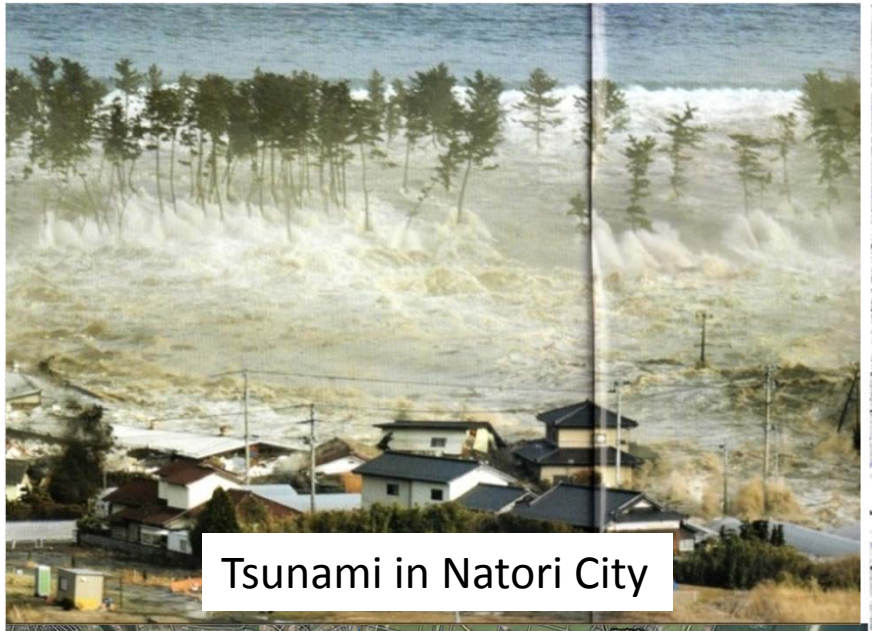
Structural measures
seawall, dyke, breakwater



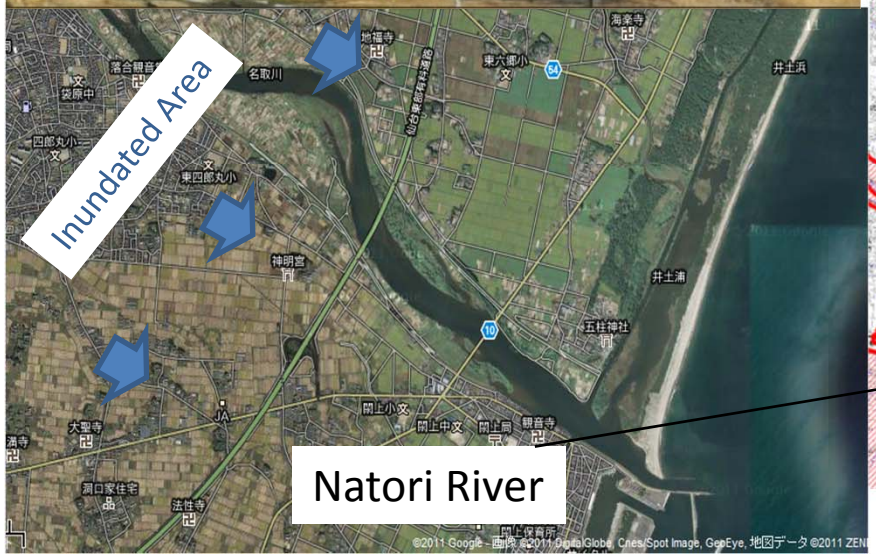
It has been reported that breakwater at the mouth of Kamaishi Bay delayed the arrival of and reduced the forces of tsunami waves greatly.

