Role of the Geospatial Information Authority of Japan in Disaster Response as Exemplified in the Great East Japan Earthquake in 2011

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Geospatial Information Authority of Japan (GSI)

interaction of nature and mankind

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physical working of nature → human activities

gravity
water
air
earth rotation
plate movement

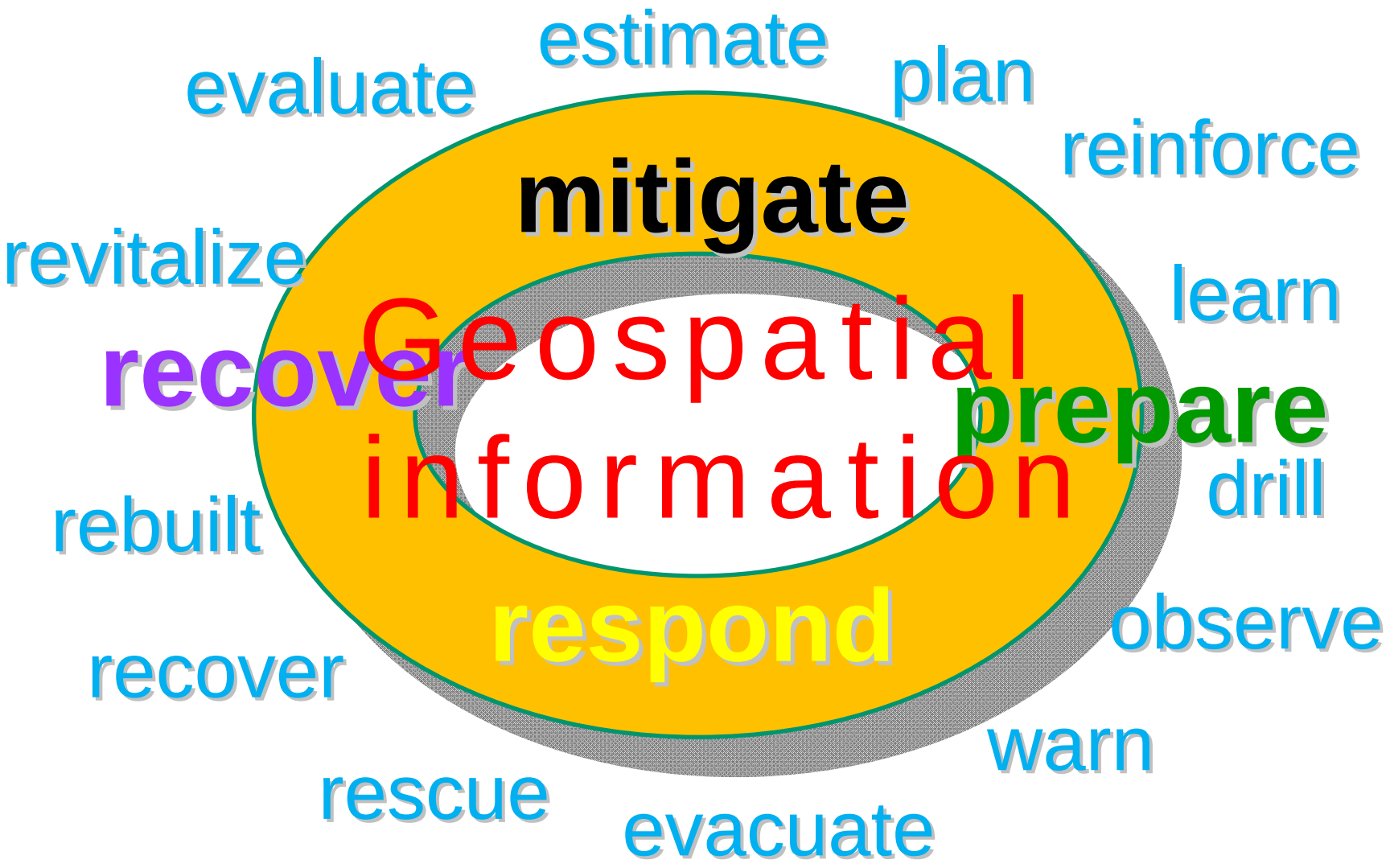
blessing

disaster

habitation
agriculture
economy
transportation
tourism

disaster life cycle

Geospatial Information Authority of Japan



Ring of Fire

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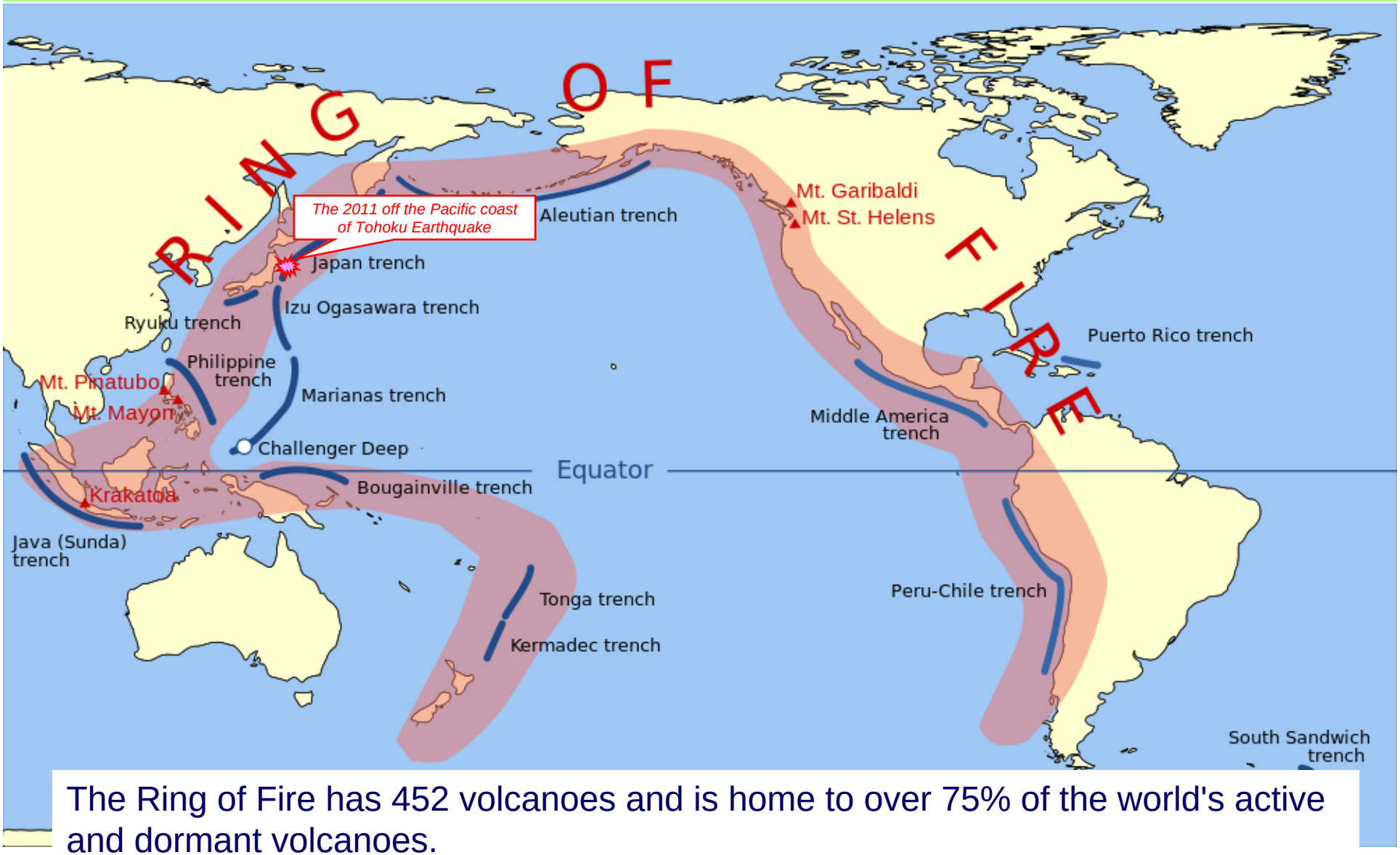


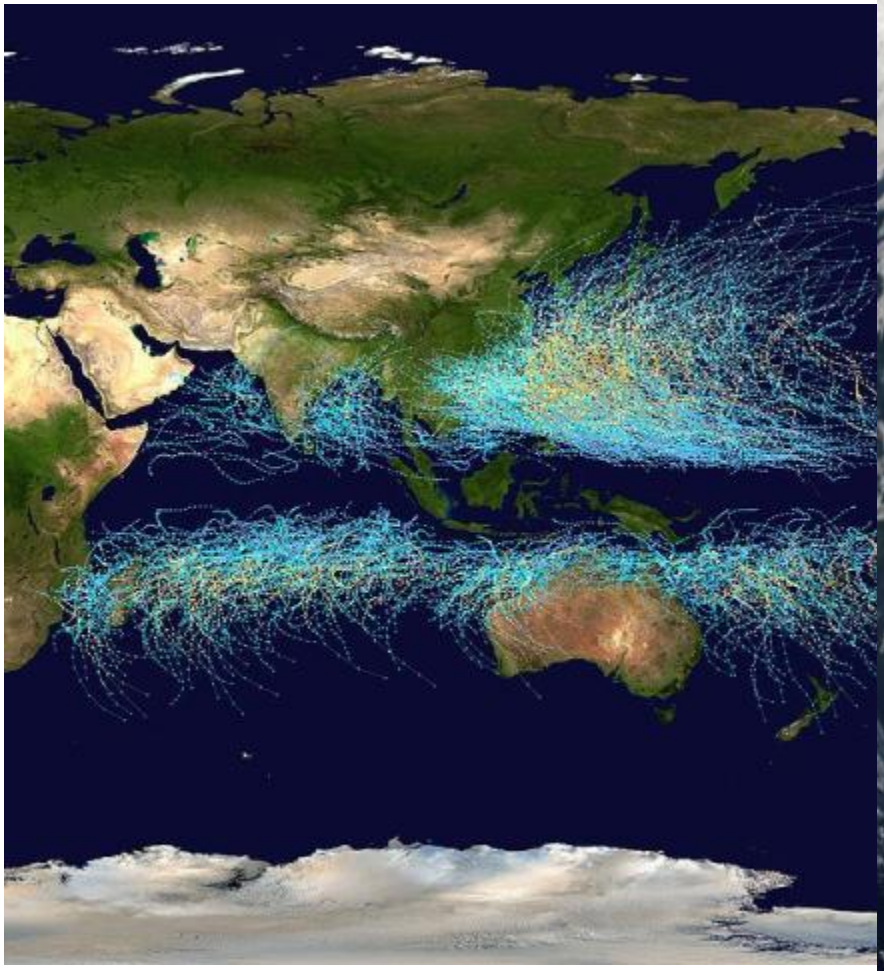
The Ring of Fire has 452 volcanoes and is home to over 75% of the world's active and dormant volcanoes.

