



United Nations
Educational, Scientific and
Cultural Organization

Great East Japan Earthquake and Tsunami

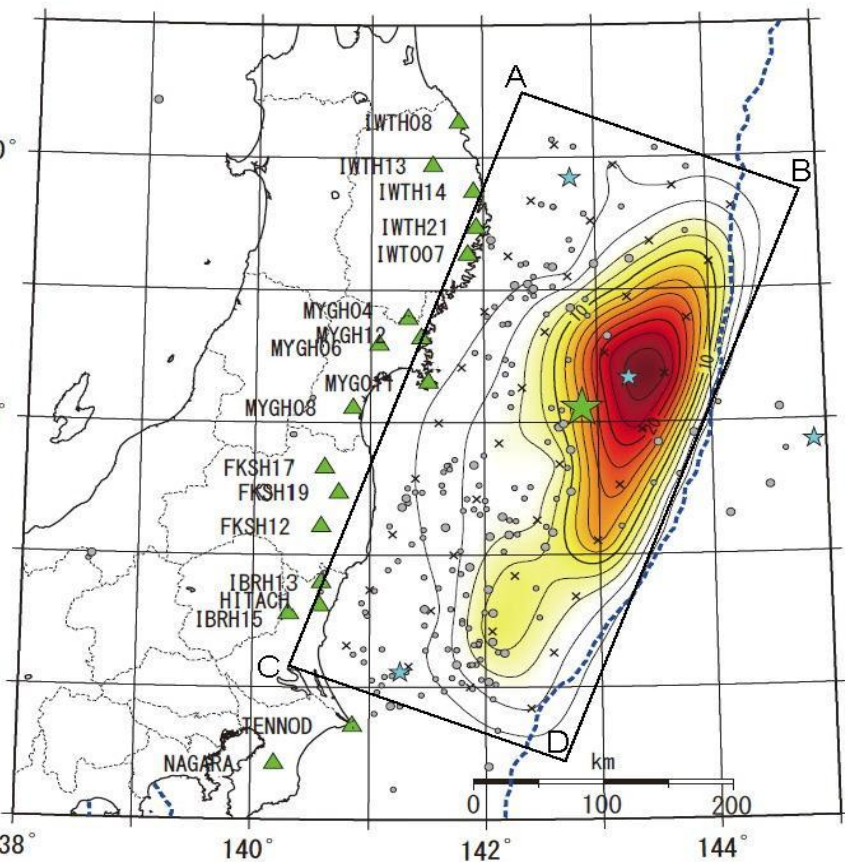
Kuniyoshi Takeuchi

**International Centre for Water Hazard and
Risk Management under the auspices of
UNESCO (ICHARM)**

Public Works Research Institute (PWRI)

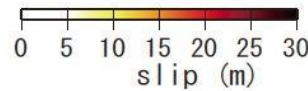
Tsukuba, Japan





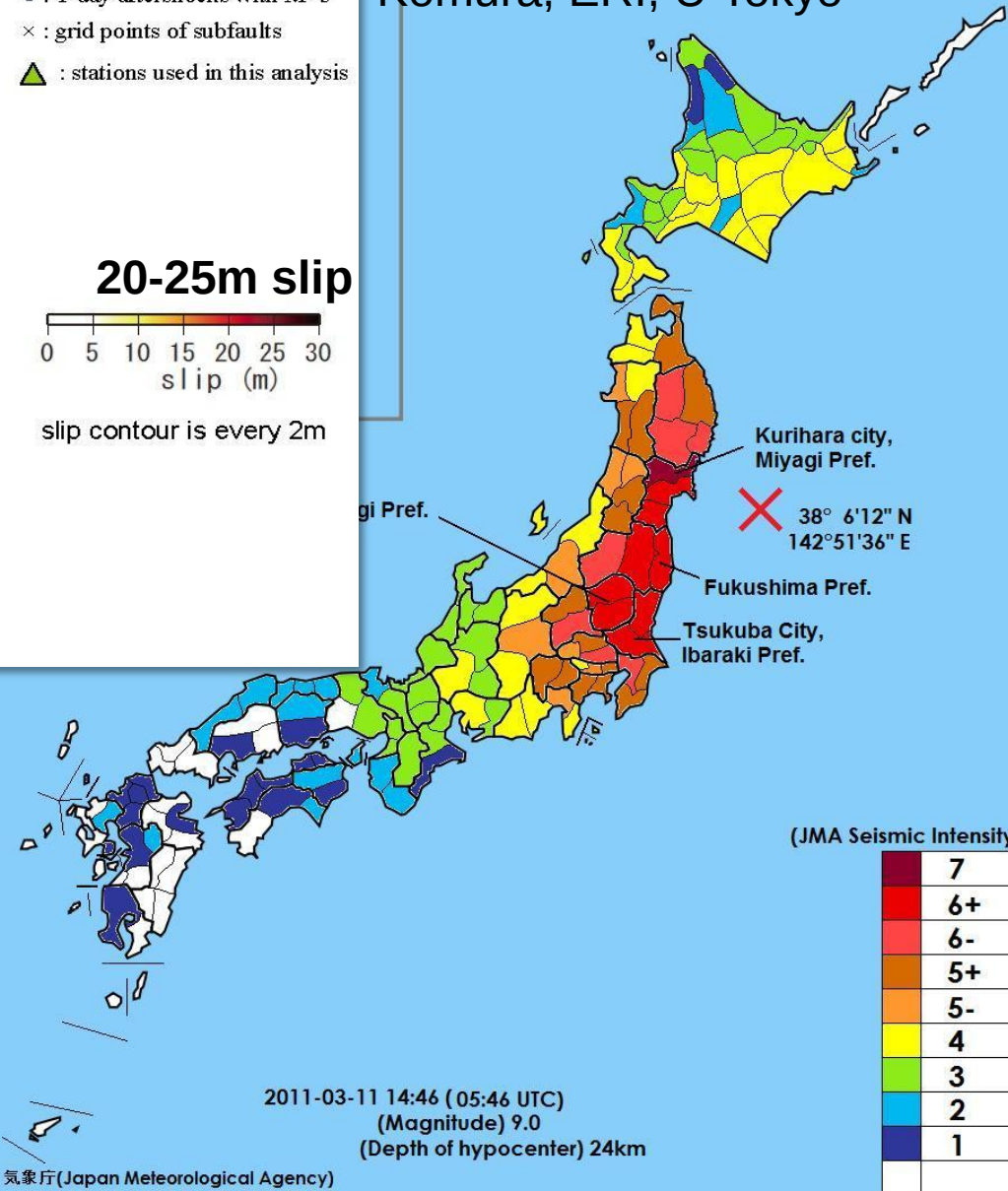
- ★ : starting point of rupture
- ★ : epicenter of aftershocks with $M > 7.0$
- : 1-day aftershocks with $M > 5$
- × : grid points of subfaults
- ▲ : stations used in this analysis