Source: Central Disaster Management Council

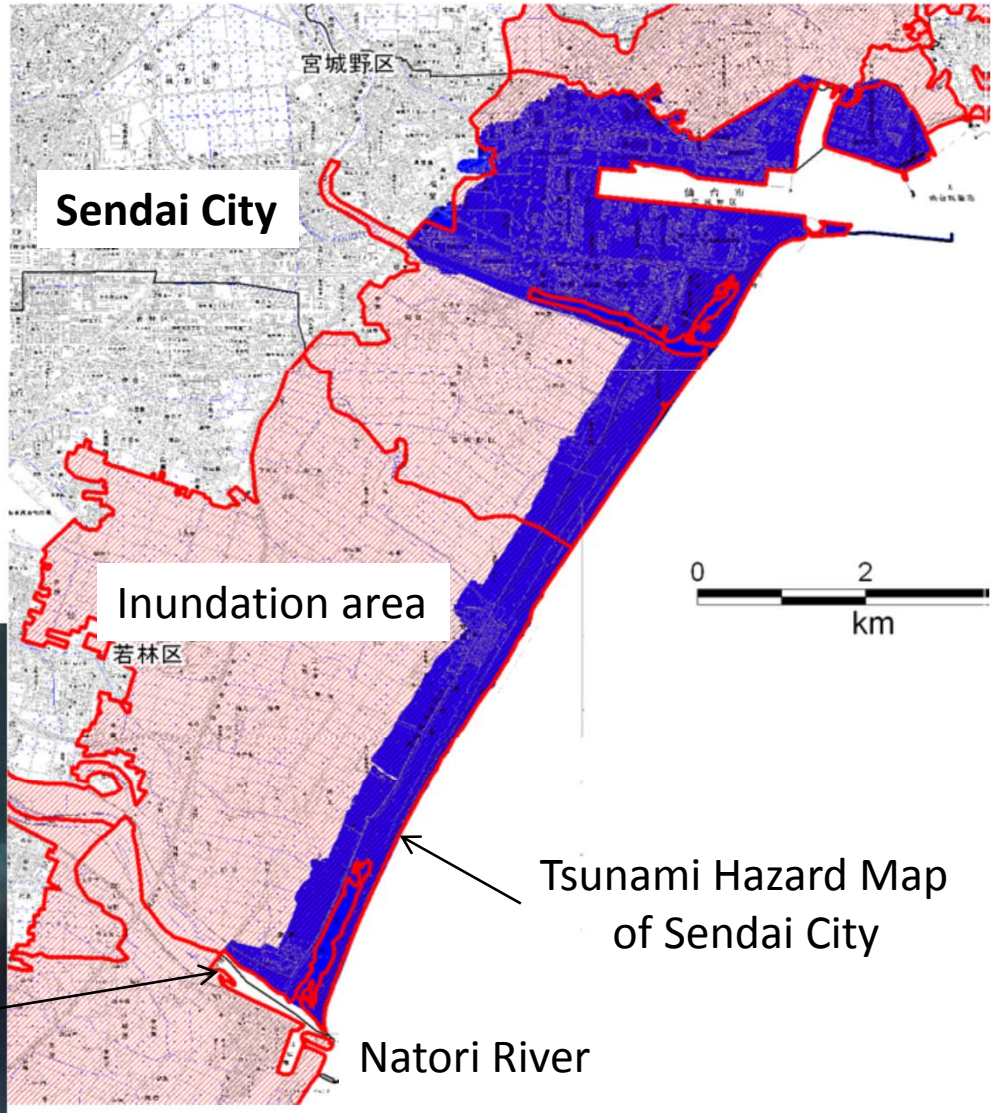
Inundation area and hazard map



Tsunami in Natori City

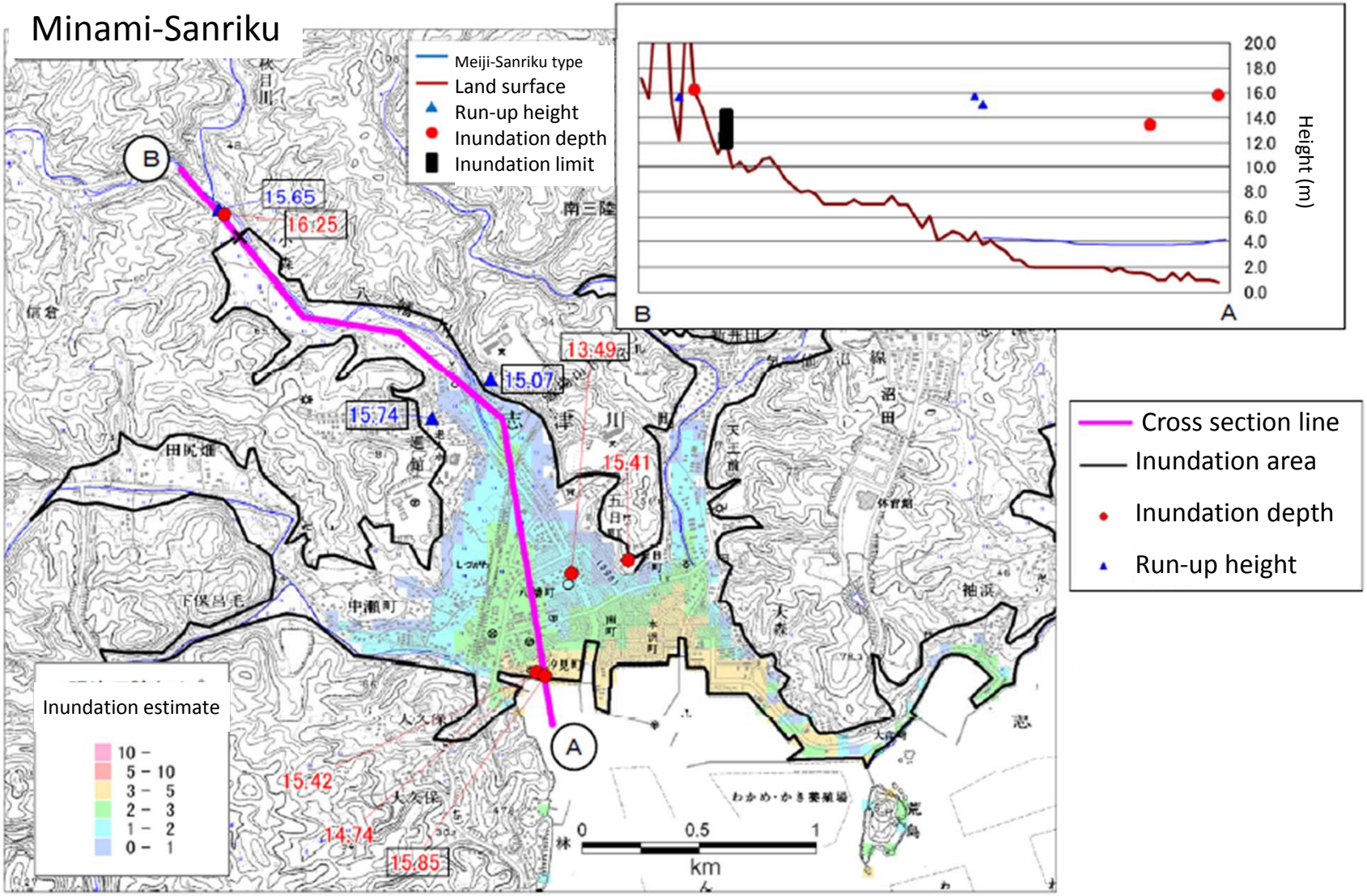


Natori River



Source: Central Disaster Management Council

Inundation area and height of tsunami in Minami-Sanriku Town



Source: Central Disaster Management Council

Implications to tsunami preparedness

The disaster management center of Minami-sanriku town

Apartment building in Minami-sanriku town

Less damage on upland

Relocation

Meiji Sanriku Tsunami(1896)

Showa Sanriku Tsunami(1933)

