Earthquake hazard mapping for community resilience in Japan

-the role of the government-

Understanding Risk Forum Focus day session

Let's shake your community – earthquake hazard mapping approach for community resilience

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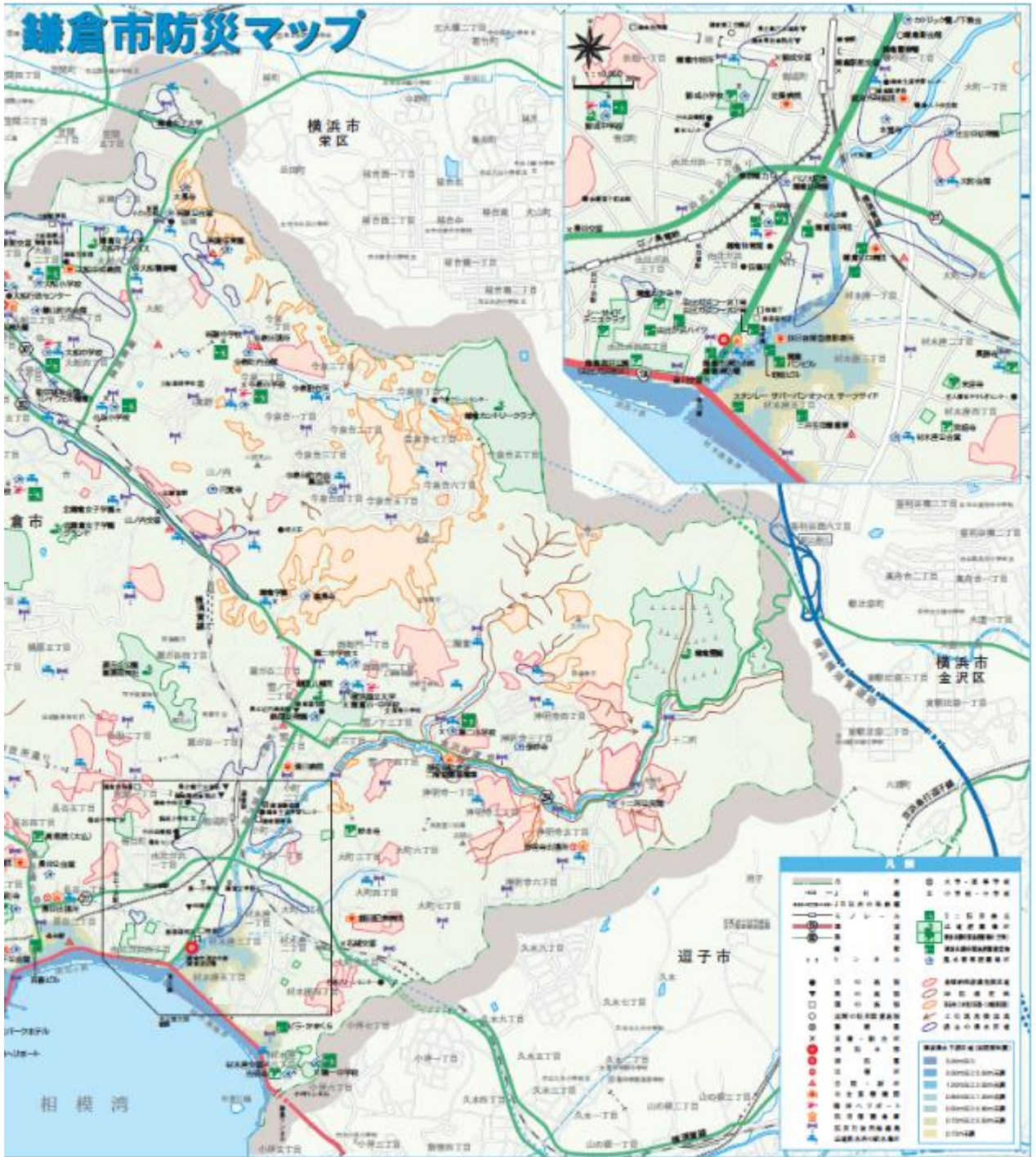
Project team "BEST PRACTICES IN IDENTIFYING RISKS FOR EARTHQUAKE RISK REDUCTION IN JAPAN"

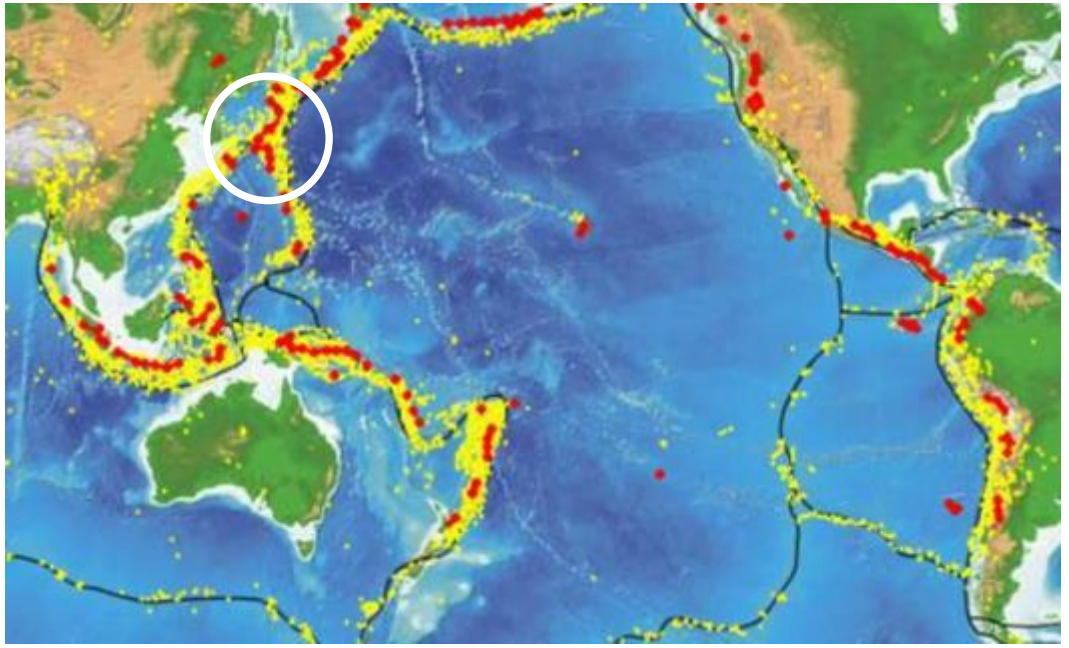
Outline

- Institutional arrangements in Japan
- What are Japanese “Hazard Maps” ?
- How are they developed ?
- How are they used ?
- Challenges