About 90% of the world's earthquakes and 81% of the world's largest earthquakes occur along the Ring of Fire.

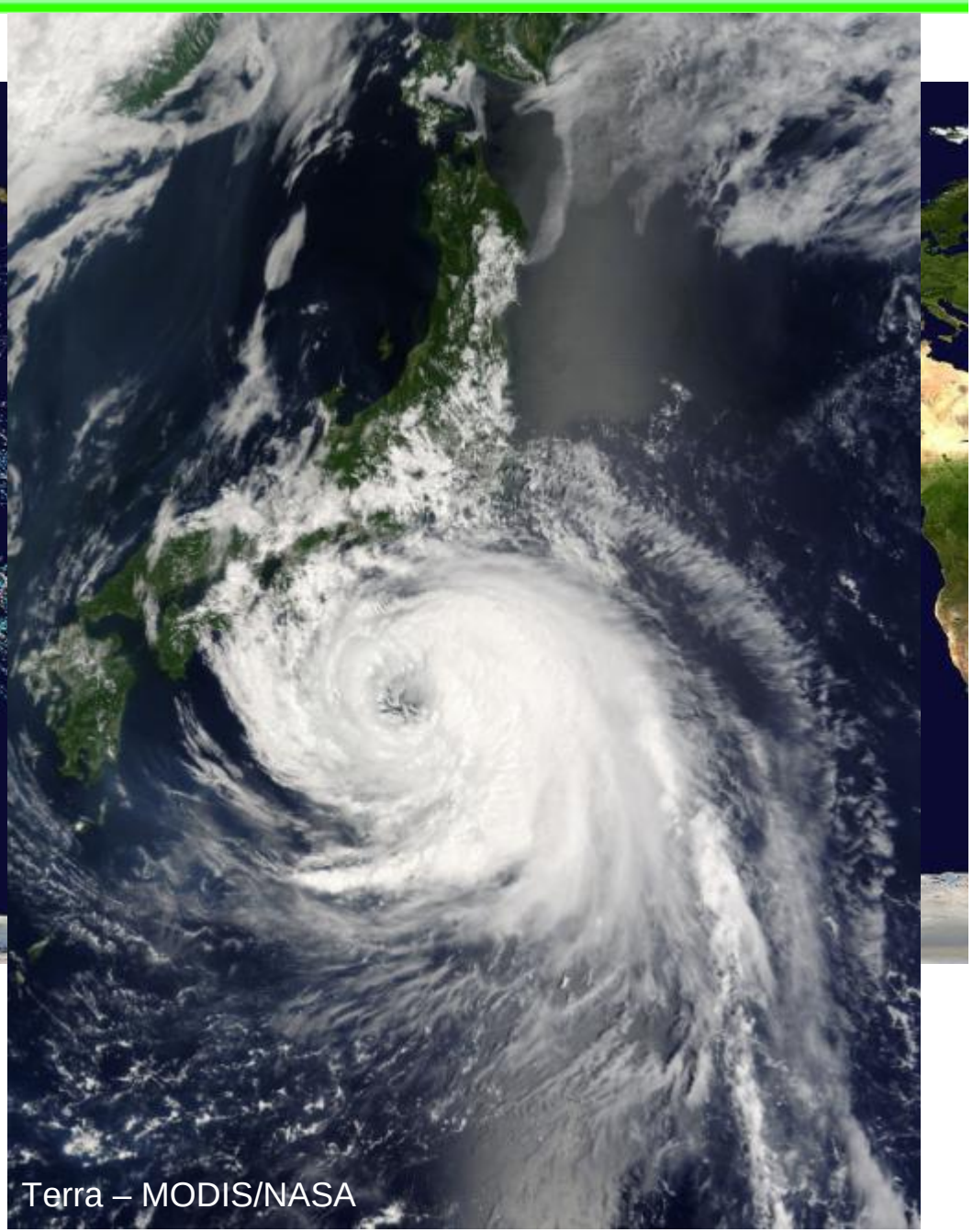
From Wikipedia

Typhoon paths

Geospatial Information Authority of Japan



Global Tropical Cyclone



Blessings

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Hazards in Japan

Geospatial Information Authority of Japan

Photo: Cabinet Office web page

Photo: Asahi Shinbun

What would be the role of NGIAs in disasters?

Mandate

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- Basic Act for Disaster Countermeasures
  - Enacted more than 50 years ago
  - To protect land and property of the country/people from hazards by making necessary institutional arrangements and other measures including financial provisions
  - 24 designated organizations in the Government including GSI
    - Mandated to gather and share information on disasters,
      while **maximizing the use of geospatial information**.

Amended after 3.11 Earthquake

GSI Response Summary

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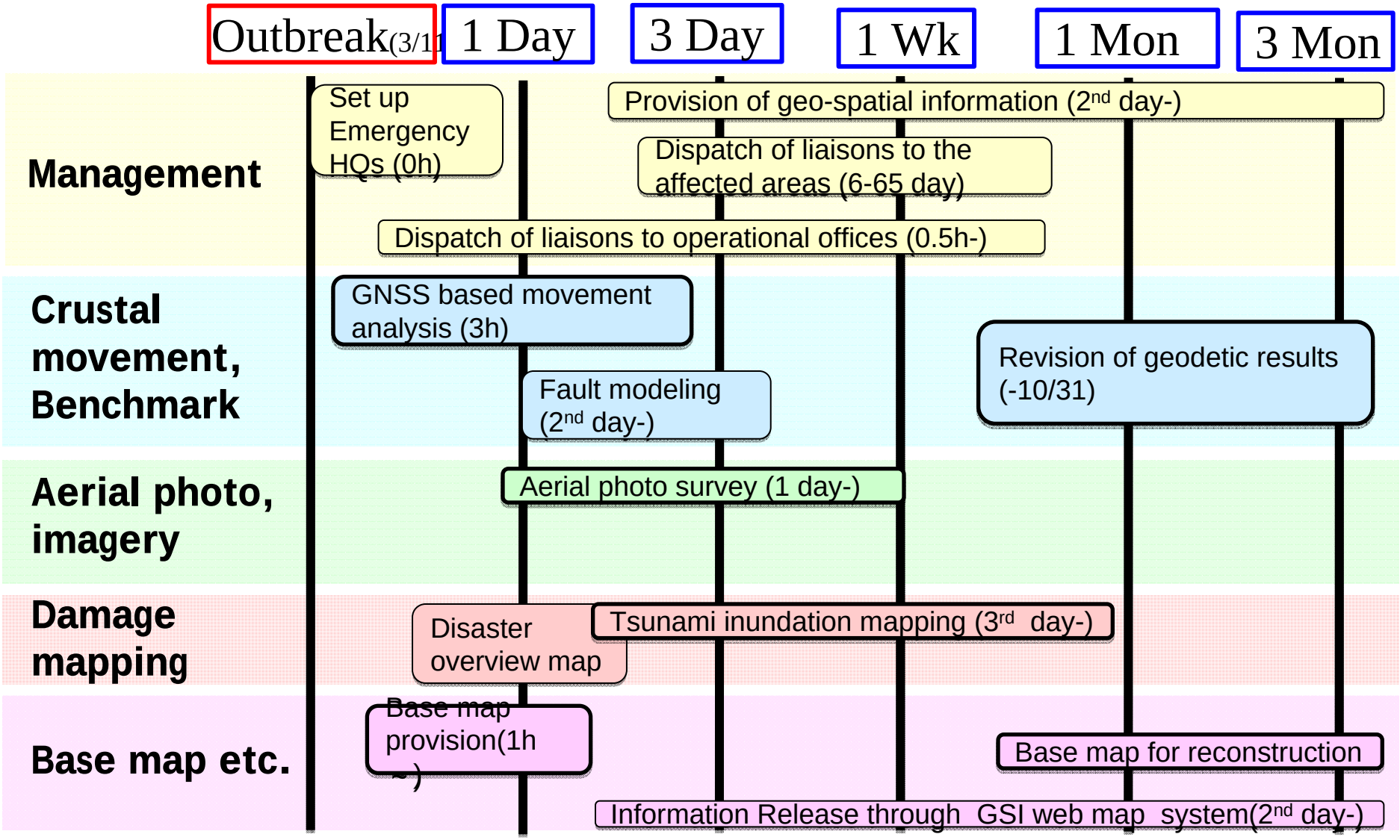
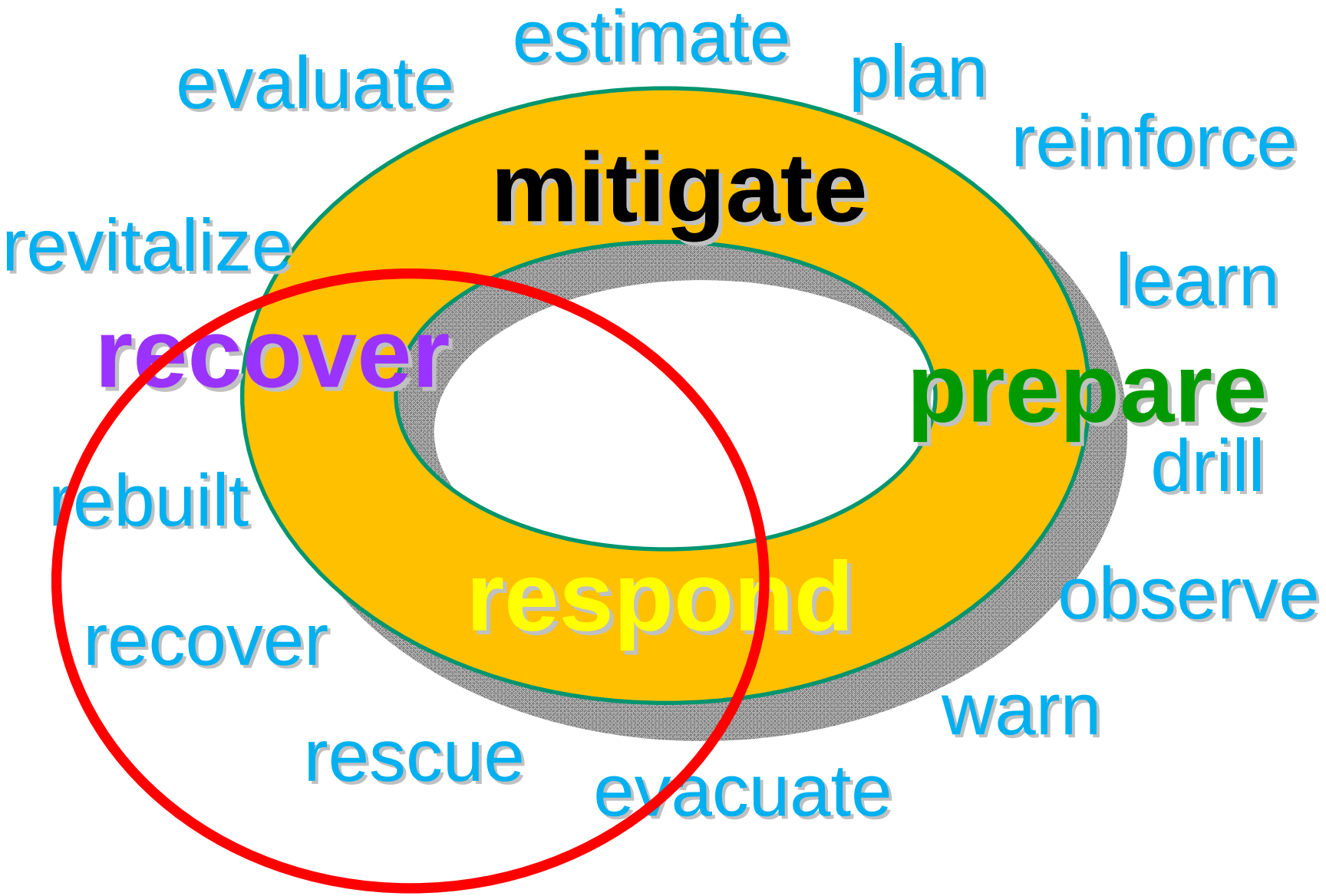