Source: Central Disaster Management Council

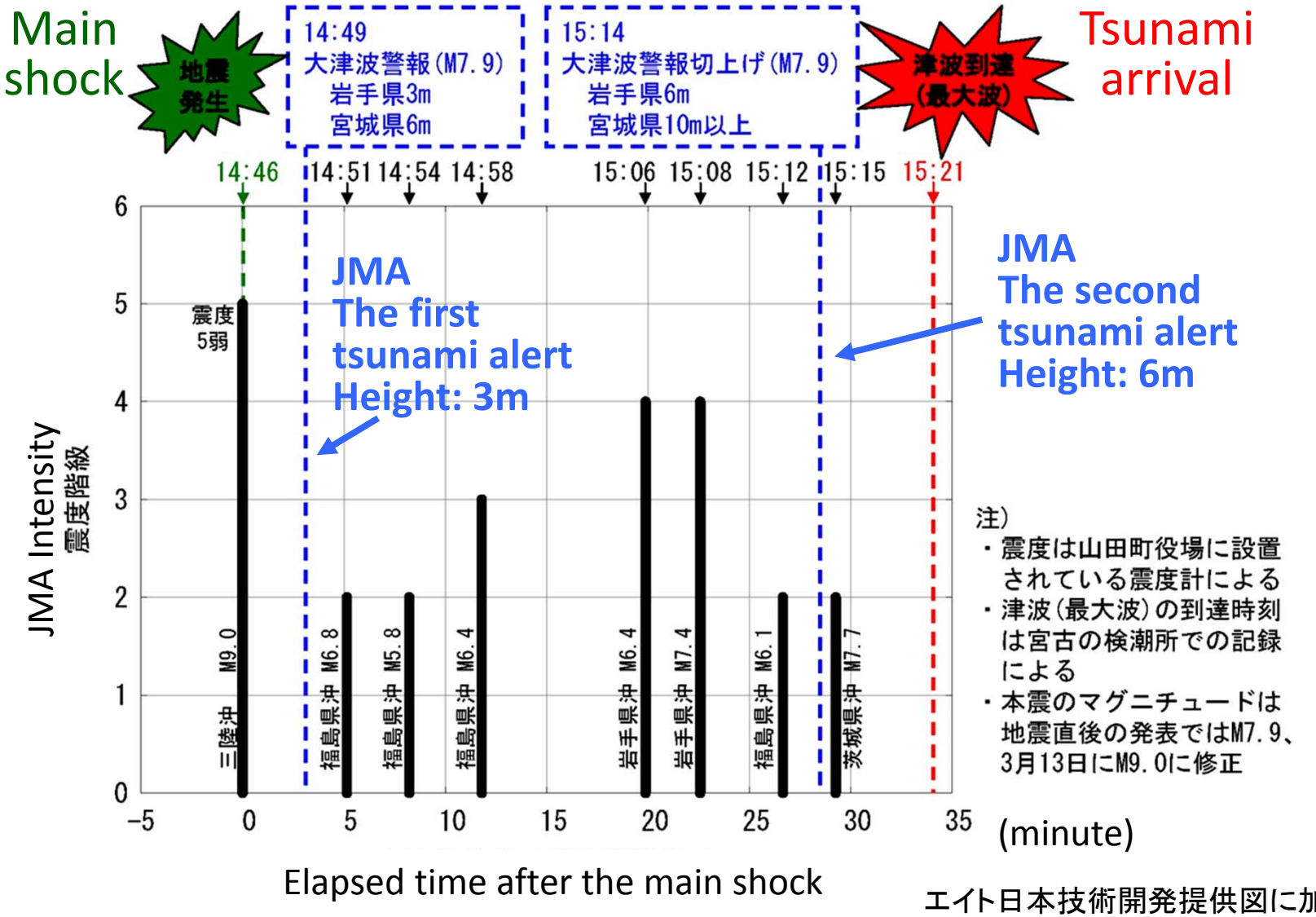
Evacuation

On 11 March 2011, before the strike of the tsunami

Courtesy of Prof.Toshitaka Katada, Gunma University
Photo taken by a local resident in Kamaishi City,
Iwate Prefecture