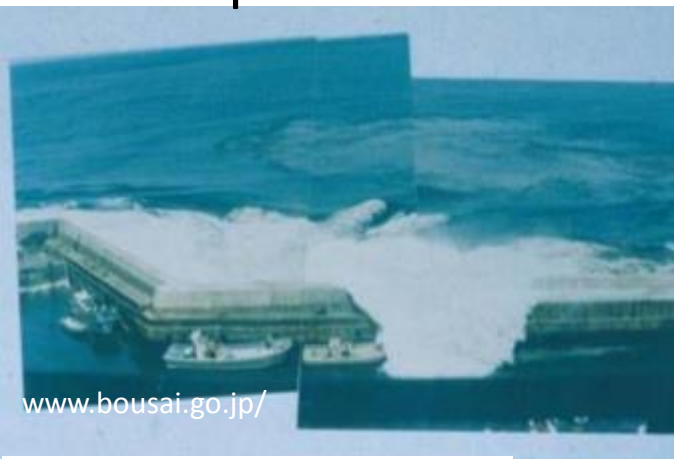
Japan has a very high earthquake risk

1995 Hanshin-Awaji Great Eq. M7.3



Pacific Ring of Fire

2011 Great Tohoku Eq./Tsunami M 9.0



1983 Sea of Japan Eq./Tsunami M7.7

And many others…

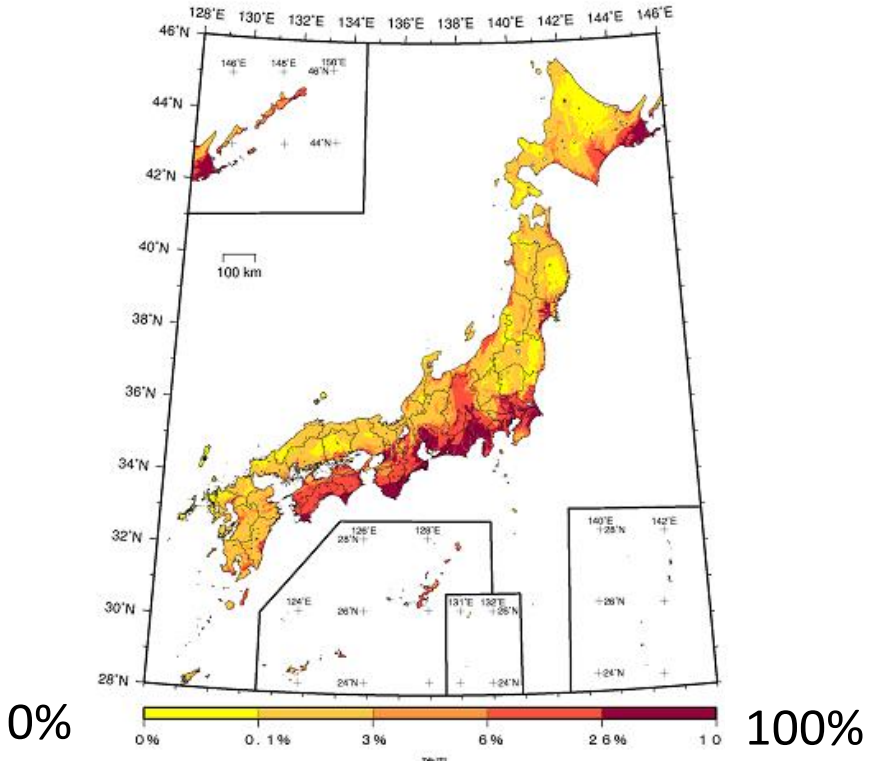
2016 Kumamoto Eq. M7.3

Institutional Arrangements for Disaster Risk Management in Japan

Source: “Disaster Management in Japan”, ”CAO

Types of Hazard Map

Probabilistic approach

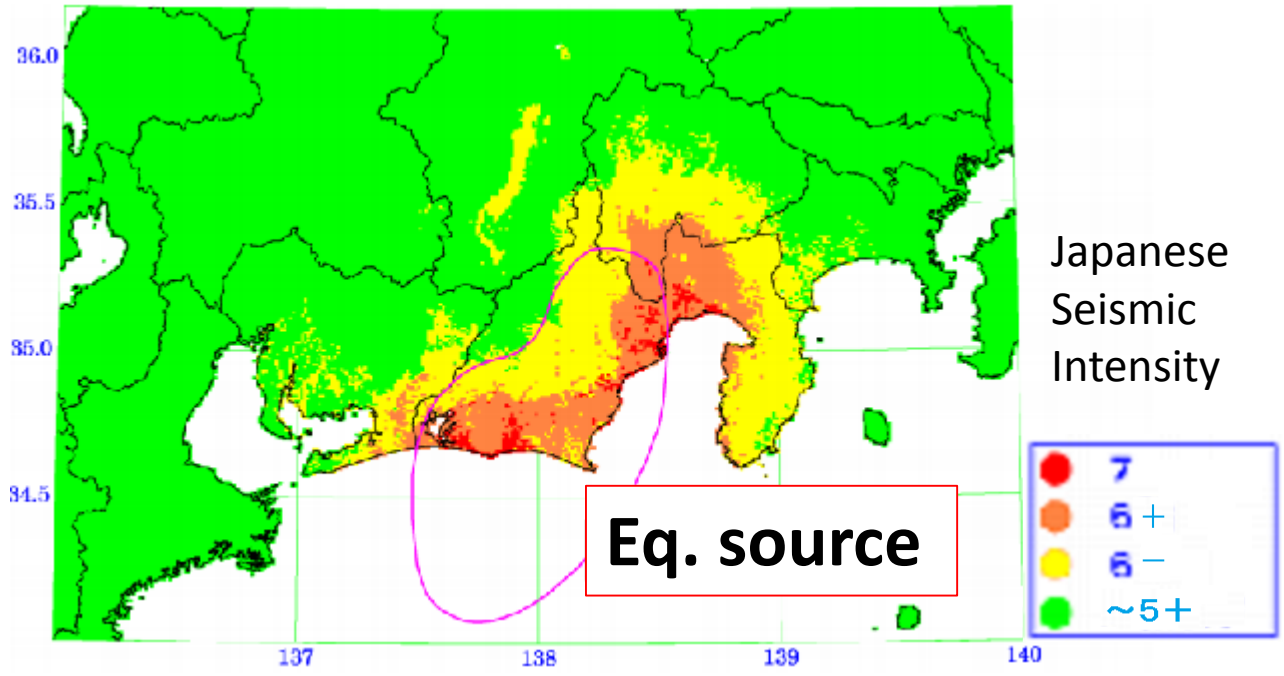


for strategy at national gov.

