

Introduction to Sentinel Asia and Data Systems for Disaster Response

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1. Overview of Sentinel Asia

- Sentinel Asia is an initiative aiming space-based international cooperation for disaster management in the Asia-Pacific region
- In February 2006, Sentinel Asia was established in accordance with the \checkmark recommendation at APRSAF-12 in October 2005
- \checkmark Sentinel Asia is expected to implement not only emergency observation but activities covering entire disaster management cycle including mitigation/preparedness and recovery phase after a disaster

Concept of Sentinel Asia Strategic Plan

"Challenges for Disaster Risk Reduction by a Collaboration between Space and Disaster Management Agencies"

MITIGATION

- Hazard Map
- **Early Warning**
- Success Story
- Pre-disaster monitoring

RECOVERY

- Mid/Long-term monitoring
- **Recovery Status**



PREPADNESS

- Training
- **Capacity Building**
- **Standard Operation** Procedure (SOP)

RESPONSE

- **Emergency Observation**
- Data Analysis
- Damage Assessment

2. Membership Status of Sentinel Asia

In total: **113** organizations. This one year, **2** organizations newly joined in as below:

- Disaster and Emergency Management Presidency (AFAD), Turkey in July 2022
- Philippine Space Agency (PhilSA), the Philippines in January 2023

Sentinel Asia





3.Sentinel Asia Constellation "Data Provider Node" currently contributing to Emergency Observations

- ✓ 8 space agencies/research institutes currently contributing to emergency observation
- ✓ If necessary, escalate emergency observation request to the International Charter







4.1 Flood in Taiwan in August 2018

✓NARLabs requested emergency observation

 \checkmark GISTDA, ISRO and JAXA provided satellite data

 \checkmark Asian Institute of Technology (AIT) provided detected flood area



https://sentinel-asia.org/EO/2018/article20180825TW.html



4.2 Earthquake in Taiwan in September 2022

- ✓ NARLabs requested emergency observation
- ✓ GISTDA, ISRO and JAXA provided satellite data
- ✓ Mohammed Bin Rashid Space Centre (MBRSC) provided affected area



22°46'10"h 22°46'N N 22º45'50"N



4.3 Volcano Eruption in Indonesia in December 2021

- ✓ JICA requested emergency observation on Volcano Eruption of Mt. Semeru
- Thanks to disaster information provided by Earth Observatory of Singapore (EOS), Nanyang Technological University and optical satellite data from FORMOSAT-5 by NARLabs/NSPO on Web-GIS, JICA found potential landslide risk that was hard to

acquire from the field survey





4.4 Flood in Pakistan in August 2022

 Provincial Disaster Management Authority (PDMA) of Pakistan requested emergency observation, and NARLabs provided satellite data and value added products using semi-automatic change detection algorithm.





The accuracy of this product is not validated.

Disclaimer:

MAP Coordinate System: CGS WGS 84



4.5 Semi-Automatic Production of Value Added Product

There is an increasing need to quickly provide useful data shortly after the emergency observation. One approach is semi-automatic production provide by TASA.

- In order to provide analyzed product for emergent case, SOP to generate Emergent Value Added Product (EVAP) is carried out.
- QGIS platform and corresponding graphical modelers are considered to establish an image change detection procedure with multi-temporal remote sensing images.
- By using Change Vector Analysis (CVA), the change between multi-temporal images is detected with a semi-automatic approach.





4.5 Semi-Automatic Production of Value Added Product

EVAP by QGIS with Customized Processing Toolbox





5. Tools Developed for Emergency Observation Requests



8 cores, 24GB memory, 20TB data volume from Ceph. (Expandable if new application requires more resources)

SFTP, provided by TASA and ASGC is a Cloud storage that stores all the Satellite imageries of past and current Emergency Observation data and analyzed value added products.



GISTDA

5. Tools Developed for Emergency Observation Requests

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OPTEMIS, developed by GISTDA, is a web application with User Friendly Interface, managing data regarding EORs (such as User requests of Emergency Observation, Area of Interests, Observation Plan, Observation data, Value Added Products). ¹³

5. Tools Developed for Emergency Observation Requests

Web based Geographic Information System (WebGIS)



Observed data and Value Added Products are displayed on easy to use visualization tool (WebGIS), to help Emergency Observation Requesters gather geographical information of the disaster areas.



5.2 Data Flow of Emergency Observation Requests



WebGIS



5. Tools Developed for Emergency Observation Requests

Mobile application developed by AIT

- Web link: https://arcg.is/1HWGWX(
- QR Code:





Mobile Application is developed by Asia Institute of Technology (AIT) to collect onsite information of disaster area (such as photographs taken on-site)

There is details about this Mobile Application will be presented, later in this session.



 University of Tokyo developed automated process to extract building maps from satellite images using deep learning technologies.

Disaster Management Organization (DMOs) need information to assess damage caused by disaster. With the combination of hazard area (ex. Inundated Area) and Building Map, DMOs may assess number of buildings in the hazardous area.



6.1 Benefits of Building Maps Sentinel Asia

1) High density area of damaged buildings often suggest high population of victims. DMO may prioritize the rescue unit dispatch to the area with most devastating casualties



2) DMO may distinguish important buildings such as hospitals, fire stations, public institutions and other infrastructures that may be damaged by the hazard.



3) By assessing number of damaged buildings, DMO may assess number of disaster victims and the size of shelter needed.

4) After the rescue phase, DMO may be able to use number of damaged buildings to plan for recovery. 18 ©.JAXA



6.2 Assessing Number of Damaged Buildings

Area in Red is inundated area. Grey Rectangular polygons are the buildings.

Grey Rectangles in the Red area presumably indicates inundated buildings.







7. Asia-Pacific Ministerial Conference On Disaster Risk Reduction

- Promoted Sentinel Asia's activities at the exhibition 19 to 22 September 2022 in Brisbane, Australia
- More than 100 participants visited Sentinel Asia booth per day

Exhibition booth with Nepal participants







8. Summary

- ✓ Sentinel Asia is an initiative aiming space-based international cooperation for disaster management in the Asia-Pacific region
- ✓ Sentinel Asia has responded over 400 emergency observation requests since 2007
- Sentinel Asia is expected to implement not only emergency observation but activities covering entire disaster management cycle including mitigation/preparedness and recovery phase after a disaster
- ✓ TASA and ASGC provides hardware and data (satellite image and value added products) to support Emergency Observation activities.
- Sentinel Asia continues collaborative projects to assist activities of Disaster Management Organizations