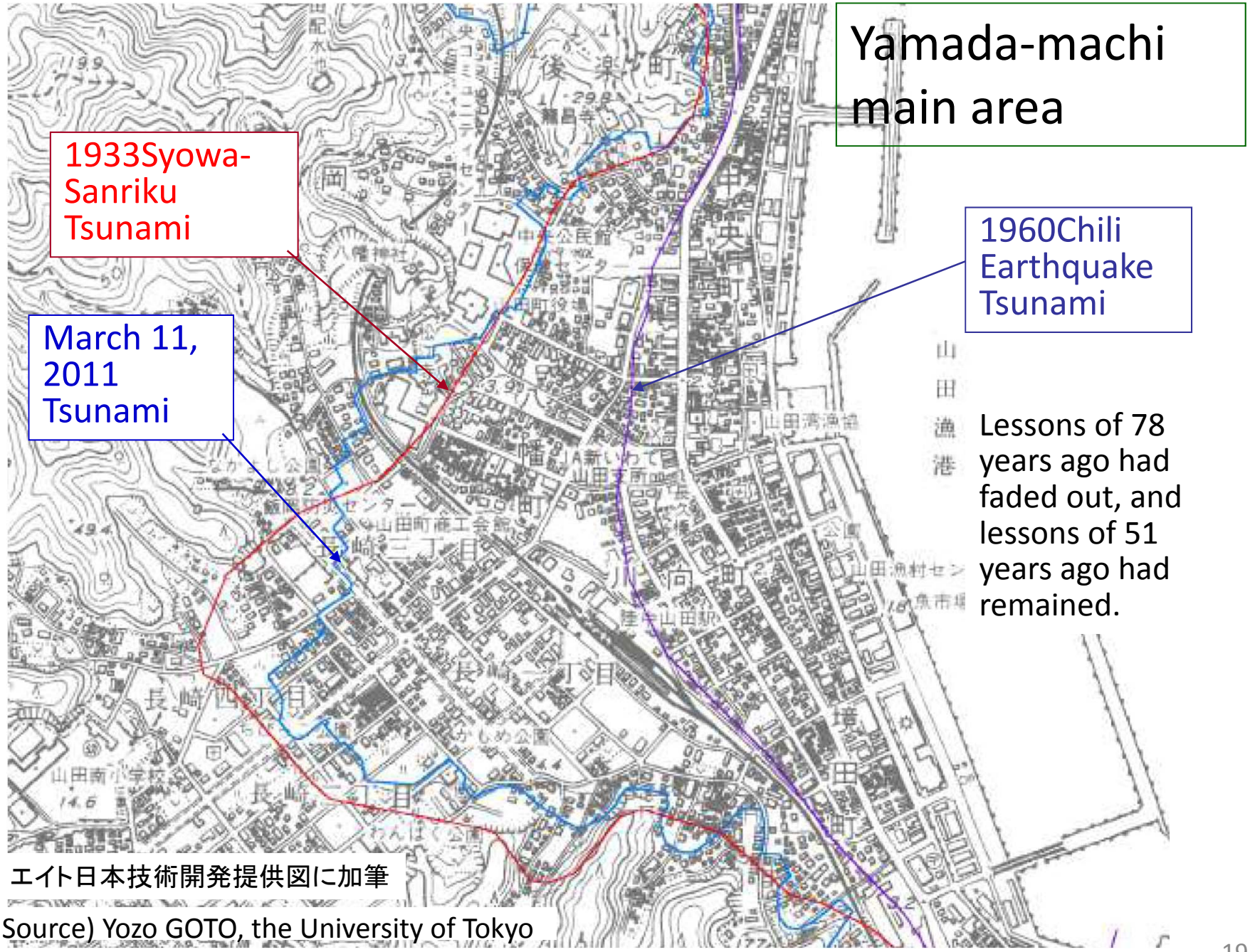
（津波襲来直前に鵜住居地区住民が撮影）

Case study on Yamada-machi, Iwate