Percentage of Japanese **seismic intensity higher than VI** in next **30 years**.

http://www.j-shis.bosai.go.jp/shm

Deterministic approach



for DRM plan at local gov.

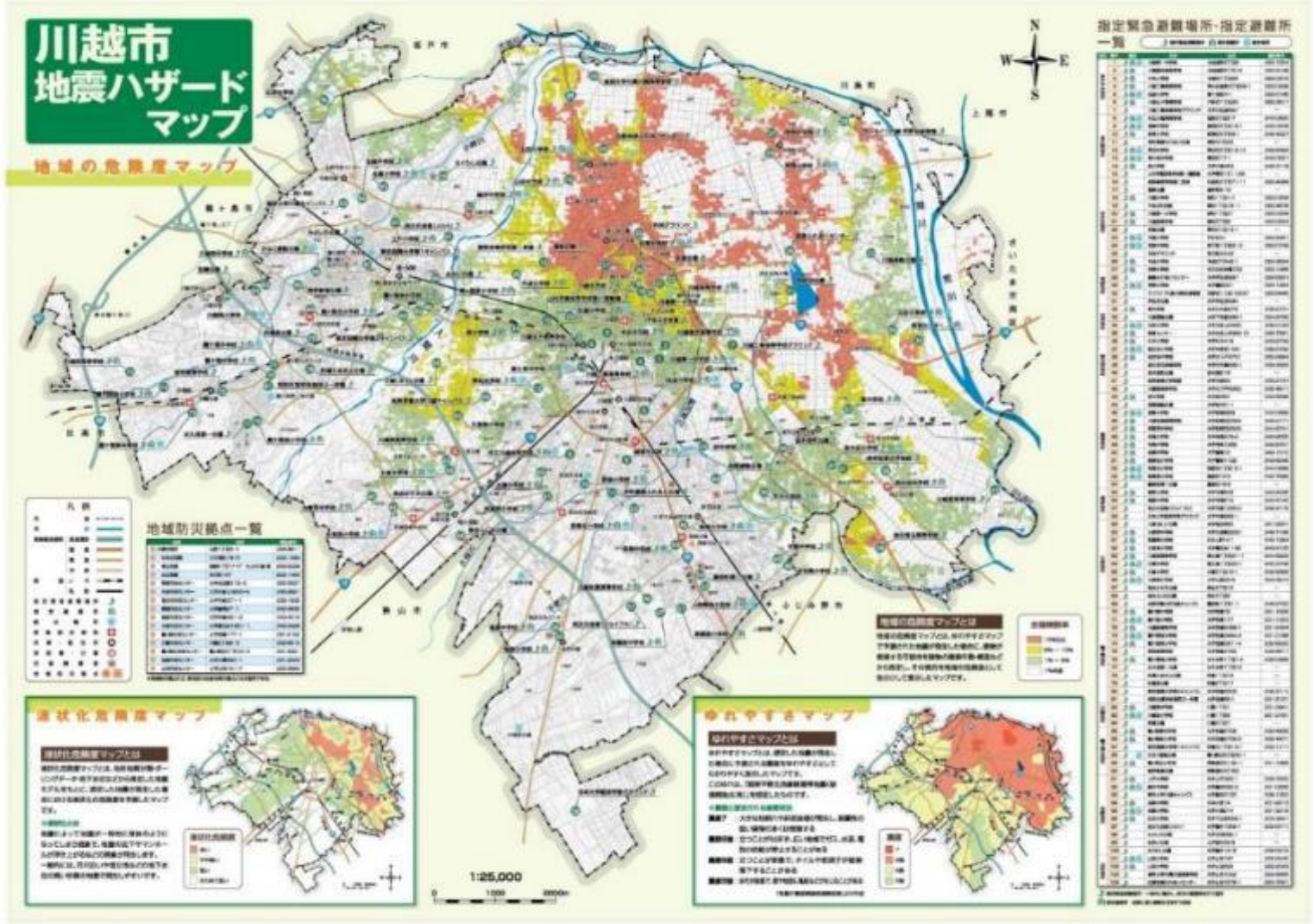
Estimated Japanese **seismic intensity** by Hypothetical **Tokai earthquake**.

http://www.bousai.go.jp/jishin/tokai/pdf/higaisoutei/gaiyou.pdf

Japanese “Hazard Maps” are made to promote awareness of risk from natural disasters and preparedness at the community level

- Every municipality must prepare a “Hazard Map”

