Applications of geospatial data and technology on disaster management activities in Japan

Bokuro Urabe

Geospatial Information Authority of Japan (GSI),

Ministry of Land, Infrastructure, Transport and Tourism, Japan
1. Recent output of UN-GGIM-AP for DRM

2. Latest Trends in Surveying and Mapping

3. GSI’s work on developing/providing Geographic Information for Disaster Management in Japan
   (a) Prepare geospatial information for disaster management
   (b) Monitoring & Early warning system
   (c) Quickly find the impact and damages

5. Summary
1. Recent output of UN-GGIM-AP for DRM

2. Latest Trends in Surveying and Mapping

3. GSI’s work on developing/providing Geographic Information for Disaster Management in Japan
   (a) Prepare geospatial information for disaster management
   (b) Monitoring & Early warning system
   (c) Quickly find the impact and damages

5. Summary
UN-GGIM-AP

• Regional Committee of UN-GGIM.
• Established: 1 November 2012
• Member: National Geospatial Information Authorities of 56 countries and regions in Asia and the Pacific
• Current Chair: Dr. Andy Barnicoat (Australia)
• Secretariat: UN-ESCAP (since Nov.2018)

Vital Role in
(Relevant to geospatial information management)
• Resolves regional issues
• Facilitate regional capacity building
• Promote globally the unique needs and interests of the region
• Contribute to the discussions in UN-GGIM

(Reference)
ECOSOC Resolution entitled “Strengthening institutional arrangements on geospatial information management”, E/RES/2016/27
UN-GGIM-AP: Working Groups

WG1: Geodetic Reference Framework for Sustainable Development

WG2: Disaster Risk Management
• This WG aims to enhance the capability of NGIAs in Asia and the Pacific region for contributing to disaster risk reduction by applying geospatial information for effective implementation of Sendai Framework for Disaster Risk Reduction (SFDRR).

WG3: Regional SDI

WG4: Cadastre and Land Management
Guidelines for DRM to assist NGIAs on taking actions against natural disasters

- International trend in utilization for DRM
- Summary of SFGISD – explore strategic viewpoint of NGIAs to manage disaster risk
- Policy and measures NGIAs can take before, during and after disasters
- Collection of Best Practices and actions by NGIAs
1. Recent output of UN-GGIM-AP for DRM

2. Latest Trends in Surveying and Mapping

3. GSI’s work on developing/providing Geographic Information for Disaster Management in Japan
   (a) Prepare geospatial information for disaster management
   (b) Monitoring & Early warning system
   (c) Quickly find the impact and damages

5. Summary
We are now witnessing a Revolutionary Innovation in Surveying and Positioning, empowered by the combination of Positioning Satellites and CORS networks.
Combination of GNSS and CORS enables Real-time, Accurate Positioning and Surveying.
Monitor the movement of the earth

Quick, accurate, efficient response on disasters
1. Recent output of UN-GGIM-AP for DRM

2. Latest Trends in Surveying and Mapping

3. GSI’s work on developing/providing Geographic Information for Disaster Management in Japan
   (a) Prepare geospatial information for disaster management
   (b) Monitoring & Early warning system
   (c) Quickly find the impact and damages

5. Summary
Hazards in Japan

- Earthquake
- Tsunami
- Volcanic Eruption
- Tropical Storm
- Flood
- Landslide

Great East Japan Earthquake in 2011
Mt. Ontake eruption in 2014
Kochi prefecture heavy rain disaster in 1998
Great Hanshin-Awaji Earthquake in 1995
Hiroshima city debris flow disaster in 1999
“Geographic Information for Disaster” may have two types of information. GSI develops/provides both types.

A) Topographic Feature Information

B) Disaster History Record

Local cenotaph for past disaster

Former River Bed; Risk of flood & liquefaction
GSI provides topographic feature information through various thematic maps. These maps help people to understand geographic feature.
Example of Disaster History Record

In Japan, natural disaster monuments can be found at many places.

These are also important information of past disasters.

Examples of Natural Disaster Monuments

- flood
- flood
- earthquake
- earthquake
- tsunami
- tsunami
- volcanic eruption
- landslides

Survey on Natural Disaster Monuments

◆ **Stone monuments** that are inscribed with *events concerning past natural disasters (disaster conditions, damage, etc.)* caused by tsunami, flooding, volcanic eruptions, sediment disasters, etc.

◆ Natural disaster monuments **convey the conditions of disaster at that time**. Since most of them are **located in disaster-affected areas**, by showing them on the map **disaster prevention awareness of local residents** will be promoted.