20-25m slip



slip contour is every 2m

Ohotsoku plate slipped
max 55m to SE
Simulation by Takashi
Komura, ERI, U Tokyo



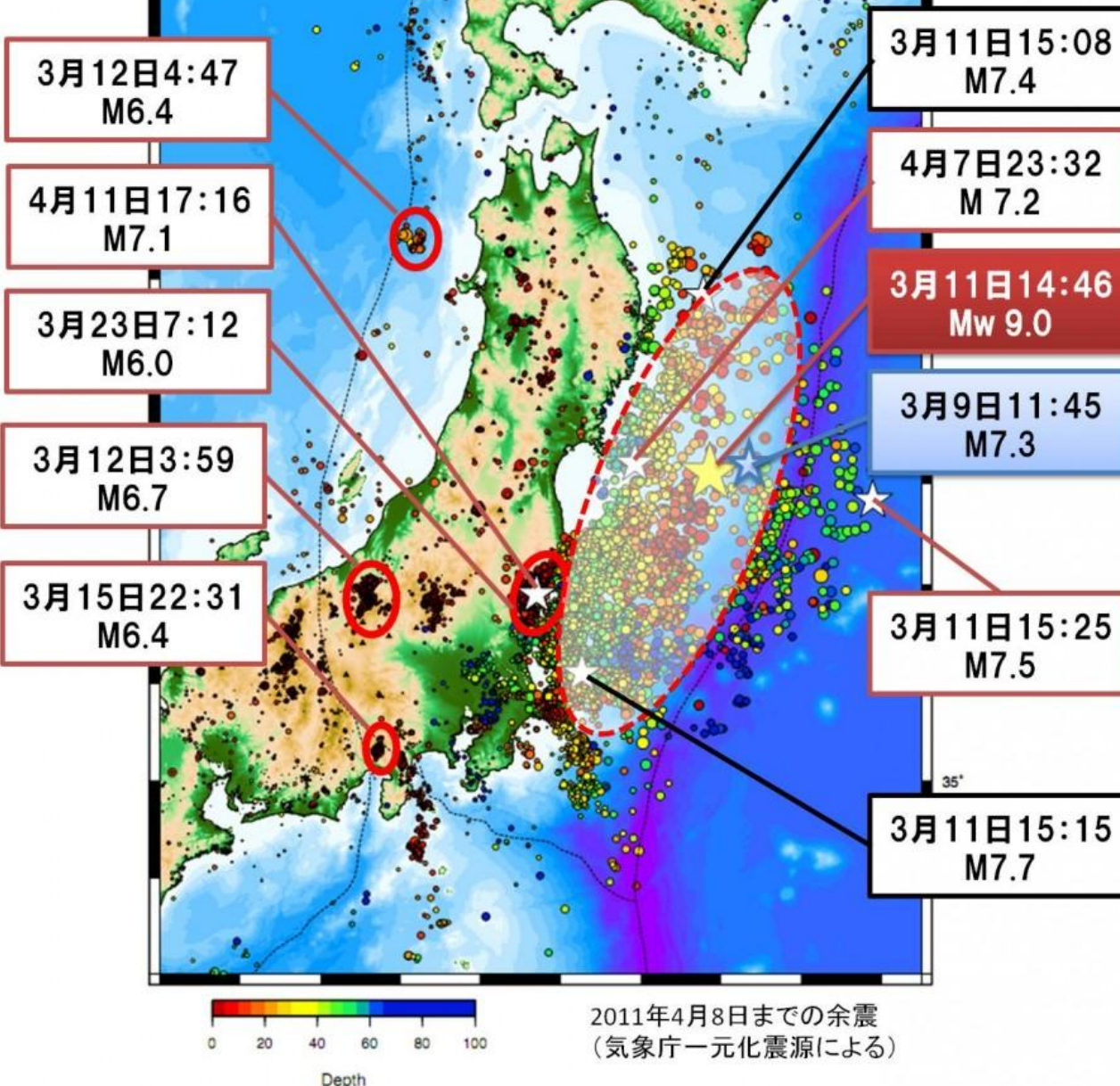
(JMA Seismic Intensity)