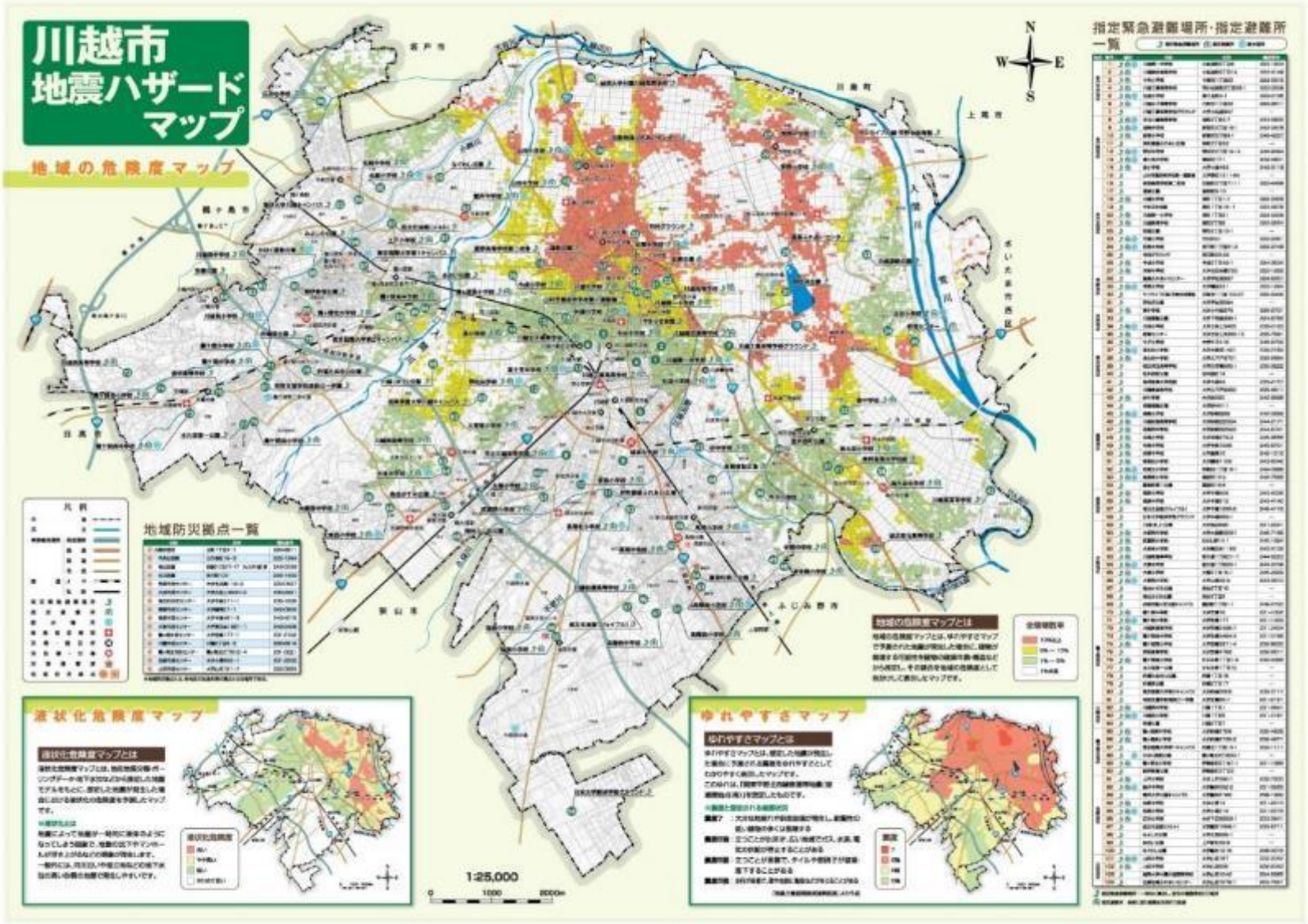
- These Hazard Maps show the level of expected hazard from a deterministic scenario of past events (or modelled), and the location of evacuation areas or the likelihood of damage from the event.



Features of a Typical EQ Hazard Map in Japan

Buildings Damage Potential Map

Liquefaction Potential Map



List of Evacuation Areas

Ease of Shaking Map

(Kawagoe City, Saitama pref. 2015)

https://www.city.kawagoe.saitama.jp/anzen_anshin/bousai_jouhou/hazardmap/jisin_hazardmap.files/uramen.pdf

More than just EQ Hazard Info.

What will happens if an Earthquake Occurs ?

Institutional arrangements

How to be Prepared for an Earthquake

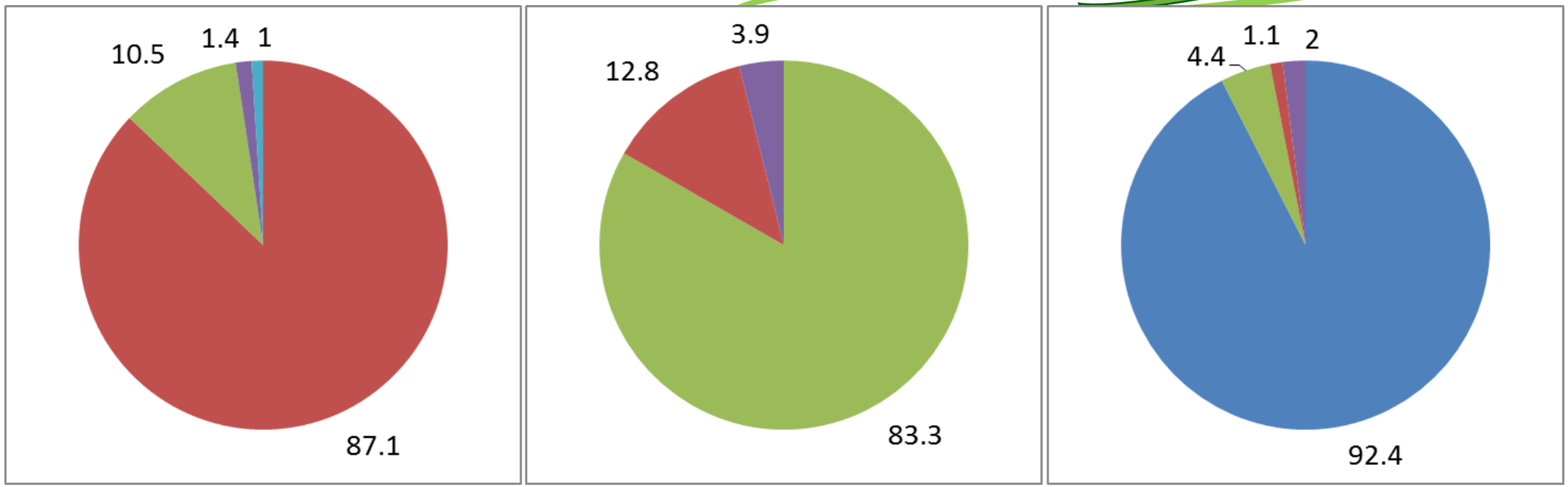
What to do during and after an Earthquake