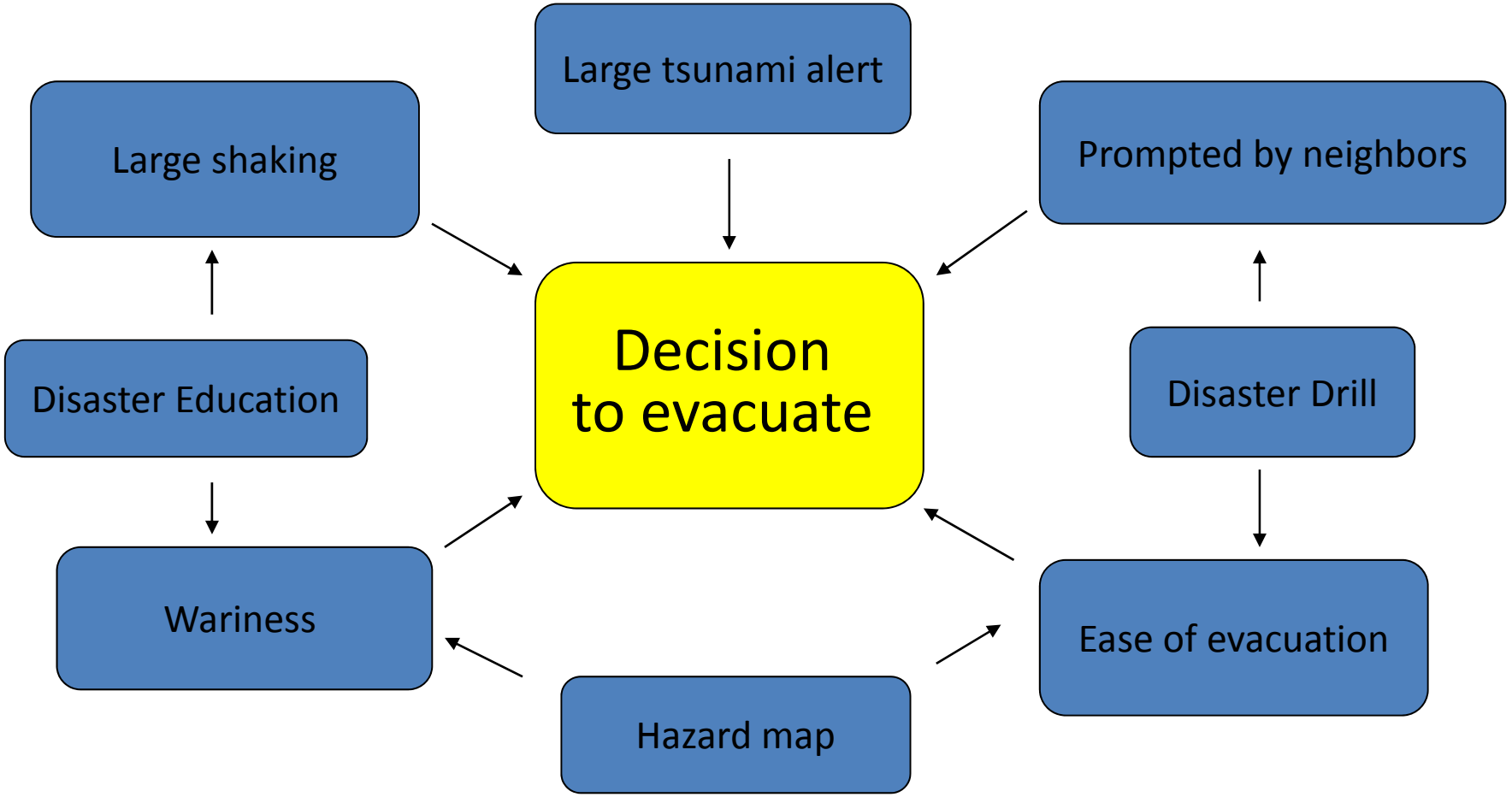
エイト日本技術開発提供図に加筆

Source) Yozo GOTO, the University of Tokyo