7
6+
6-
5+
5-
4
3
2
1

2011-03-11 14:46 (05:46 UTC)
(Magnitude) 9.0
(Depth of hypocenter) 24km

Source : 気象庁(Japan Meteorological Agency)

(By: Dr.Oki, Dr.Tsuji, Dr. Nishida)



Sumatra EQ

2004.12.26	Mw 9.1
2005. 3.28	Mw 8.6
2007. 9.12	Mw 8.5
2009. 8.10	Mw 7.5
2010. 4. 6	Mw 7.8





Nobiru18 Apr



Ishinomaki 18 Apr



Ishinomaki 18 Apr



Ishinomaki 18 Apr



Shizukawa-cho18 Apr



公立志津川病院



Photos from NASA Earth-watching satellites
Kashima, Fukushima





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Kashima, Fukushima





Photos from NASA Earth-watching satellites
Naruse-gawa, Miyagi

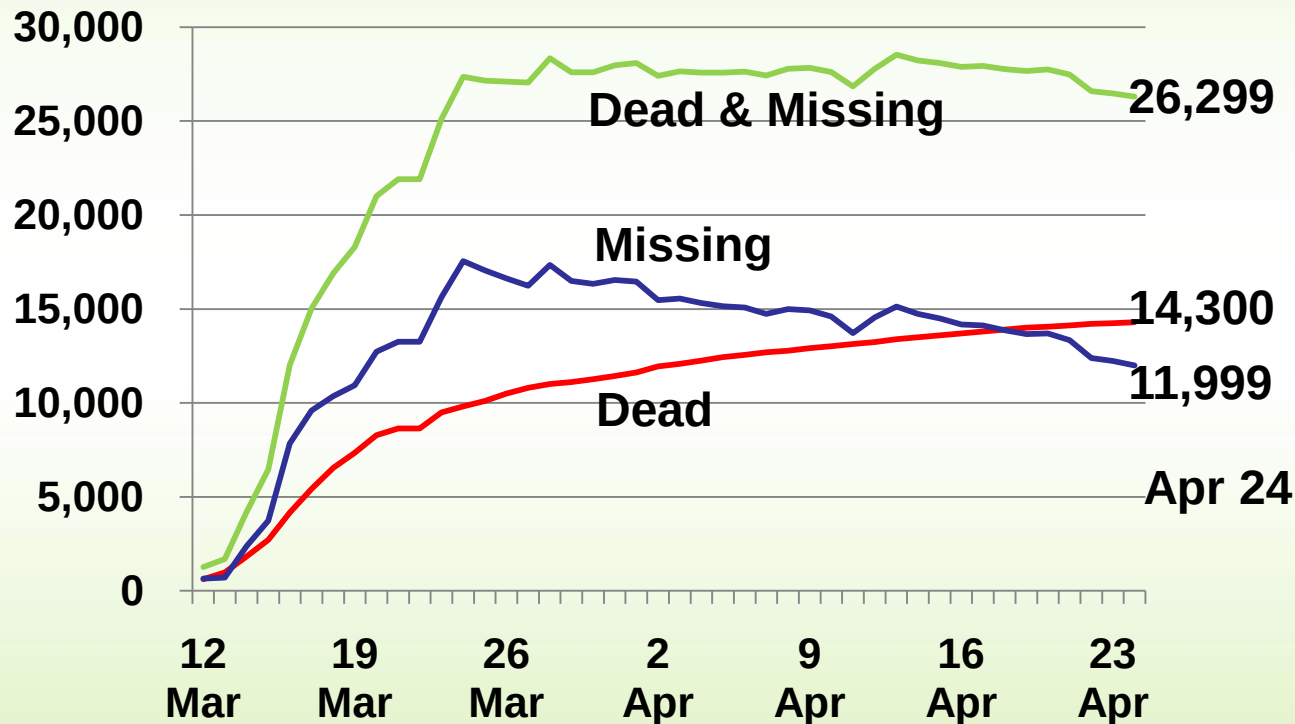




Photos from NASA Earth-watching satellites
Naruse-gawa, Miyagi



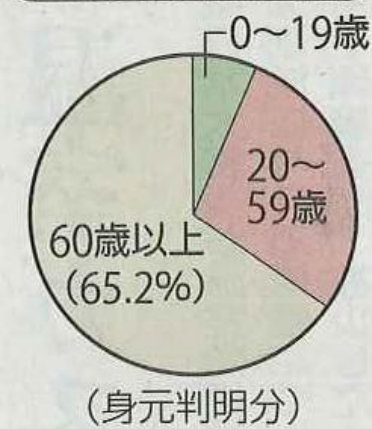
Human damage by Yomiuri-shinbun
Data source: National Police Agency