Things to consider before Evacuating

(Example: Kawagoe City, Saitama pref. 2015)

https://www.city.kawagoe.saitama.jp/anzen_anshin/bousai_jouhou/hazardmap/jisin_hazardmap.files/omotemen.pdf

Causes of Death Differs



Great Kanto
Eq. (1923)
100,000+ dead

Hanshin-Awaji
Great Eq.(1995)
6,000+ dead

Great Tohoku
Eq. (2011)
19,000+ dead

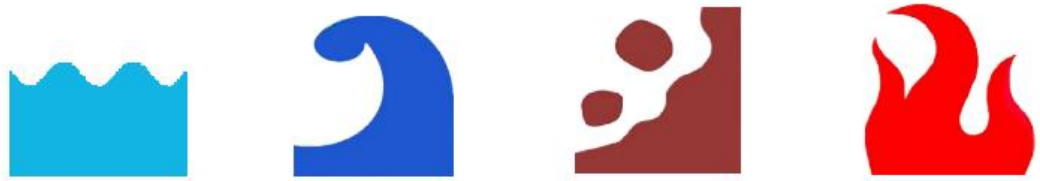
Source: CAO

Cause of death : Fire after earthquake : Building collapse
: Tsunami : Burial by pond failure : Others

…Needs to study different hazard

Evacuation areas & “Hazard Maps”

- Similar hazard maps are prepared for the other hazards. (Tsunami, landslides, liquefaction, fire & floods.)



Icons of evacuation areas for different hazards

- Selection method for evacuation area is also defined.

＜Types of evacuation Area
（designated by disaster type）＞

a) **Emergency Evacuation Area**

To secure life from imminent disaster risk

- Safe area from disaster risk
- In case where the area is not safe, has safe structure and is located higher than expected Tsunami inundation depth .

b) **Evacuation Area**

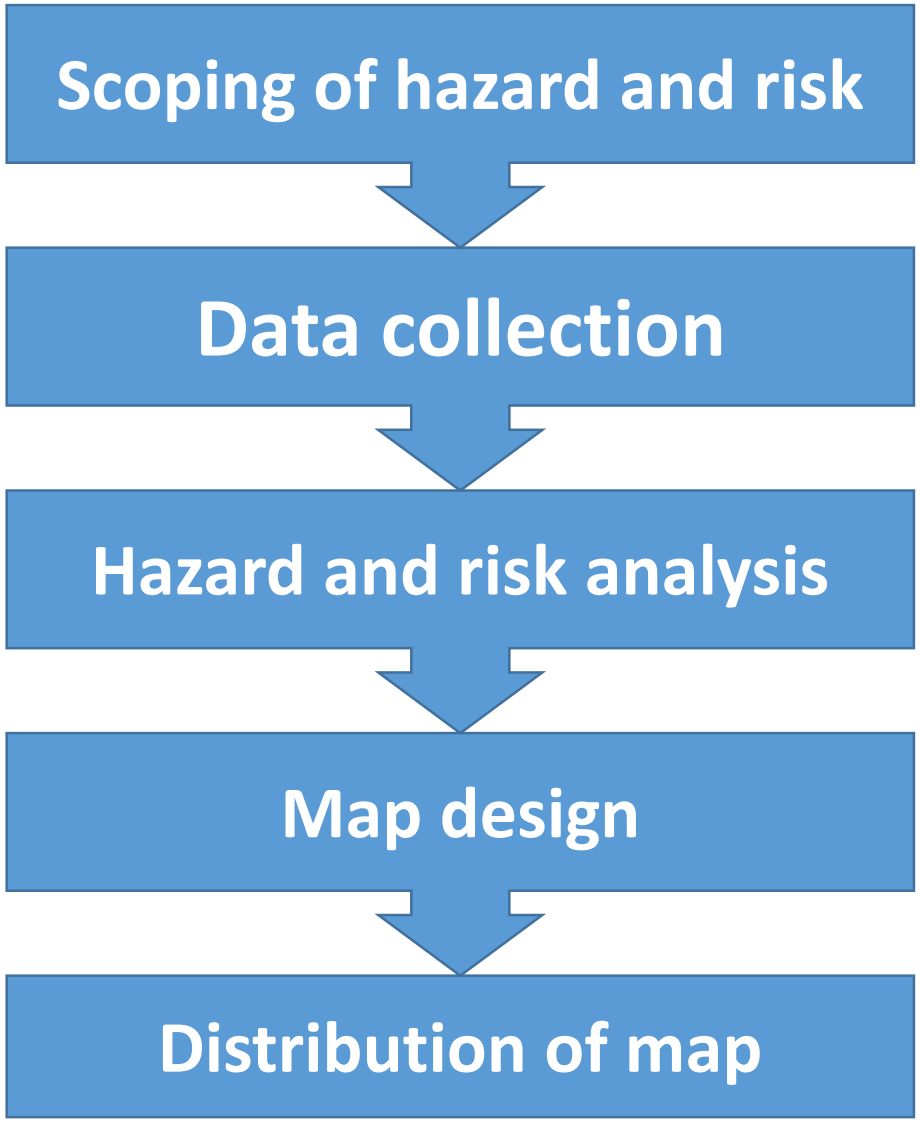
Area to stay some period until disaster risk diminishes.