**Draw the Natural Disaster Monuments on GSI Maps**
MLIT Hazard Map Portal Site

Information useful for evacuation and disaster preparedness

**Overlaid hazard maps**
Various information about anywhere in Japan, which is useful for disaster risk reduction, can be overlaid and viewed as a single map.

- Overlying information and viewing as one map

**Local hazard maps**
Hazard maps of municipalities across Japan are available.

- Flood hazard map (Chiyoda Ward, Tokyo)
- Tsunami hazard map (Fujisawa City)

**Evacuation route**
**Measures for flooding**
**Enhancing seismic safety**
**Measures for liquefaction**

Hazard Map Portal Site:  [http://disaportal.gsi.go.jp/](http://disaportal.gsi.go.jp/)
1. Recent output of UN-GGIM-AP for DRM
2. Latest Trends in Surveying and Mapping
3. GSI’s work on developing/providing Geographic Information for Disaster Management in Japan
   (a) Prepare geospatial information for disaster management
   (b) Monitoring & Early warning system
   (c) Quickly find the impact and damages
5. Summary
GNSS Continuously Operating Reference Stations (CORS)

GNSS: Global Navigation Satellite System

GLONASS (Russia)  
Galileo (EU)  
QZSS (Japan)  
GPS (US)

5-m high stainless pillar  
Batteries  
Tilt meter  
Heater  
Arrester  
Receiver  
IP Router

1318 stations (approx. 20 km interval)

North American plate  
Eurasian plate  
Pacific plate  
Philippine Sea plate
 REGARD system workflow

Real-time CORS Network for Tsunami Warning

1. Real-time positioning
   Continuously

2. Calculate displacement vector

3. Estimate fault model

4. Send results

Repeat for 5 min.
All data from various sensors are sent to JMA (Japan Meteorological Agency) for Warning using TV/mobile devices etc.
1. Recent output of UN-GGIM-AP for DRM

2. Latest Trends in Surveying and Mapping

3. GSI’s work on developing/providing Geographic Information for Disaster Management in Japan
   (a) Prepare geospatial information for disaster management
   (b) Monitoring & Early warning system
   (c) Quickly find the impact and damages

5. Summary
Crustal deformation detected by GNSS CORS

The deformation caused by the Great East Japan Earthquake (Mar. 2011)
Crustal Deformation Detected by GNSS CORS

The 2016 Kumamoto Earthquake (M7.3)

- Co-seismic deformation detected by GNSS CORS
  - SW-ward: max. 98 cm
  - Upward: max. 24 cm

- Detected deformation data was provided to the public in a few hours after the earthquake.

GNSS CORS helps find the impact and extent of potential damage caused by earthquakes.
Aerial Photos

The photos revealed the impact and extent of damage in detail.

2018 Chugoku Region Heavy Rain Disaster

GNSS CORS provides accurate positional control to the airplane.

The photos revealed the impact and extent of damage in detail.
Video images taken from a helicopter → ortho-rectified real-time
Integrated Disaster Information Mapping System

“DiMAPS”

On-site Image

Situation Center

Overlaying Live Information from Different Sources on One Map

Collapse of the XX Bridge

YY Hospital

Stored fuels

Live Camera

Live Video by Aircraft

On-site Vehicles

Local Government

Big Data

Digital Map Table

Local Government

Big Data
Geospatial Information Platform for Decision Makers
1. Recent output of UN-GGIM-AP for DRM

2. Latest Trends in Surveying and Mapping

3. GSI’s work on developing/providing Geographic Information for Disaster Management in Japan
   (a) Prepare geospatial information for disaster management
   (b) Monitoring & Early warning system
   (c) Quickly find the impact and damages

5.Summary
SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development
- Geospatial information is crucial for disaster risk management.
  - In Japan, GSI is providing various thematic maps to understand topographic features.
  - Disaster history information is also important to understand the risk.
  - Geospatial Information helps activities at all phases of disaster.

- National Geospatial Information Authorities in Asia and the Pacific annually have UN-GGIM-AP meeting to discuss technical and substantive activities in the geospatial information field at the regional level. The guideline for Disaster Risk Reduction using Geospatial Information is now available.

- Such geospatial information will contribute to achieve SDGs.
Thank you for your attention

Contact to:
Bokuro URABE urabe-b9510@mlit.go.jp
GSI Japan https://www.gsi.go.jp/ENGLISH/index.html