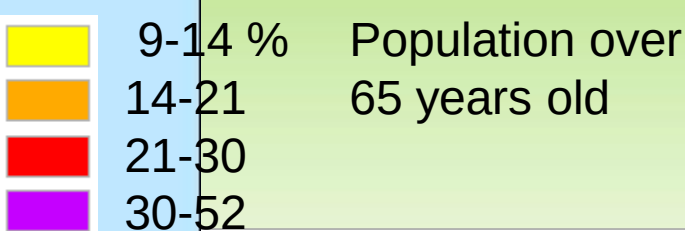
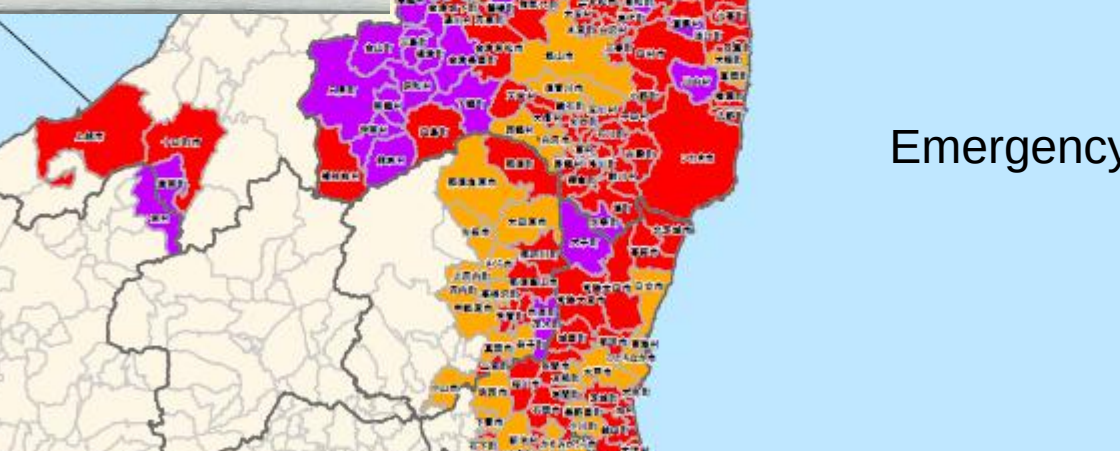
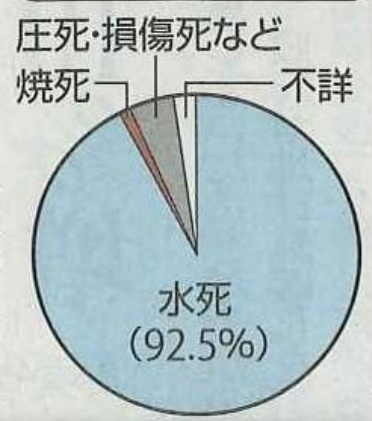
Evacuated (NPA;
up to 25 Mar by
Asahi Shinbun)

Mar	15	570 000
	20	334 854
	25	248 092
	31	172 064
Apr	5	163 008
	10	151 115
	15	138 212
	20	133 454
	25	130 904