disaster life cycle



Disaster caused by the Great East Japan Earthquake on 11 March 2011

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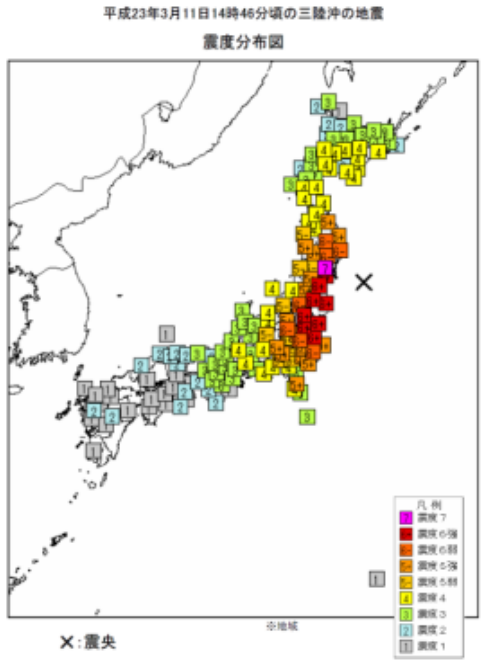
- Earthquake:

  Epicenter: Off coast of Sanriku area

  Depth: 24km Magnitude: 9.0

  Fault: Length 450km, Width 200km



- Tsunami:
  - Highest elevation reached: 43m
  - Inundated areas: 561 square km
  - Nuclear plant accident

What GSI did at 3.11 Earthquake

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- Provision of maps of affected areas(paper maps, digital maps, printed images)
- Detection and analysis of ground surface movement with GNSS control point network
- Air survey (Aerial photos, Ortho images)
- Photo interpretation to map inundated areas
- LiDAR survey for detailed elevation data
- SAR interferometric analysis
- Resurvey of geodetic control points
- Reconstruction of destroyed GNSS station
- Recalculation of geodetic coordinate system
- Guidance for local governments' resurvey
- Modeling of fault slip using inversion method

What GSI did at 3.11 Earthquake

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in emergency response phase

- Provision of maps of affected areas
  - Immediately (< 1h) to designated Government offices starting from small-scale maps (1:500k).
- Detection and analysis of ground surface movement with GNSS control point network
- Air survey (Aerial photos + Ortho images)
  - Photo interpretation and measurement of damaged areas.
- …

Provision of Maps (< 1 hour)

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Ground Surface Movement (+ 3 hours -)

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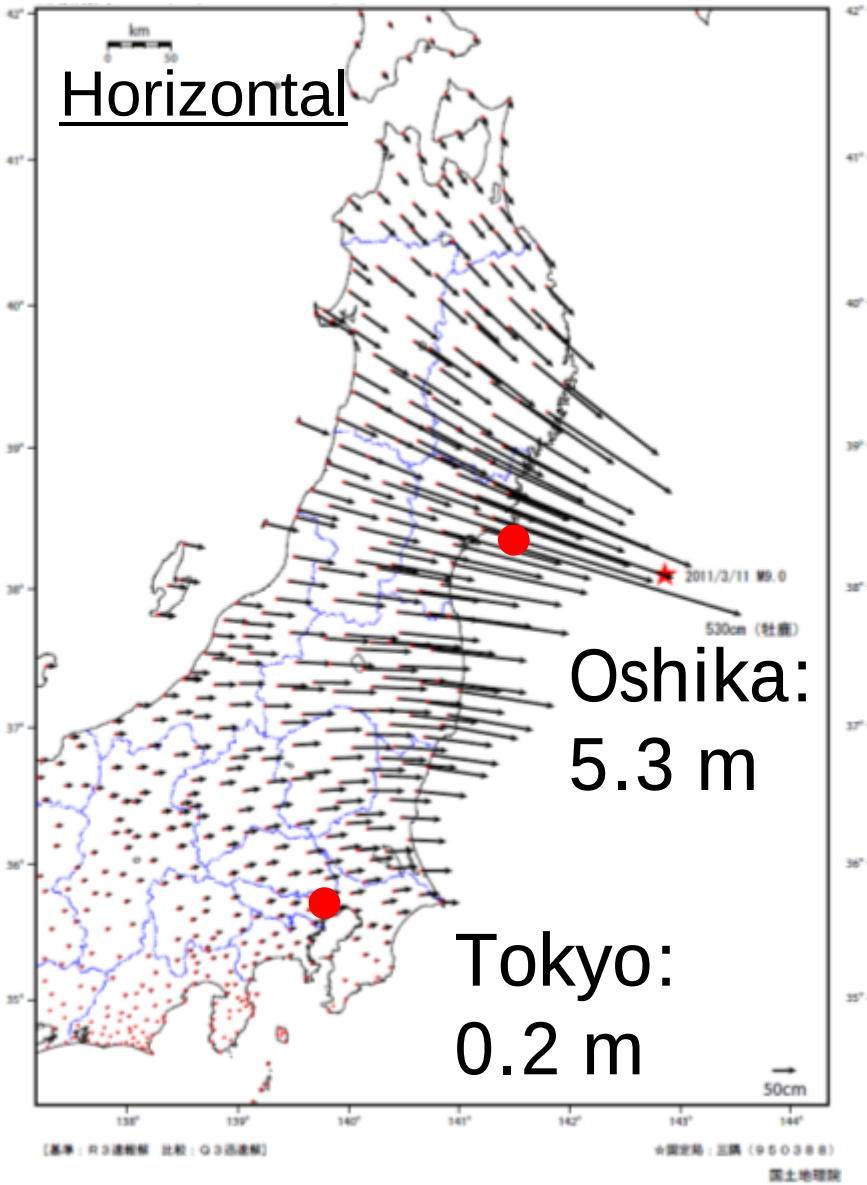
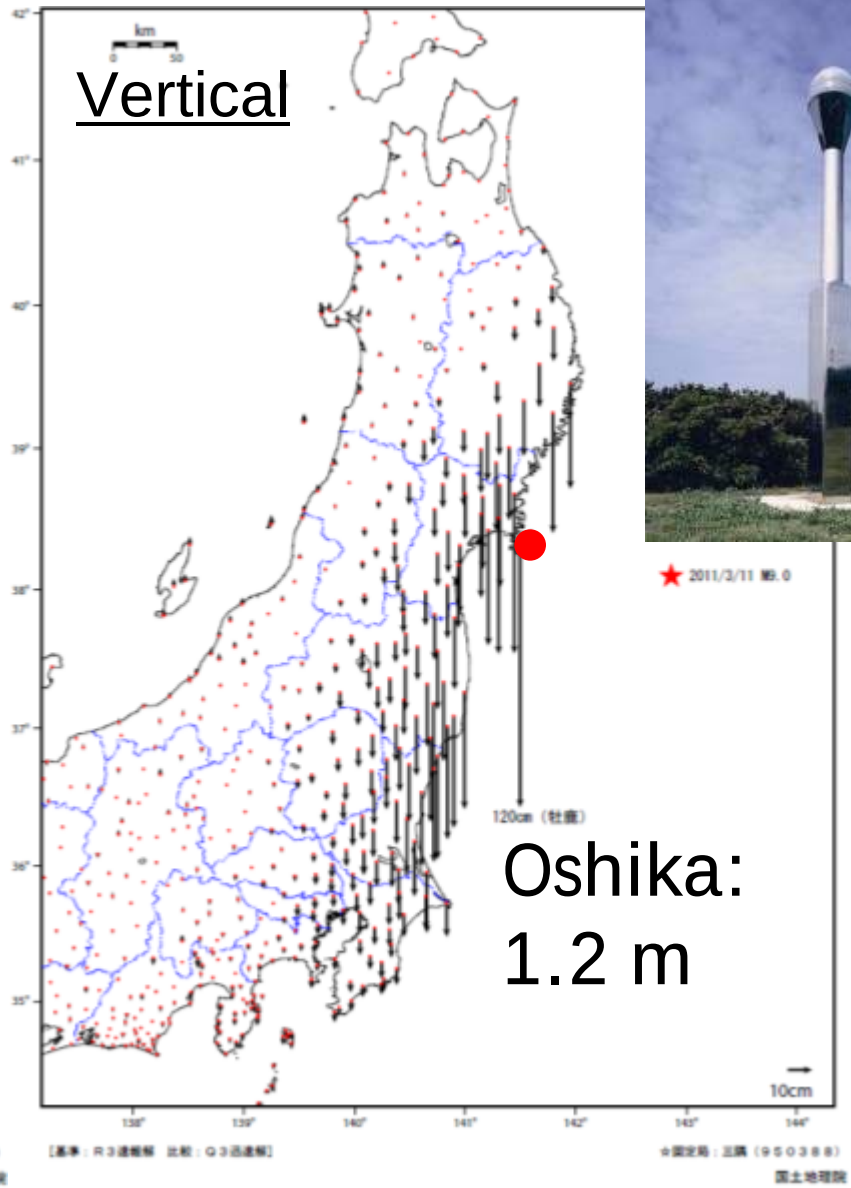
GNSS based control stations observed large crustal movement