- Appropriate size for evacuees' stay
- Possible to distribute life support items
- Relatively small effect of disaster
- Easy transport access by vehicles.

b’) **Welfare Evacuation Area**

Evacuation Area for those who needs special attention where room and smooth use is secured.

Standard Process to Create Japanese “Hazard Maps”



Definition of items to analyze &
responsible departments at the city/town/village level

Data for analysis & Data to include in map
(**Municipality often receives data from prefecture gov**.)

Selection of analysis method
Various methods depending on available data

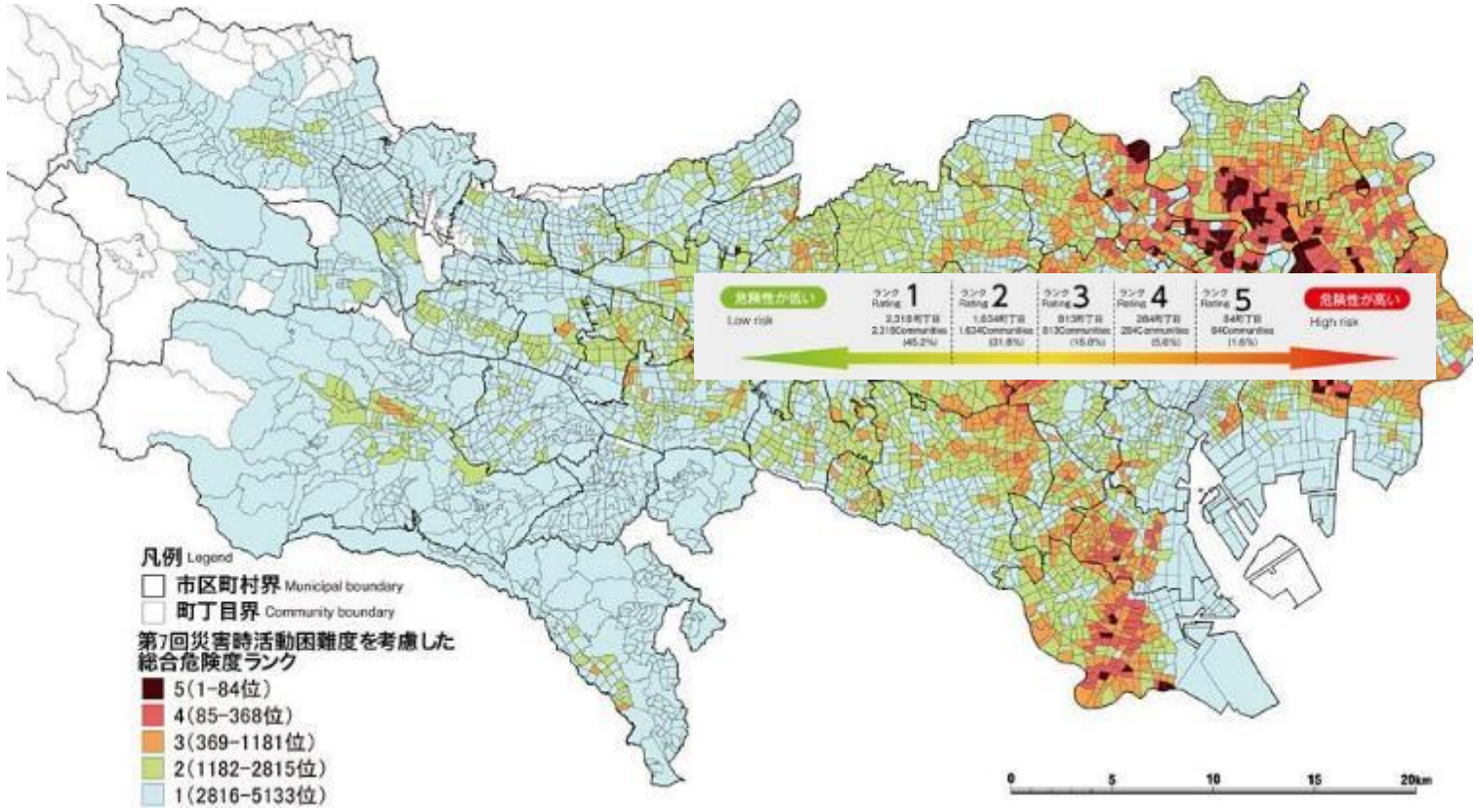
Paper size, output scale, mapping area and items,
educational information

Distribute to households, Bulletin boards, Web site

Good Visualization is Important

- **Illustrations** should be visually pleasing for all ages
- Use of **colors** to follow cartographic conventions:
  - **High risk…Red or dark**
  - **Low risk…Green or blue**
- **Articles** for the vulnerable
  - Ex. Preparation for women or elderly.