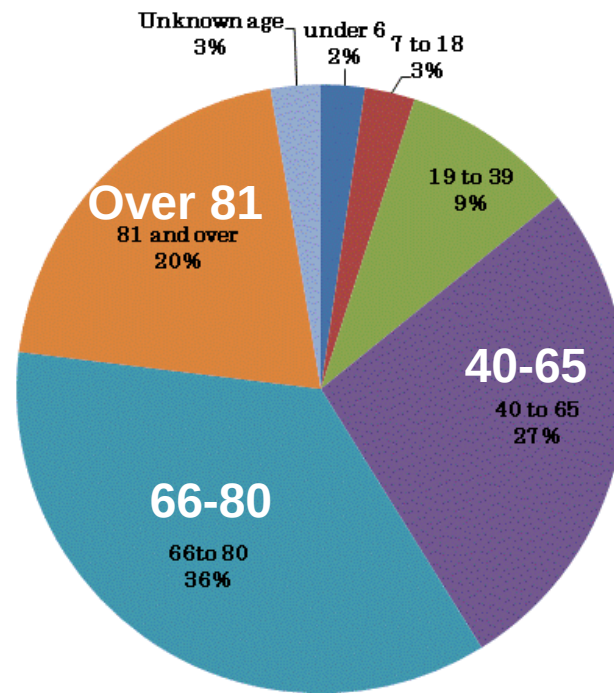
亡くなった人の年齢



死因



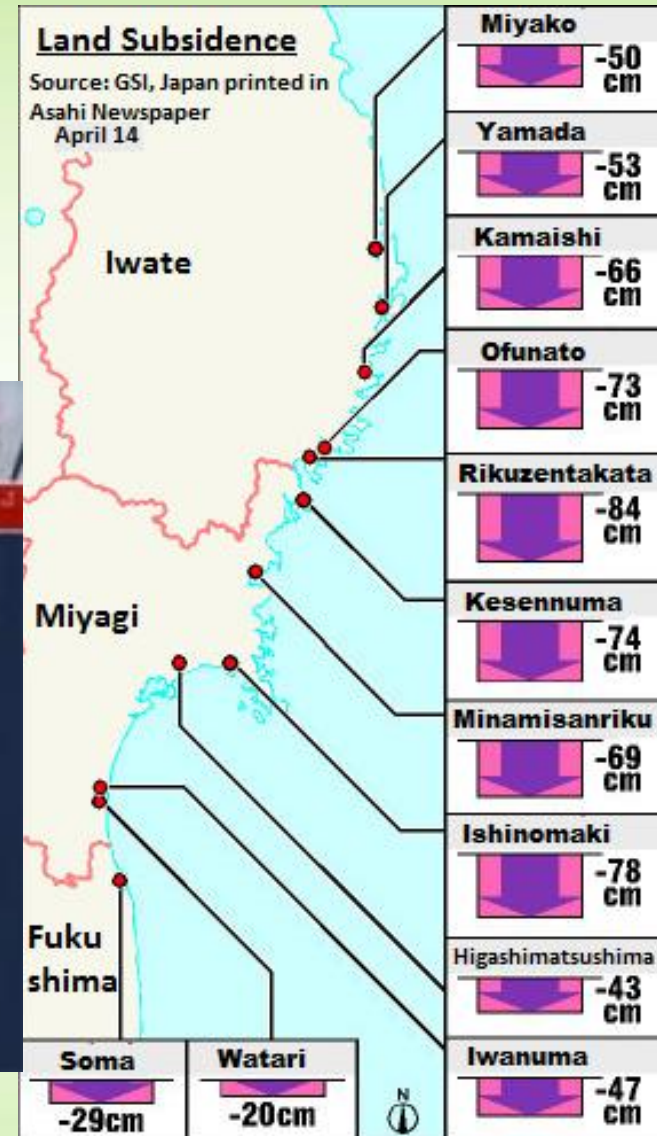
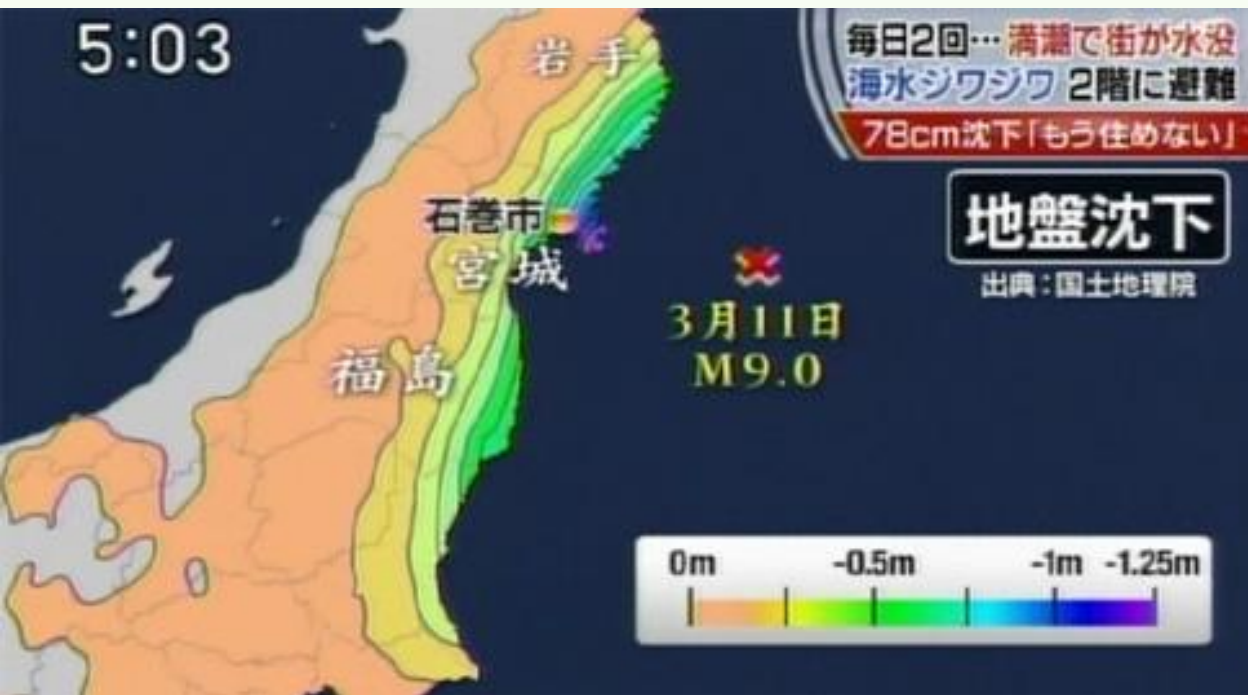
Fatalities by Age Group (as of 22, Apr. 10:00 am)