Air photos (+ one day -)

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Photo Interpretation (+ 3 days -)

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Inundation Areas

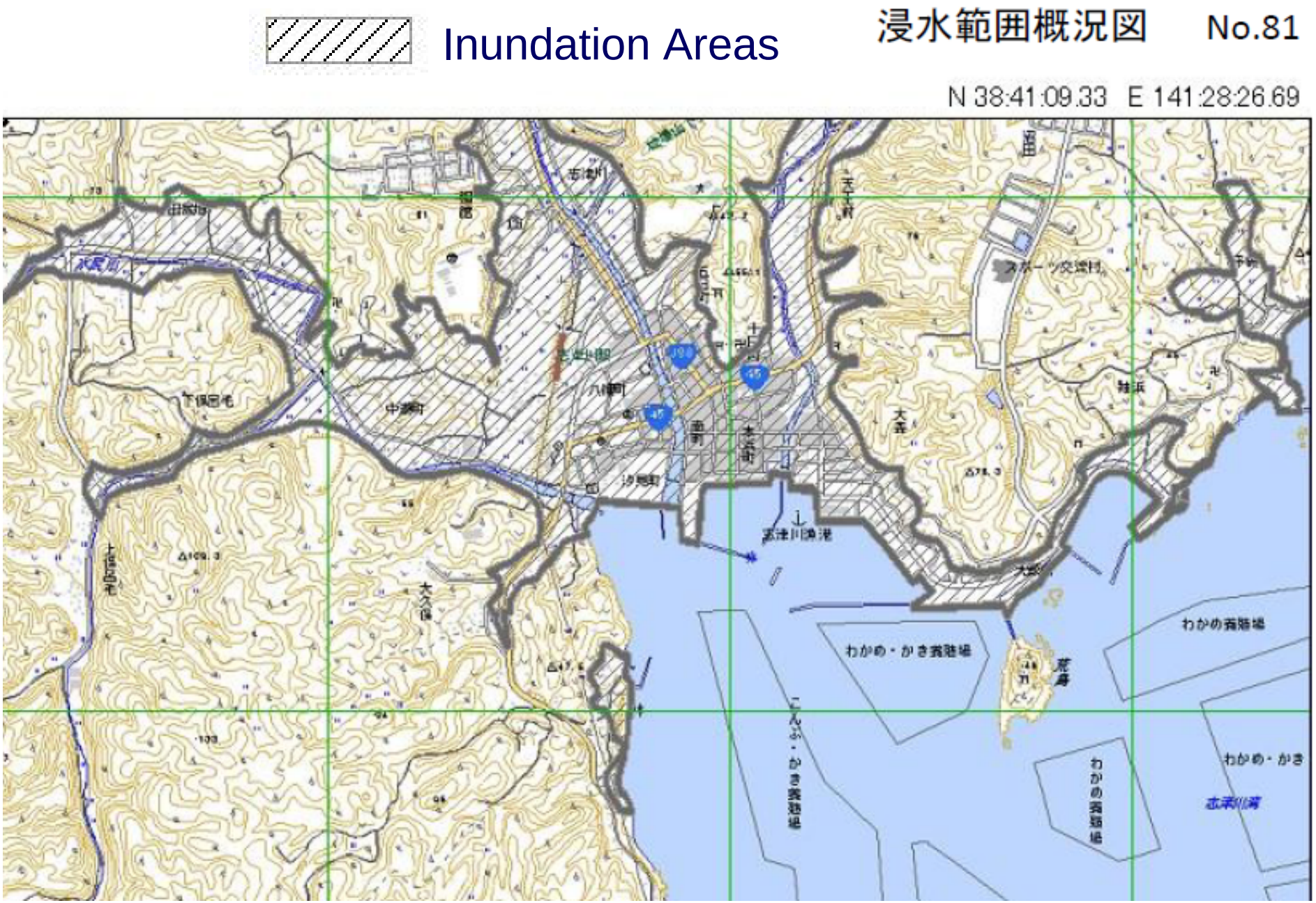

Photo Interpretation (+ 3 days -)

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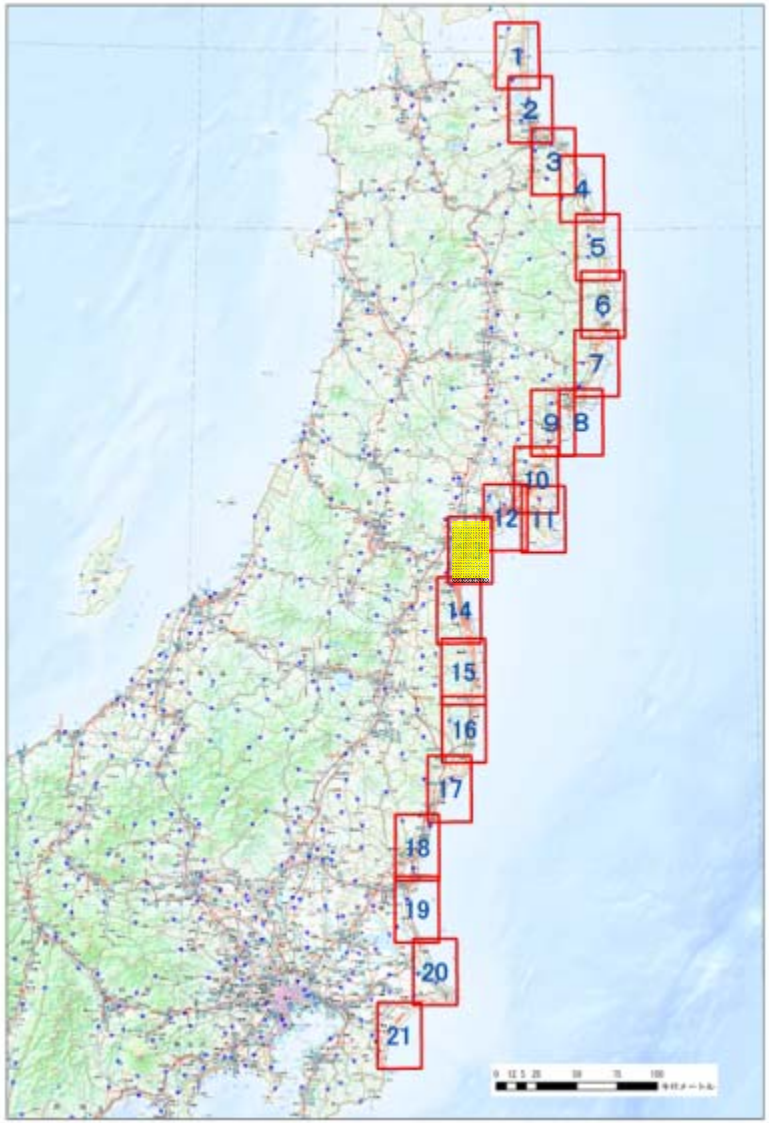

Total inundation areas: 561 square km

Recovery Phase (+ 1-2 months -)

- Resurvey for new coordinates of geodetic control points
  - Resurvey of selected control points
  - Calculation of transformation parameters
  - Revision of coordinates of control point network origins (horizontal & vertical)

- New mapping of damaged areas
  - 1:2,500 scale mapping for reconstruction planning