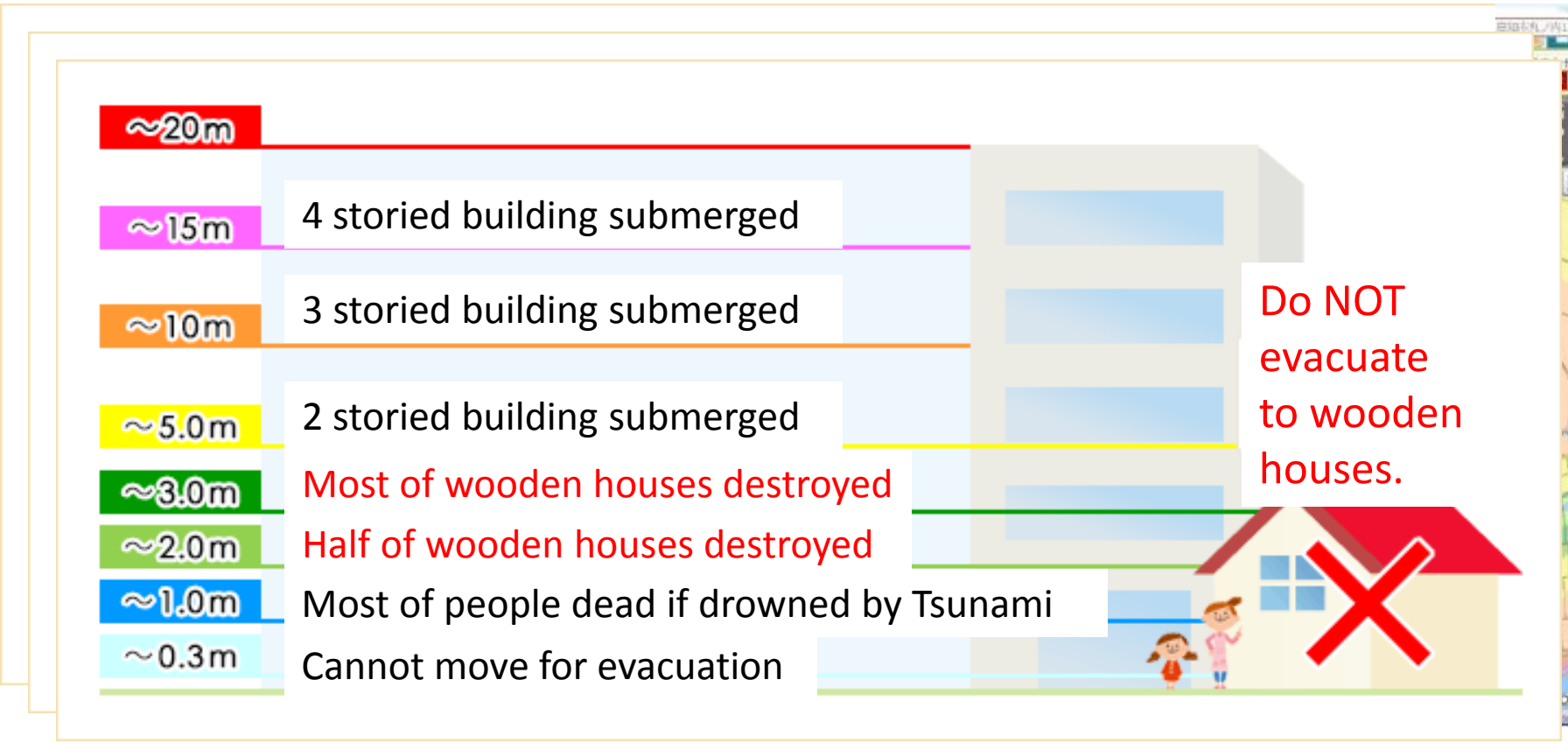
Example 1:
Tokyo metropolitan government assessment of fire following risk . Dark colors show high risk considering multiple indexes such as fire, density of urban areas, etc.

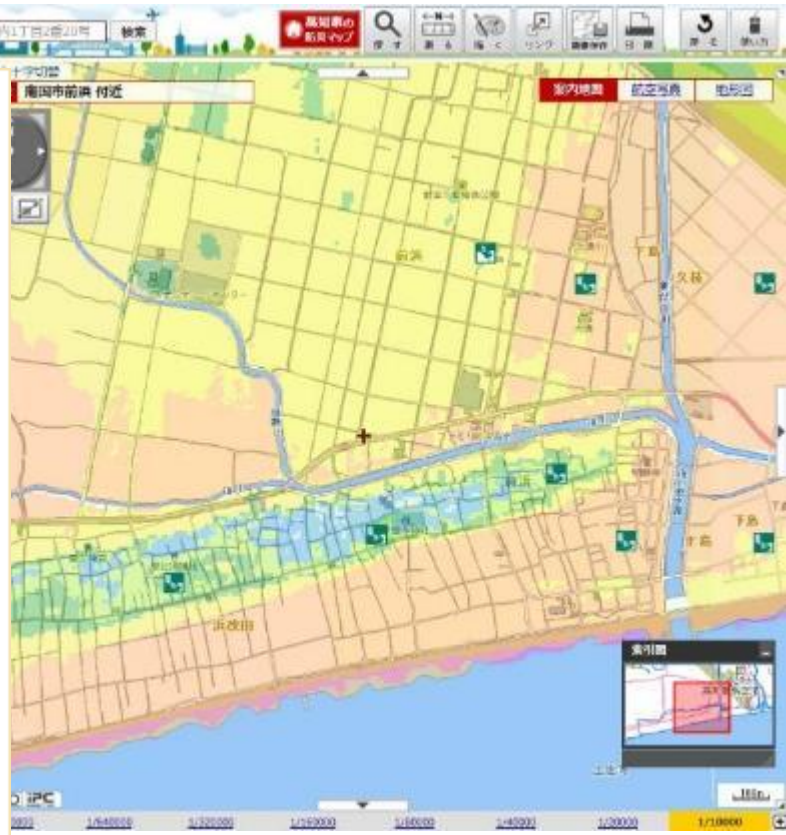


http://www.toshiseibi.metro.tokyo.jp/bosai/chousa_6/home.htm

Good Visualization is Important

Example 2: Color indicates estimated Tsunami inundation depth.
Ex. Inundation of 2-3m deep will destroy almost all wooden houses.





http://bousaimap.pref.kochi.lg.jp/kochi/top/agreement.asp?dtp=1&dtpold=&npg=/kochi/top/select.asp&npr=dtp=1/pl=3