7981 total identified bodies, counted as 63% total confirmed dead



Emergency mapping team, Kyoto U



Max subsidence 116cm Oshika





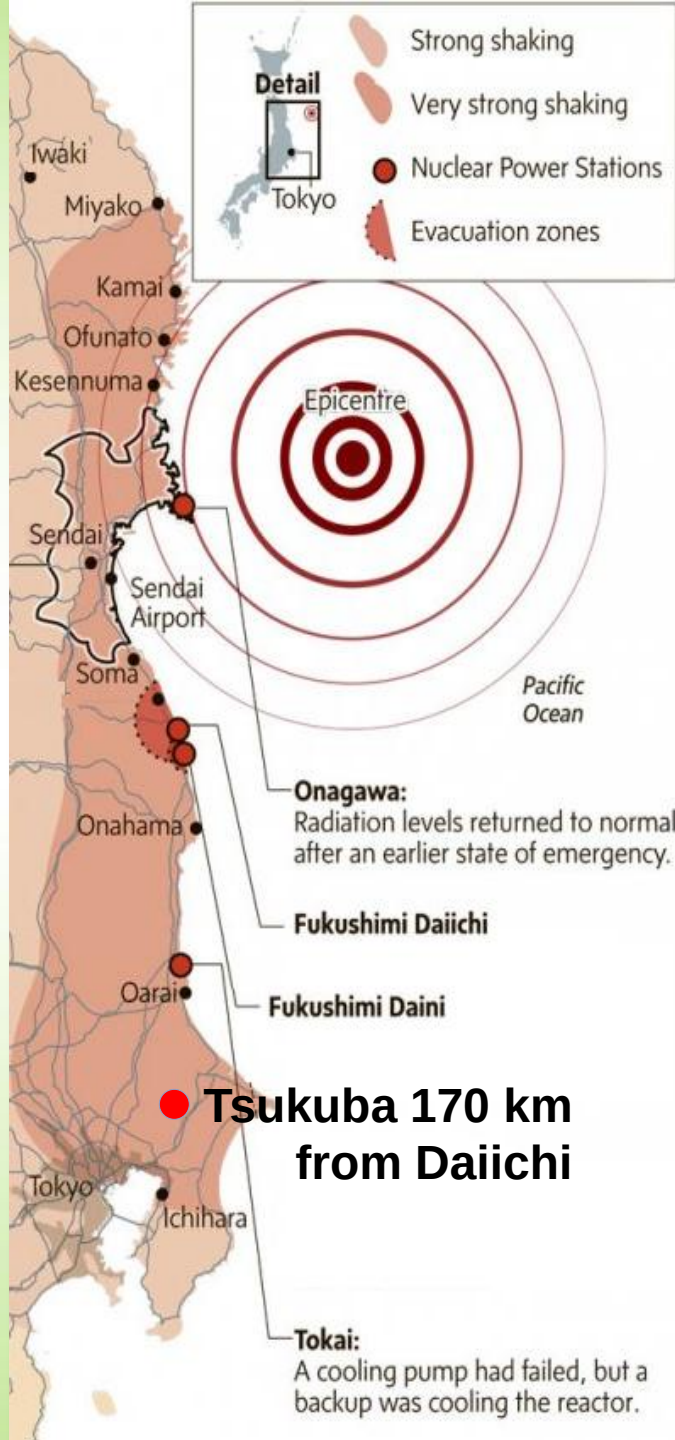
Photos from NASA Earth-watching satellites
Fukushima Daiichi