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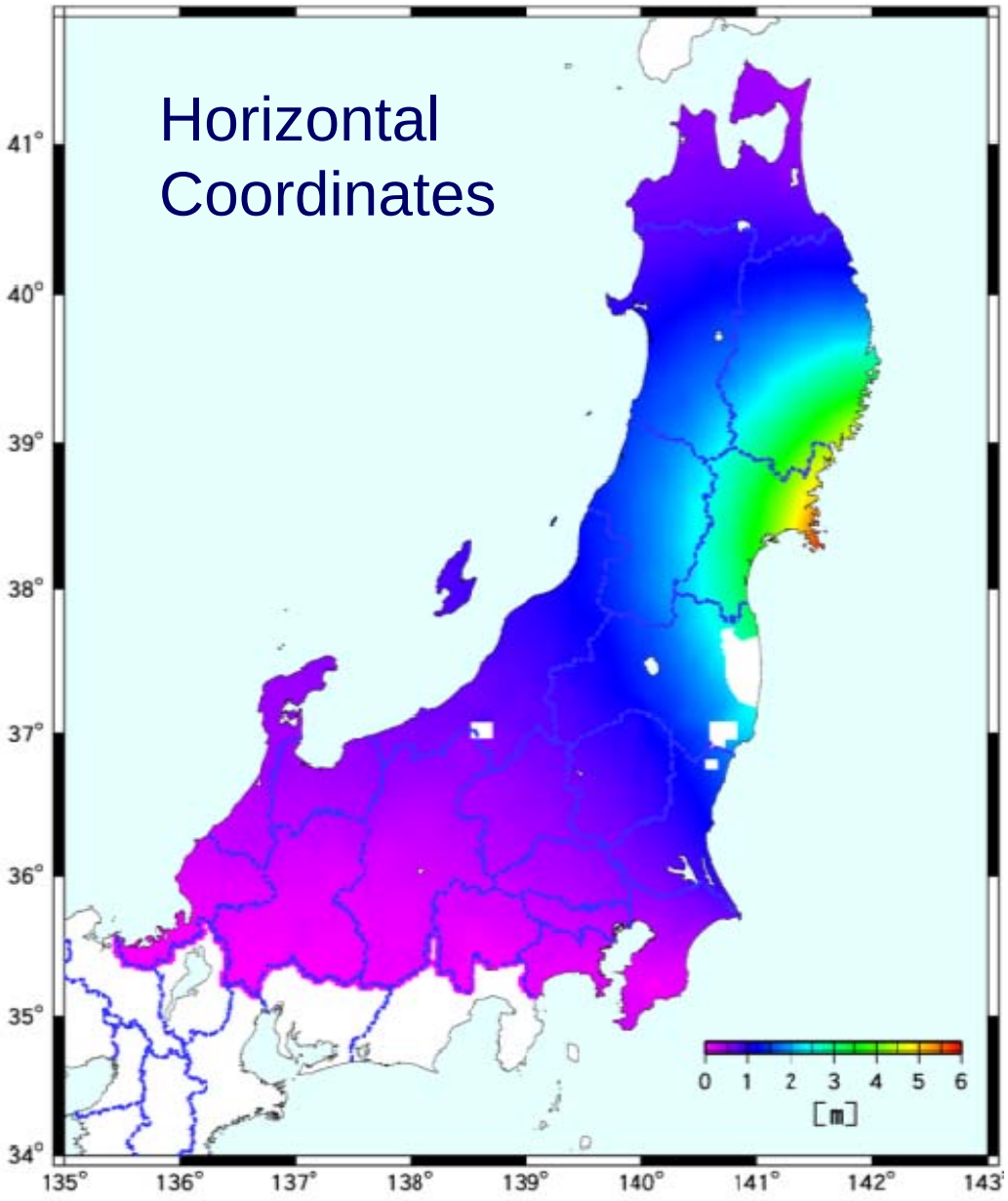
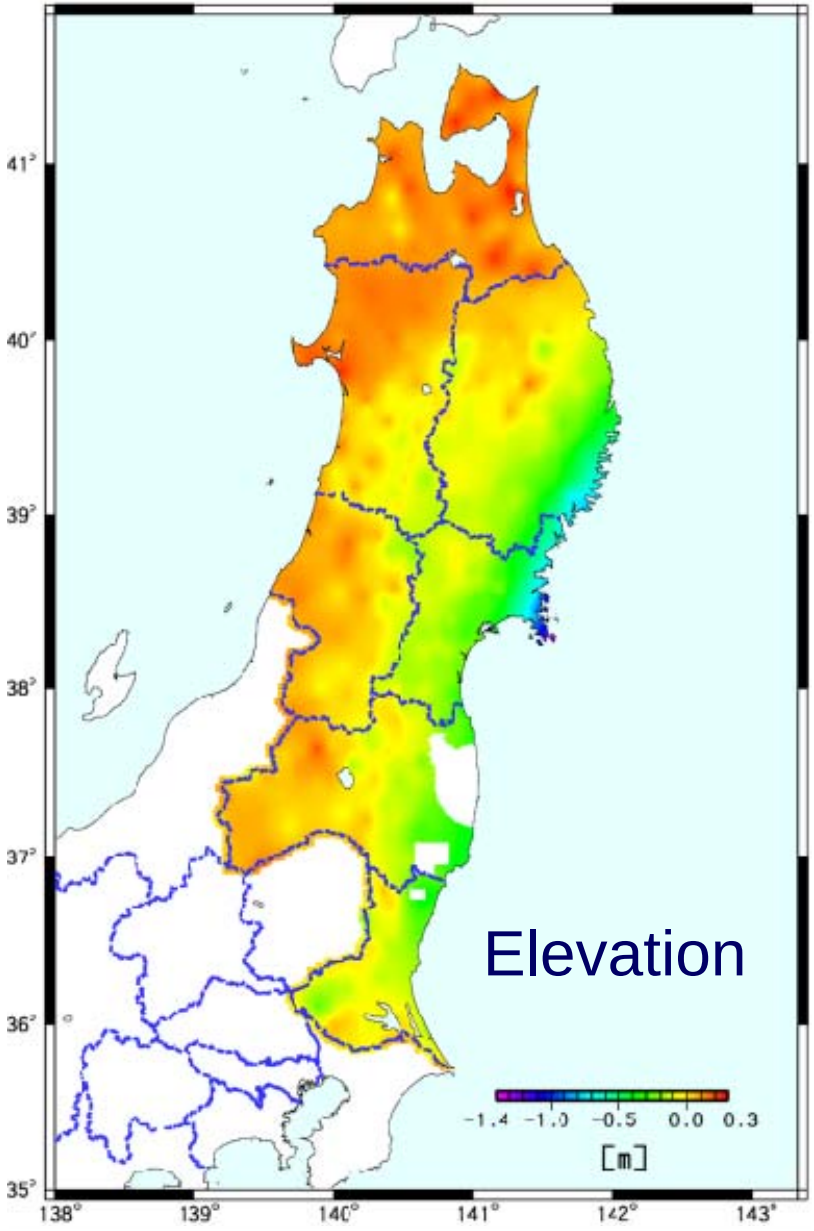
Correction parameters for triangulation points





Recovery Planning Map

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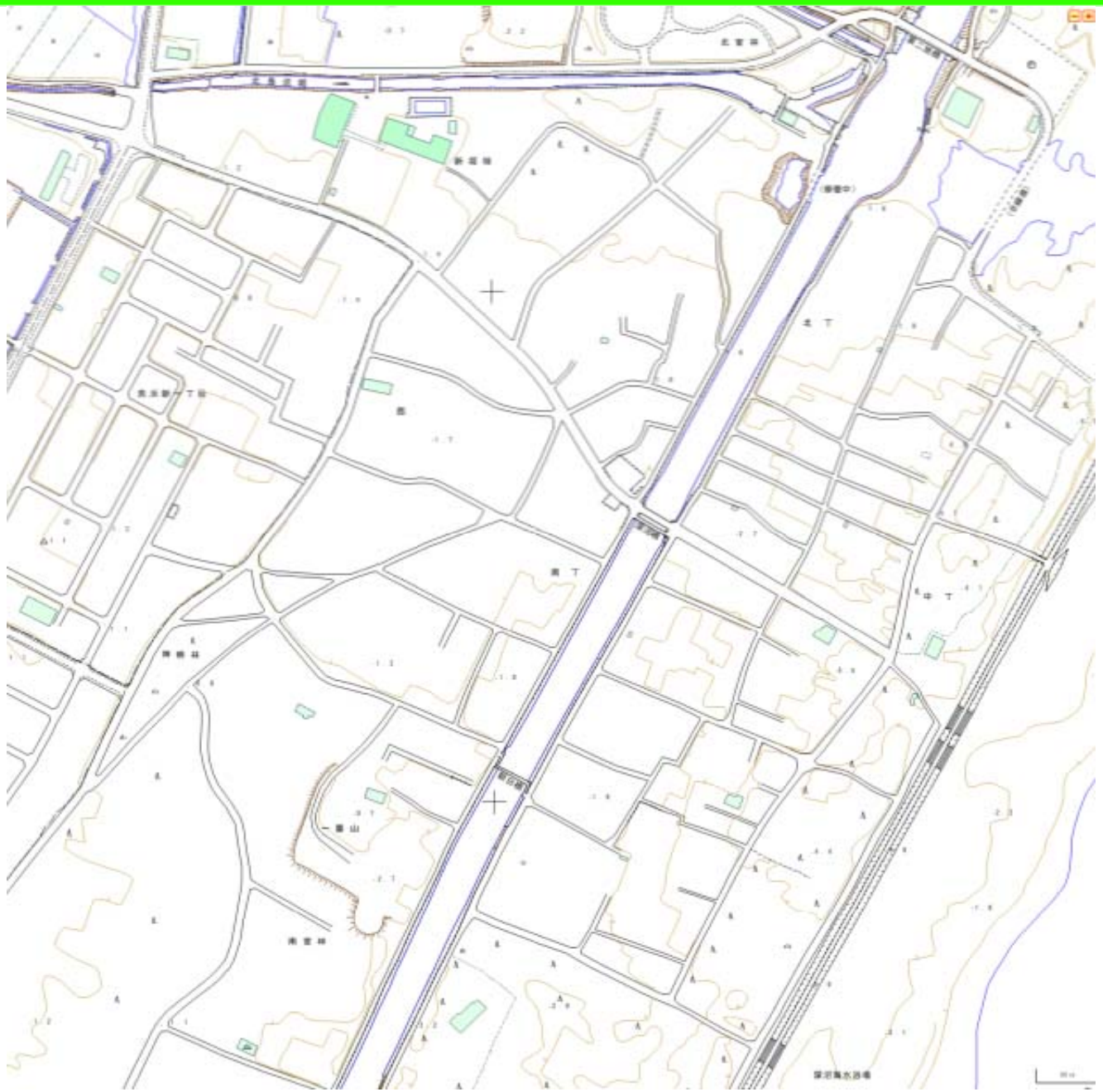

To whom?