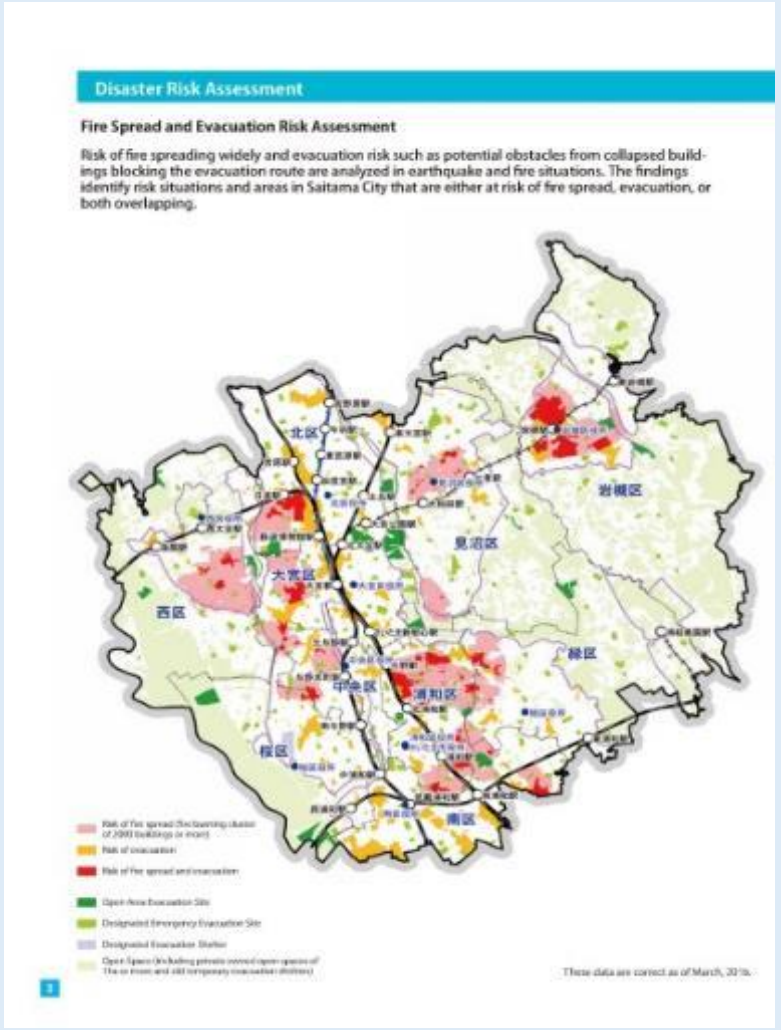
Dissemination and its use

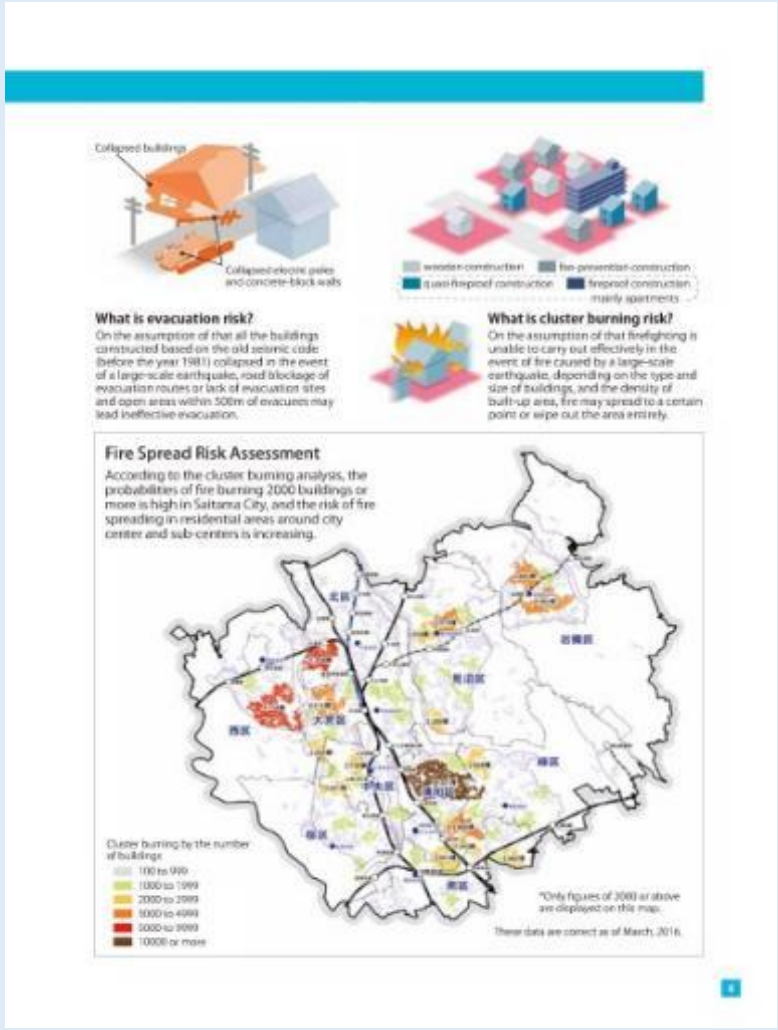
- City gov. Website
- Paper version

- Lectures upon request
- Host town walks using hazard map
- Use of hazard map for disaster education in classroom or for residents

Photo: Courtesy of Saitama city

Example for Saitama city, Japan





Challenges in Making Them Useful

- Low **awareness** of Hazard maps by communities
- The hazard **scenario** can be wrong
- Need to keep asset **database** up-to-date
- **Justification** for risk and hazard assessment
- Handling of **extreme scenario**
  - Limitation of **structural** measure

Example in Saitama city

＜Experience in database maintenance＞
・All building database using GIS prepared 10 years ago. (1/1,000 scale)

・Only periodical update necessary. Hard to recover if maintenance is stopped.

・GIS data can be used for other purposes as well.

＜Justification of assessment＞
・Basis to promote disaster preparedness measures by government leaders including mayor.

Thank you for your attention!

Questions?