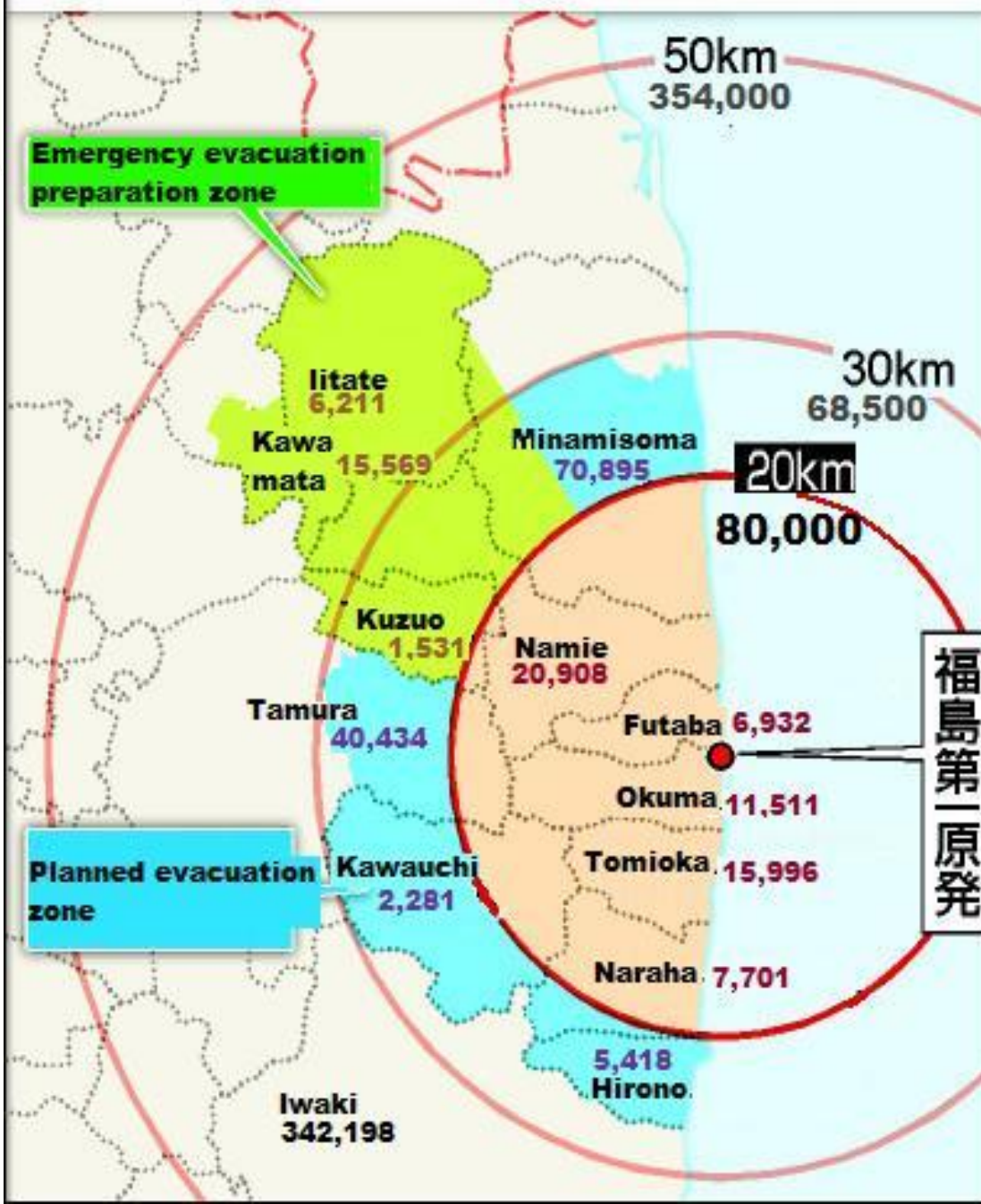


Photos from NASA Earth-watching satellites
Fukushima Daiichi



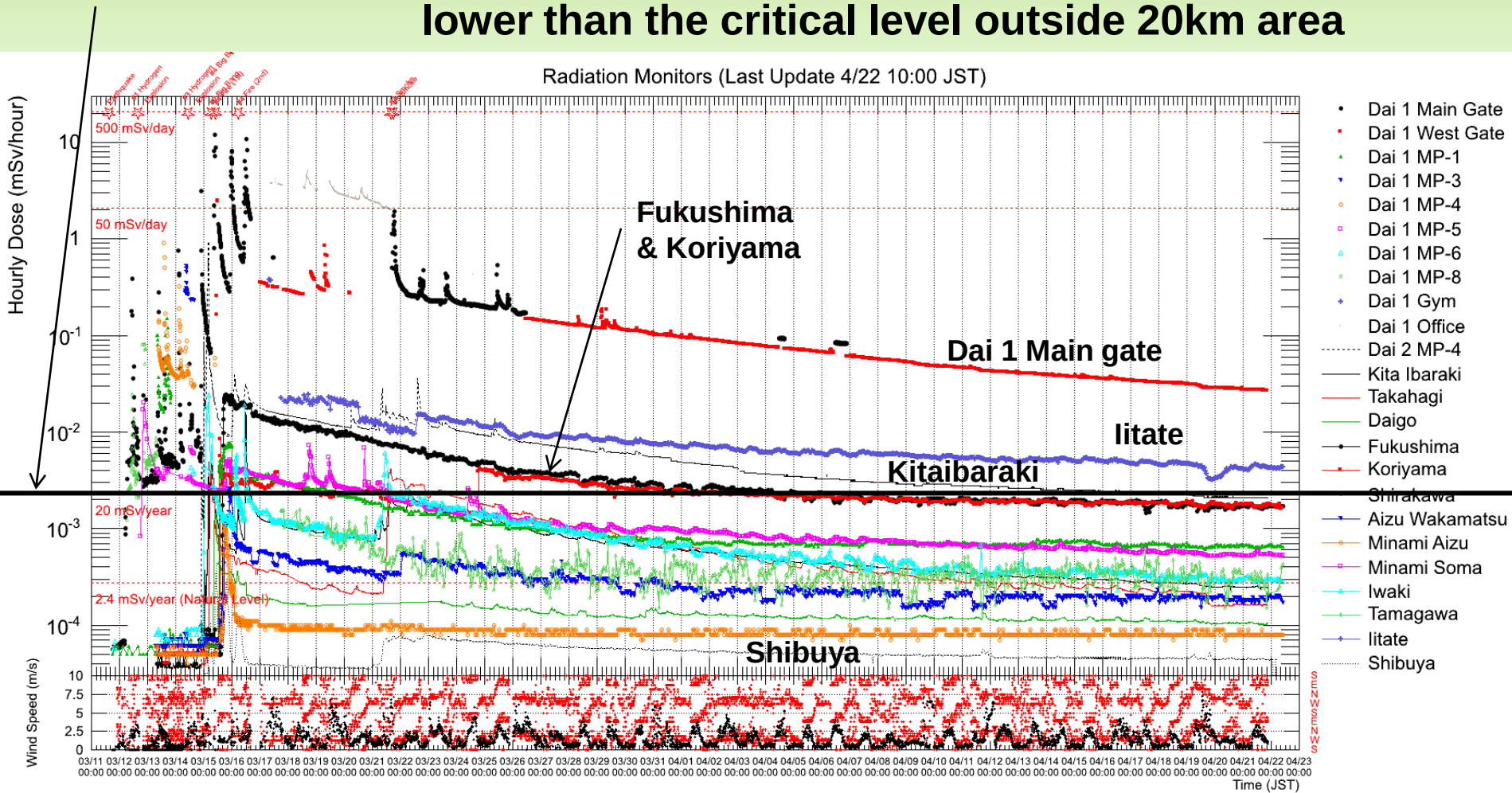


Evacuation Zones and Affected Population



20 mSv/year

Declining radiation: Total annual Sv would be much lower than the critical level outside 20km area