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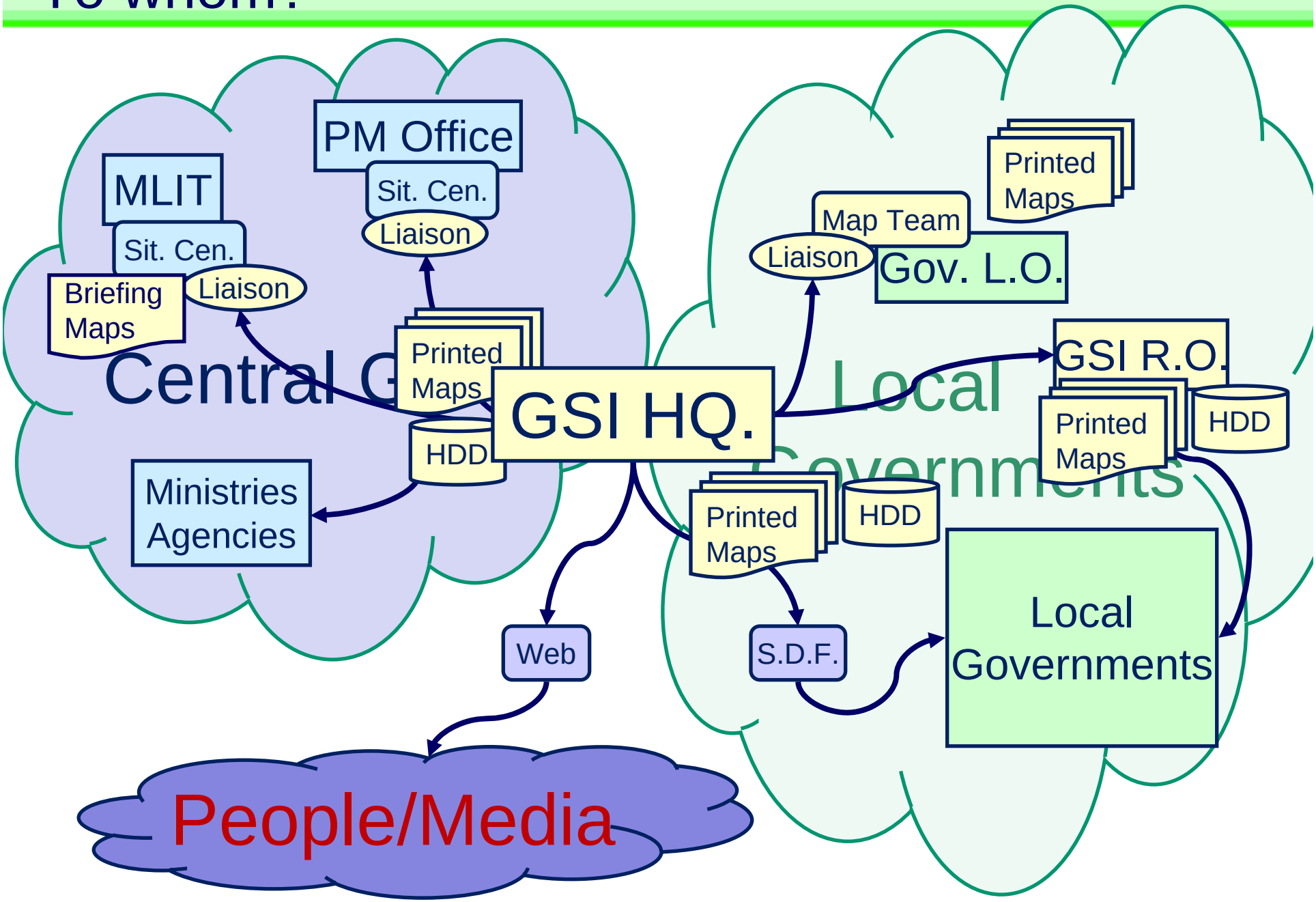

disaster life cycle

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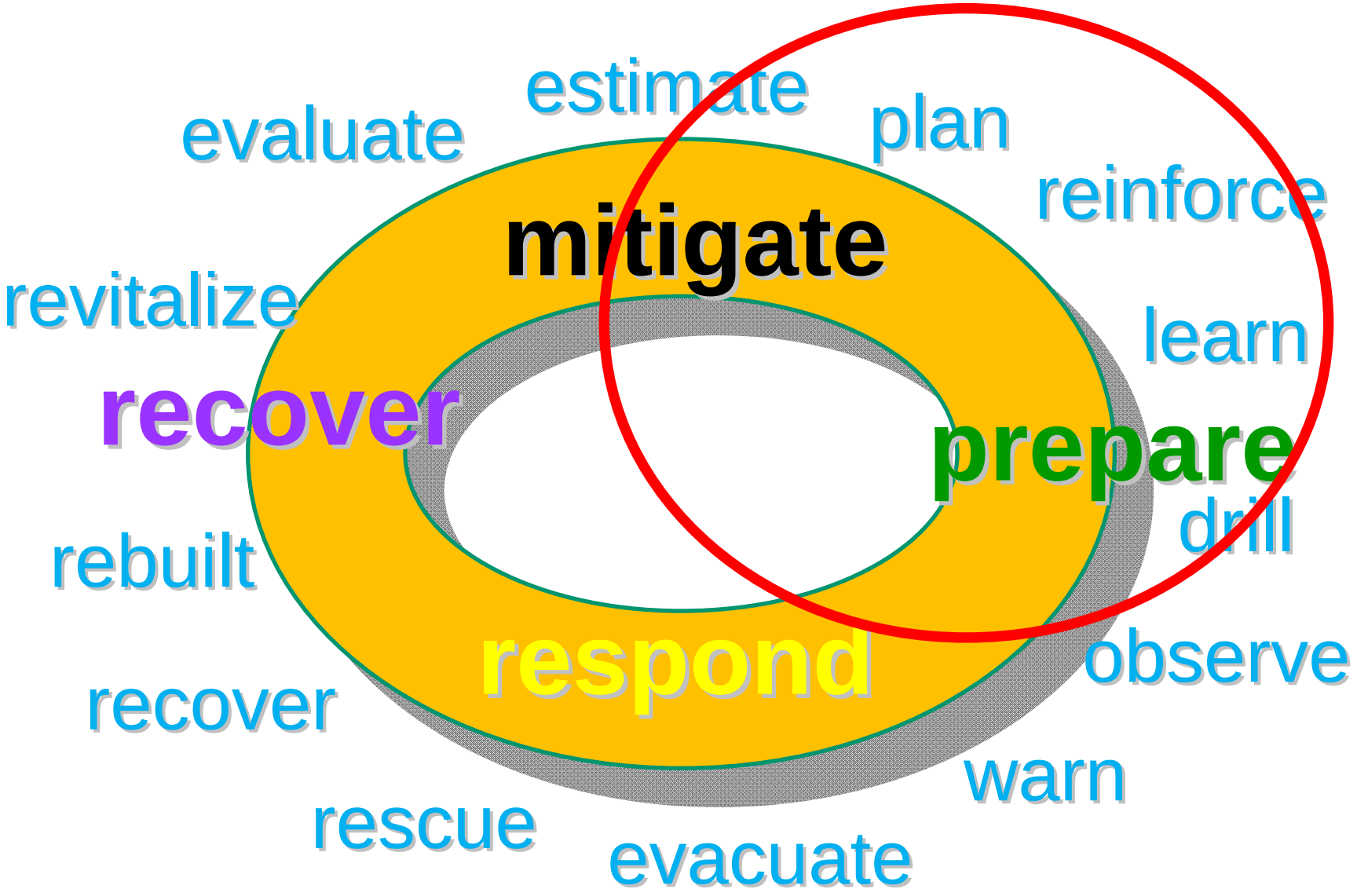