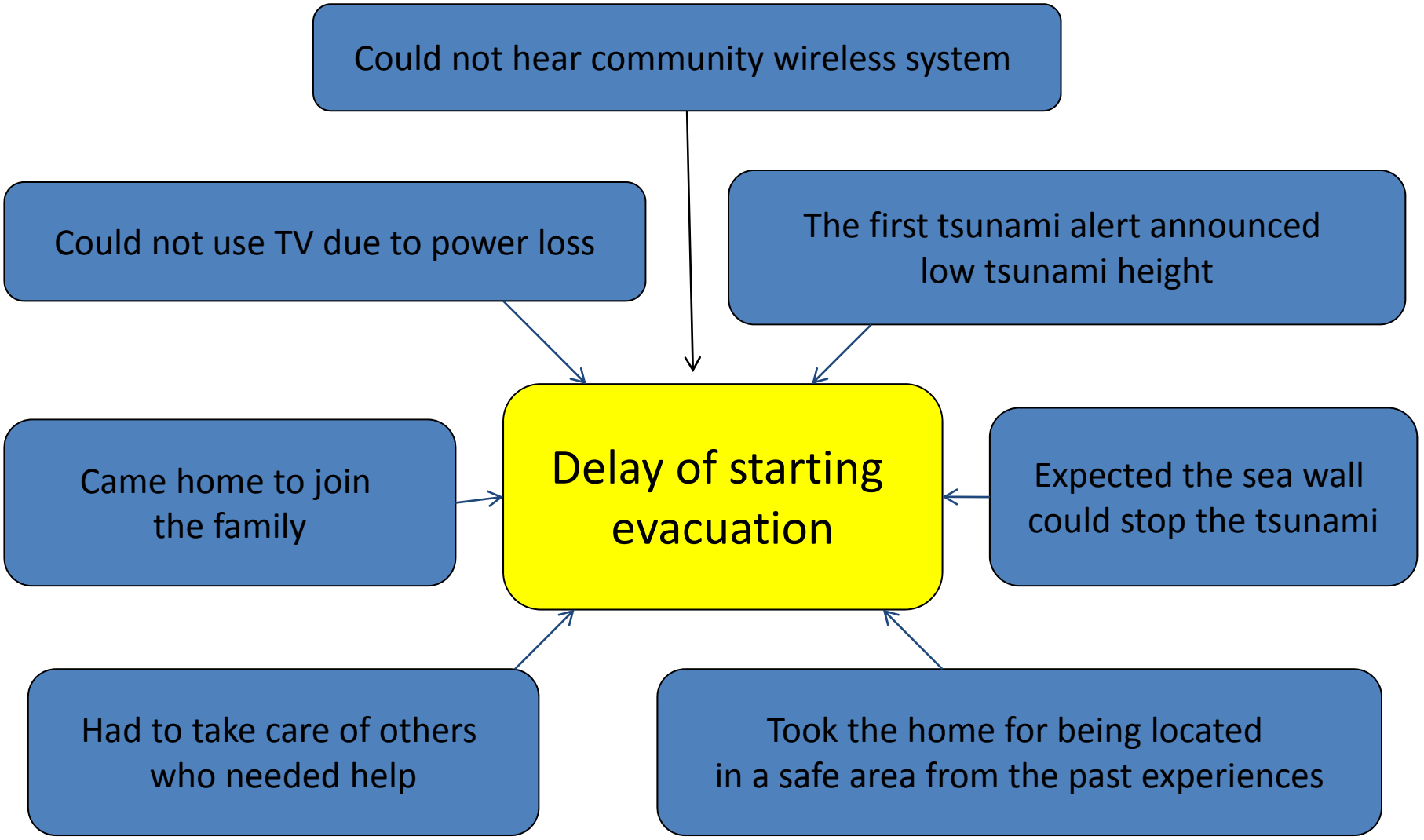
Source) Yozo GOTO, the University of Tokyo