3/11 15 21 4/1 22

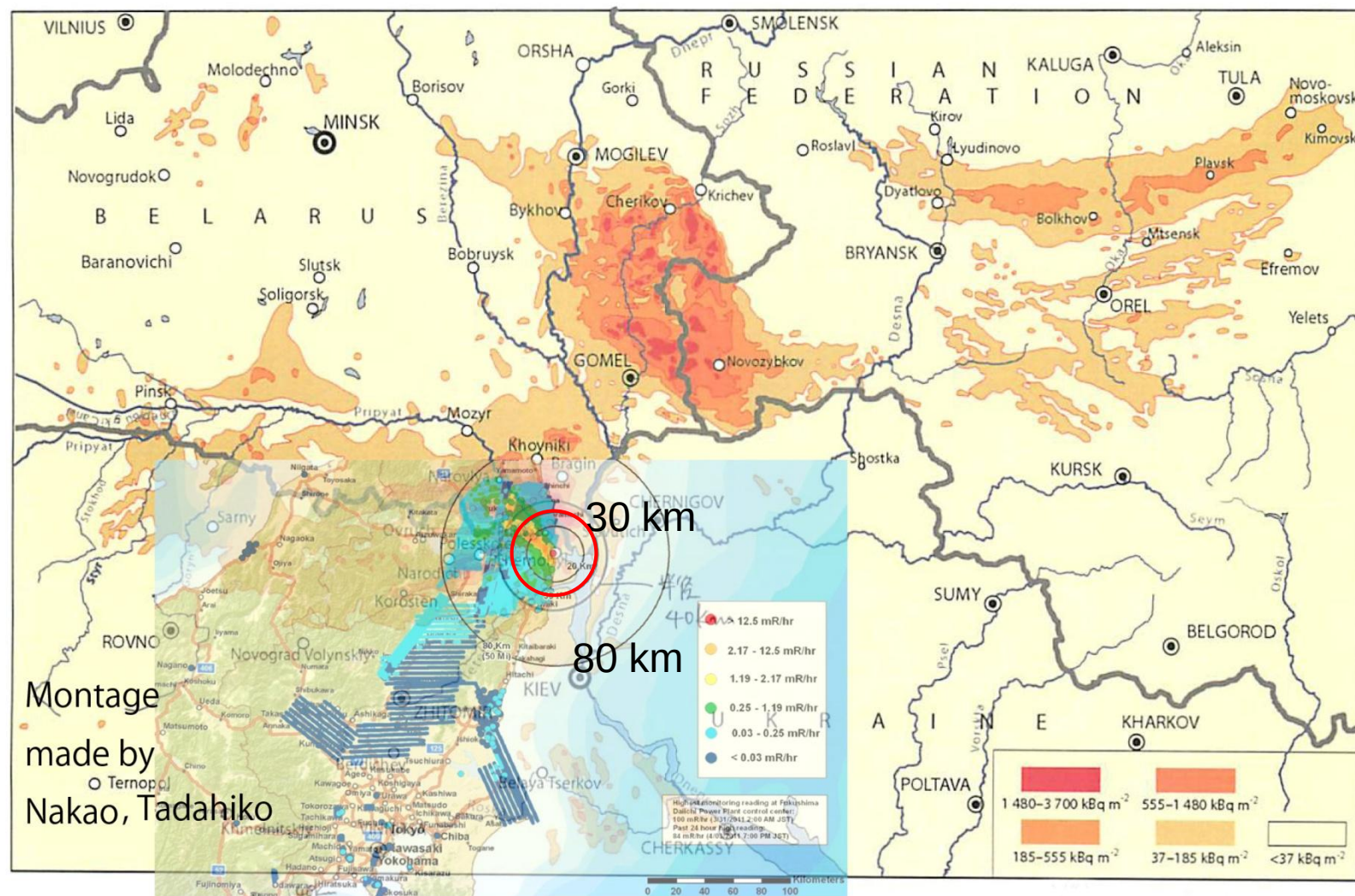
<http://dl-web.dropbox.com/u/16653989/NuclPlants/can.gif>

A Japanese living in US plotted from the information exposed by governmental agencies of Japan.



In comparison with Chornobyl case

Figure II. Map of ^{137}Cs deposition levels in Belarus, the Russian Federation and Ukraine as of December 1989 [128]



Based on: http://www.unscear.org/unscear/en/publications/2008_2.html & <http://blog.energy.gov/content/situation-japan/>

Main characteristics

- A concatenation of disaster events from EQ to Tsunami & Nuclear.
- A break of access network to resources propagating from local to nation & intern'l.
- Happened in the most well experienced and prepared nation.
- Unprecedented disaster in the world which put us to rethink about how to live with nature.
- Little damage on buildings. A dam break.



Some lessons/reactions

- “Tsunami Tendenko” Everybody has to run away by itself without caring even parents or children at Tsunami (1896 Meiji Sanriku)
 - Tragedy in Sanrikutakada 13 community chiefs and many others lost lives by helping the elderly and handicapped
- “Tsunami 3m” was announced 3 minutes after the EQ and electricity went down. Corrections in 30’ and 45’ later never reached the people.
- Under estimate in hazard maps Evacuation centers were hit and many lives were lost. Over confidence in evacuation center. Limits in historical records based design. (>65 centers were hit)
- Neglecting Jogan Tsunami (869) AIST engineers appealed TEPCO to renew the basis for the Jogan Tsunami in 2009 but the voice was not taken up.



Some reactions

- Failure of EQ prediction? System for forecasting fell short.
- Much worse? if it happened in any other countries. How effective were the efforts taken so hard so far?
- If it happens in Tokyo, the impacts must have been much more destructive to the whole Japanese and international economy. How to design development to avoid chain reactions and network break in globally dependent society? How to keep the access available to resources such as water, foods, energy, information and transportation?
- Discipline and order: Is it a surprise to be calm, patient, quiet and honest under the extreme suffering?



By Kyung Lah, CNN (March 16, 2011)

<http://edition.cnn.com/2011/WORLD/asiapcf/03/16/japan.cultural.order/index.html>

- * Victims organize themselves and wait patiently for supplies**
- * Japanese are raised to put the group ahead of the individual**
- * Its rules sometime seem too conformist, but in this case, they are benefits**
- * Japanese are hurting, but they are mourning quietly**

Tokyo (CNN) -- I've been asked questions along this theme multiple times, from my friends and family in the United States to colleagues who work around the globe: How, amid Japan's worst natural disaster in 100 years, can the Japanese seem so calm?

Food and water are both scarce. Electricity in the tsunami zone is nearly nonexistent. Survivors have lacked information about their missing loved ones.

But unlike other disasters where the world has observed looting, rioting and public outbursts of sorrow and rage, it has seen a country quietly mourning, its people standing patiently for hours in orderly lines for a few bottles of water.



Discussions for reconstruction

- Not a reconstruction but a new construction with new development concepts such as eco city, compact city, new energy city ???
- Landuse regulation
 - Move to higher lands
 - Tall buildings
 - Tsunami dikes, highways: Where & how high to build?
- How far to secure safety by structural protection?
 - Decision principle: Economic efficiency? National balanced development policy? National safety? (If Tokyo were hit)
- How to secure safety against excess events?
 - Evacuation policy especially for the disaster weak.
 - Evacuation rather than tsunami dikes???