What can we do in pre-disaster stage

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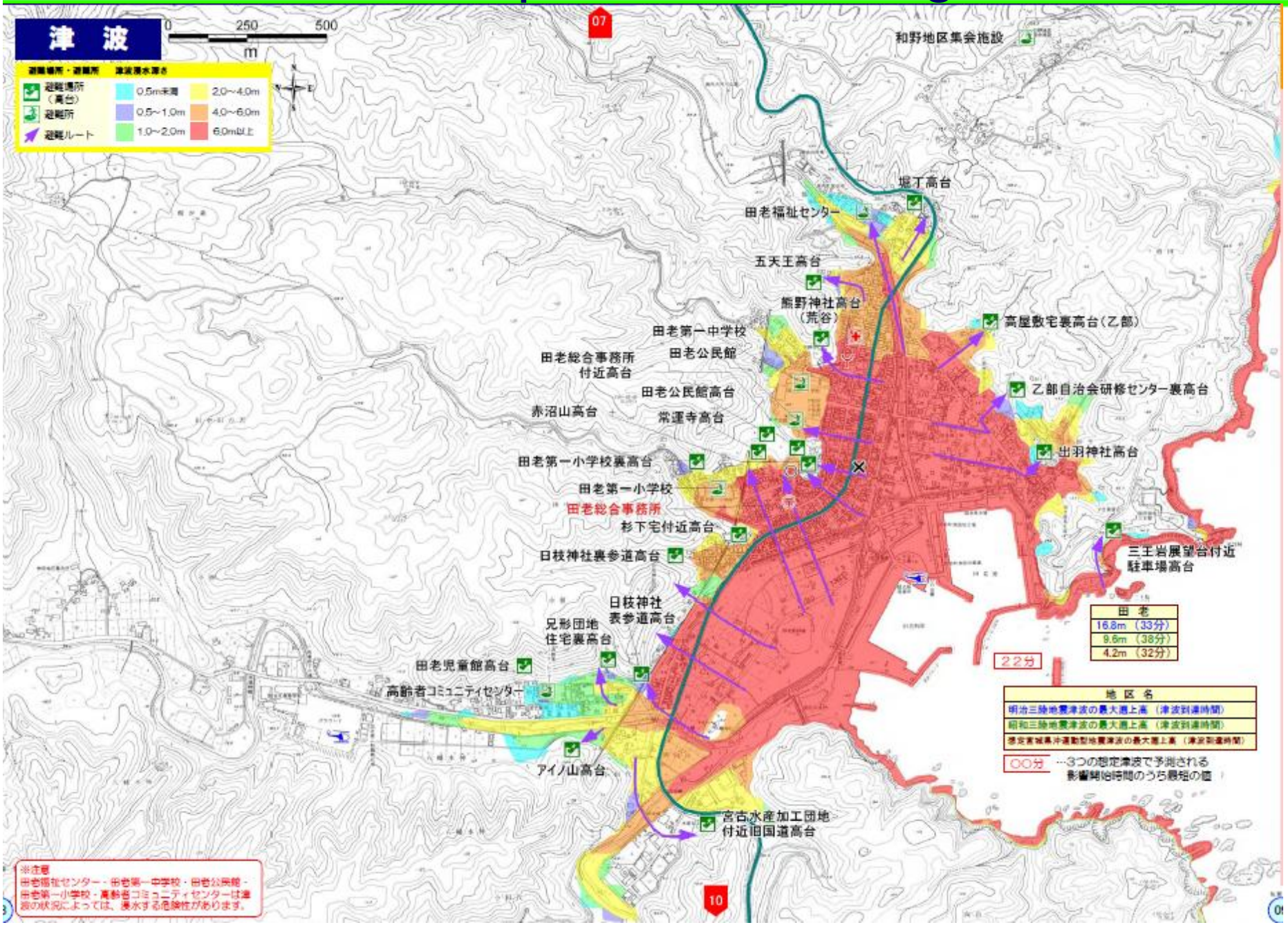

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Geospatial Information Authority of Japan

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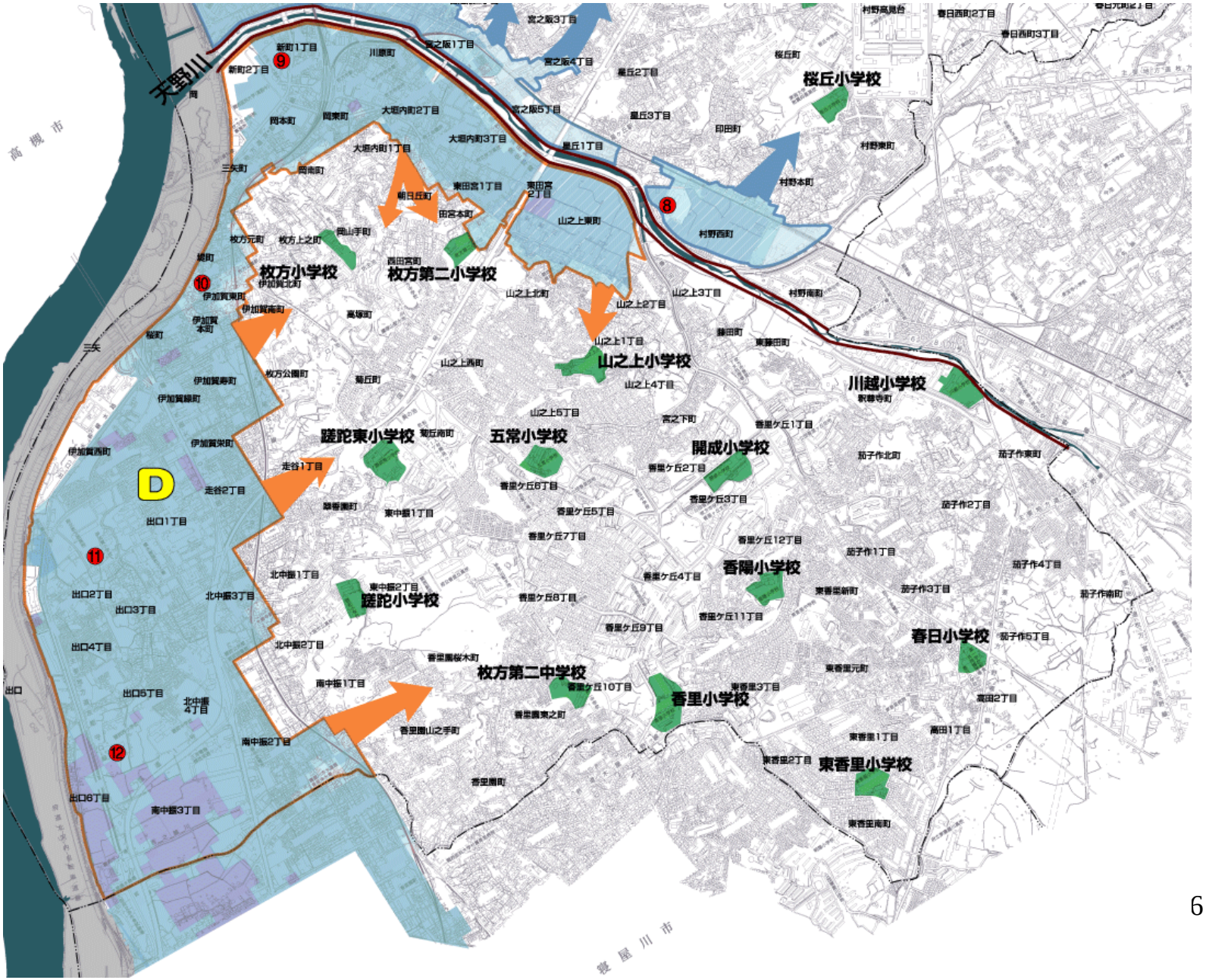

What can we do in pre-disaster stage

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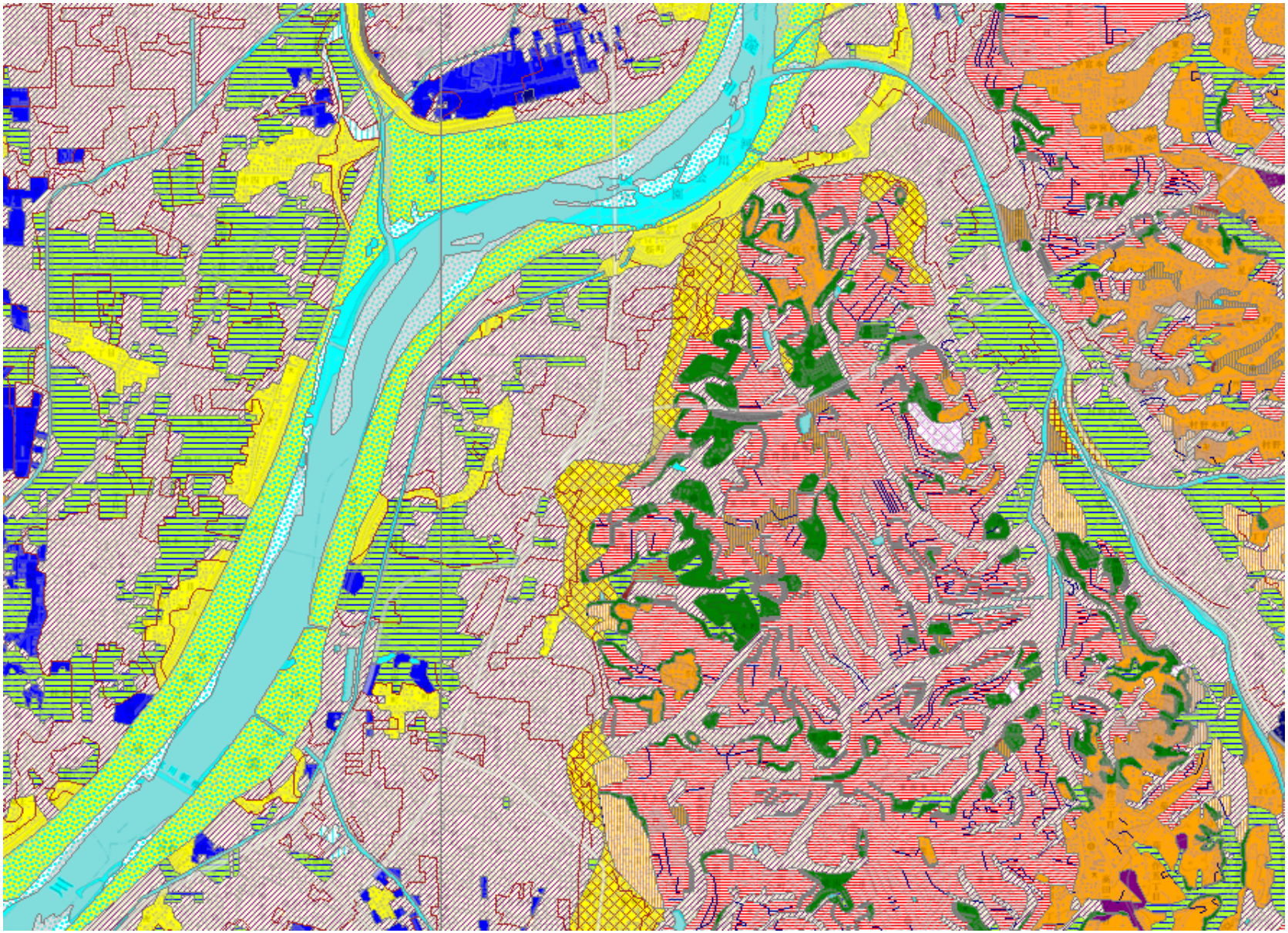

What should be done in preparation?