Factors of the decision making of evacuation



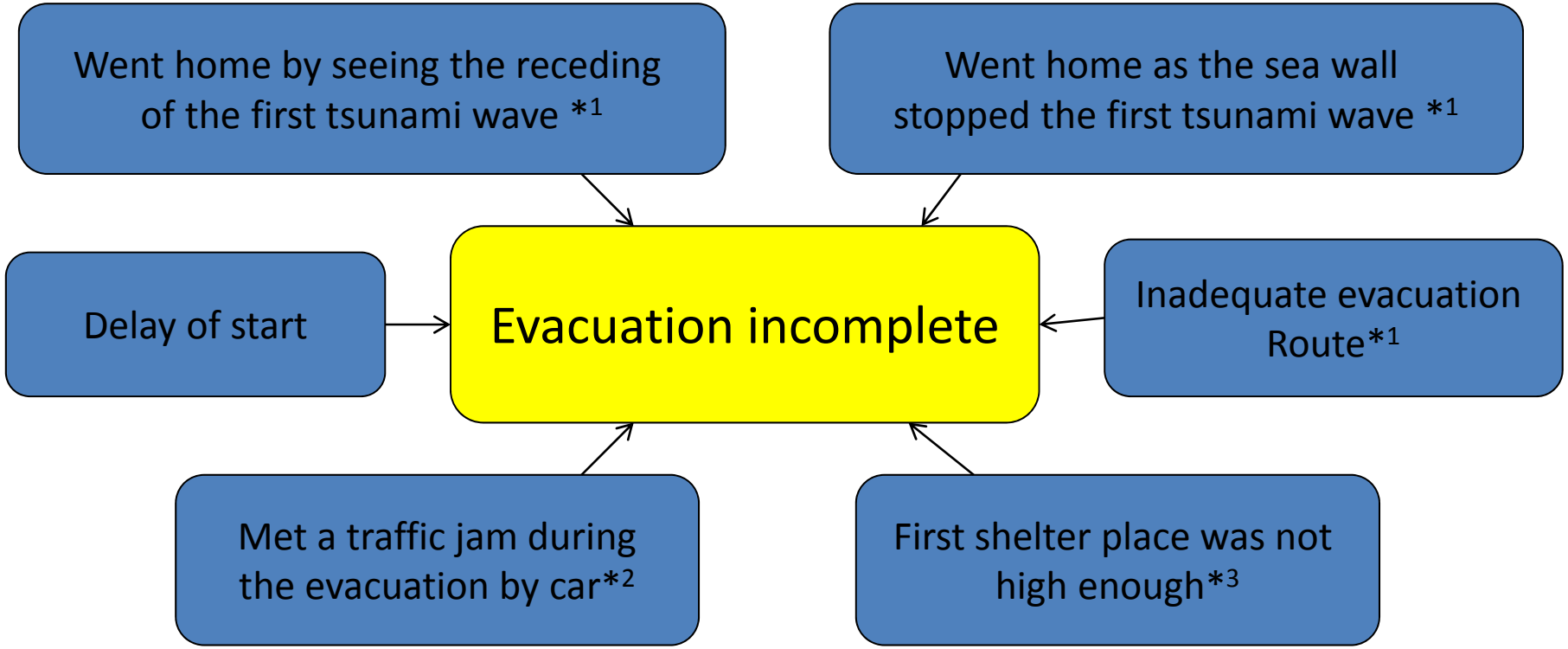
Source) Yozo GOTO, the University of Tokyo

Factors to delay the start of evacuation



Source) Yozo GOTO, the University of Tokyo

Factors of evacuation incomplete



*1 From the witnesses in Yamada-machi

*2 63.4% of evacuees took cars for evacuation and 36.6% were trapped by traffic jams.
(Prof. Seki of Toyo Univ. http://www.47news.jp/news/2011/05/post_20110523172902.html)

*3 56% of the first shelter places were washed by the tsunami.
(Higashi Nippon Broadcasting Co.,Ltd. http://www.surece.co.jp/src/press/backnumber/20110428.html)

Source) Yozo GOTO, the University of Tokyo

Present Discussion
Tsunami disaster mitigation

Level-1

Frequently Occurring Tsunami

- Return period: about 100 yrs (50 – 150?)
- Protect human lives and properties
- Structural measures

Level-2

Massive Tsunami

- Return period: about 1000 yrs (?)
- Much bigger than the Level-1 Tsunami
- Protect human lives at least
- Non-structural measures such as evacuation system, city planning, ･･ in addition to structural measures

Source: The interim report,
The technical Investigation Committee of Central Disaster Management Council

Conclusions of 2011 White Paper on DM

- 1. Review damage projections
- 2. Revise disaster plans
- 3. Prepare for other devastating earthquakes
- 4. Redefine roles of central and local governments
- 5. Strengthen support to disaster victims
- 6. Share lessons with other countries

Thank you for your attention.

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