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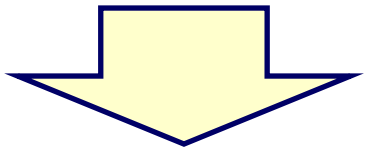
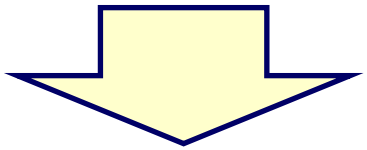
"What we can't do normally can't be done well in emergency response."



Good preparation makes us respond successfully to disasters.



What makes us well prepared for disasters?

Archive

- Old air photos immediately tell us the impact of a disaster when compared to those taken after the disaster.
  - Archiving maps and air photos to make them readily available for disaster response is NGIA's important responsibility.

Map revision

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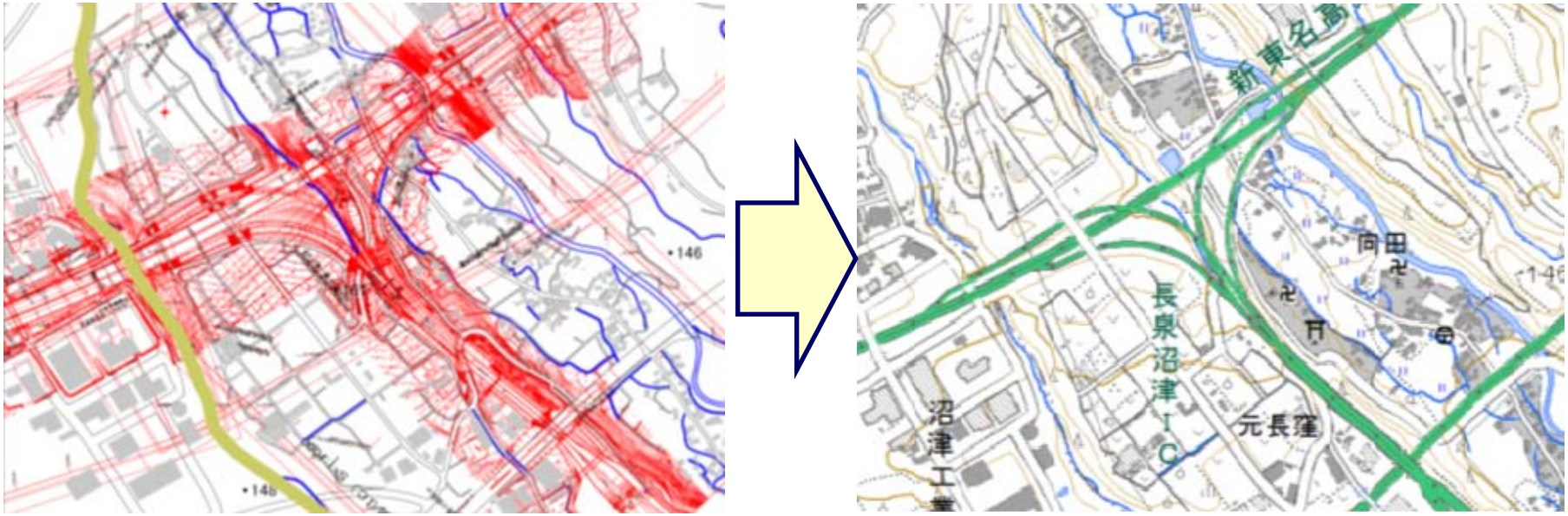
- Rescue workers from remote areas rely on maps in the planning of their operations.
- If maps don't show latest features, their work might be significantly hampered.



Cooperation with relevant organizations

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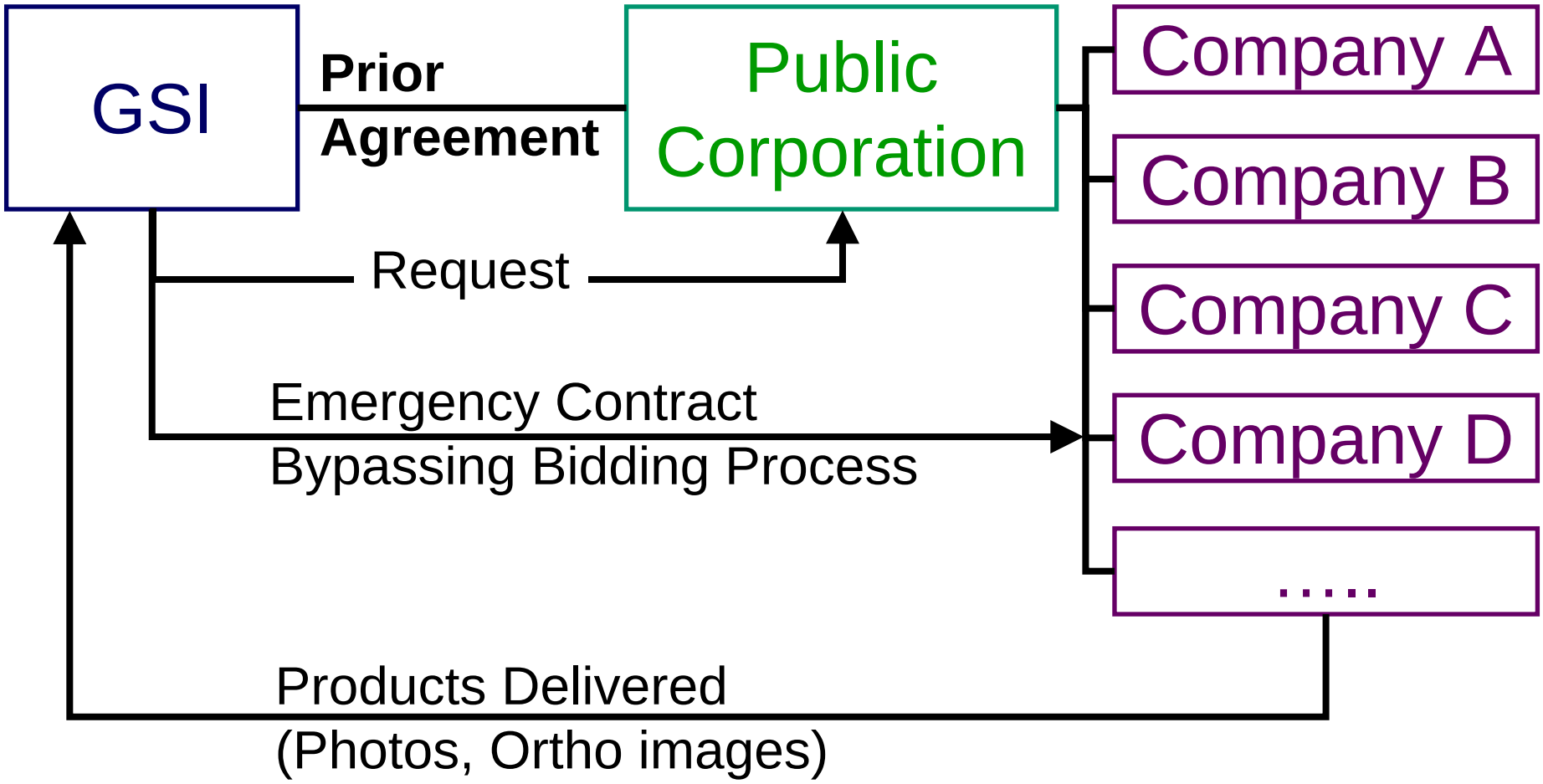
Arrangement for Emergency Air Survey



Drills

- Drills train us well prepared for disasters and also help us identify processes/equipment that need improvement/repair.
  - Communications
    - Response in 10 minutes to emergency messages to cell phone
    - Teleconference in 30 minutes
  - Air photos transfer to users (after plane landing)
    - < 4 hours for 11 prefectures around Tokyo
    - < 6 hours for the rest

Concluding Summary

- We can prepare for disasters through understanding the workings of nature and the interaction with human activities GEOGRAPHICALLY.

- GEOSPATIAL INFORMATION is vital throughout all the processes of disaster life cycle.

- NGIA should voluntarily contribute to disaster measures, especially the prompt response to disaster.

Concluding Summary

- Prompt provision of paper maps, printed copies of maps and aerial photos of damaged area on the scene can greatly help the rescue and recovery activities.

- Collaboration among the relevant organizations is the key for good contribution. Pre-disaster relationships with central and local governments and relevant private sectors should be critical.

Concluding Summary

- Archiving maps and air photos to make them readily available for disaster response is NGIA's important responsibility.

- Map revision is also an important task for NGIAs as the preparation for disaster response.

- The role of NGIAs is becoming increasingly important because of the growing awareness on the critical role of geospatial information in case of disasters. NGIAs should constantly improve their preparedness for disaster.

Concluding Summary

Geospatial Information Authority of Japan

- GSI has a lot of experiences and knowledge for disaster prevention and response. We would be appreciate if we can share our experiences in the NGIA community of the world through such as science and technology cooperation programs and ODA schemes.

- Contact: International Division

  intex@gsi.go.jp

THANK YOU!

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