Overview of Sentinel Asia

June 16, 2025

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Sentinel Asia Secretariat
Satellite Applications and Operations Center (SAOC)
Japan Aerospace Exploration Agency (JAXA)

1.1 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 recommendation at the 12th session of the Asia Pacific Regional Space Agency Forum (APRSAF) in October 2005
- ✓JAXA serves as the Secretariat for Sentinel Asia

Steering Committee Meeting in December 2024, co-organized by IWMI and JAXA

Sentinel Asia website: https://sentinel-asia.org/

1.2 Concept of Sentinel Asia Strategic Plan

- ✓ 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

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

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

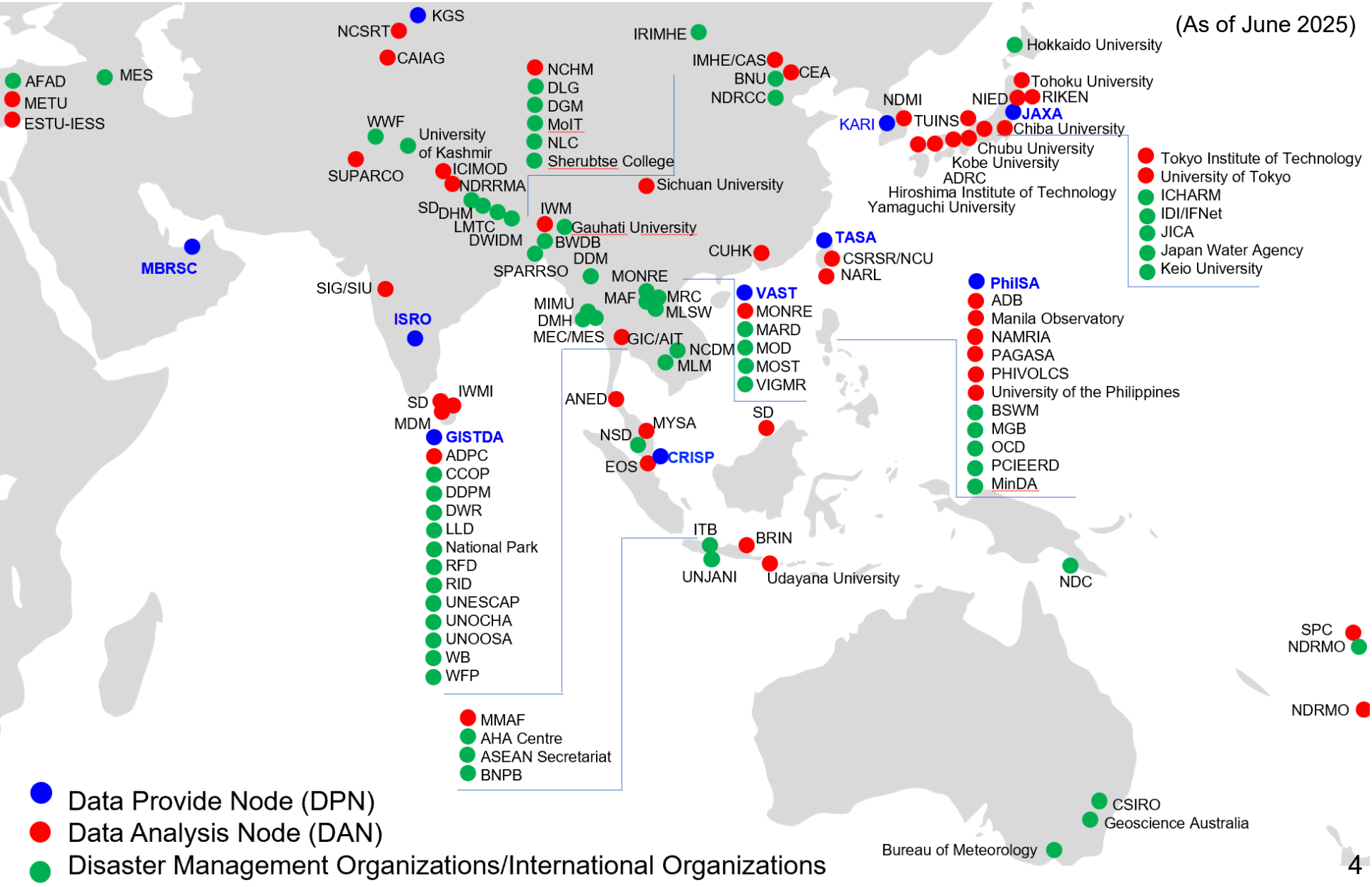
PREPADNESS
- Training
- Capacity Building
- Standard Operation Procedure （SOP）

RECOVERY
- Mid/Long-term monitoring
- Recovery Status

RESPONSE
- Emergency Observation
- Data Analysis
- Damage Assessment

2.1 Membership Status of Sentinel Asia

127 organizations in the Asia-Pacific region voluntarily support Sentinel Asia activities



2.2 Membership Status of Sentinel Asia

Indonesia

(As of June 2025)

No.	Organization Name	Member Category
1	National Disaster Management Agency (BNPB)	JPT
2	National Research and Innovation Agency (BRIN)	DAN
3	Institute of Technology Bandung (ITB)	JPT
4	Universitas Jenderal Achmad Yani (UNJANI)	JPT
5	Center for Remote Sensing and Ocean Sciences (CReSOS) Udayana University	DAN
6	Ministry of Marine Affairs and Fisheries	DAN

International Organizations in Indonesia

No.	Organization Name	Member Category
1	The ASEAN Secretariat	JPT
2	ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre)	JPT

2.3 Sentinel Asia Member Categories

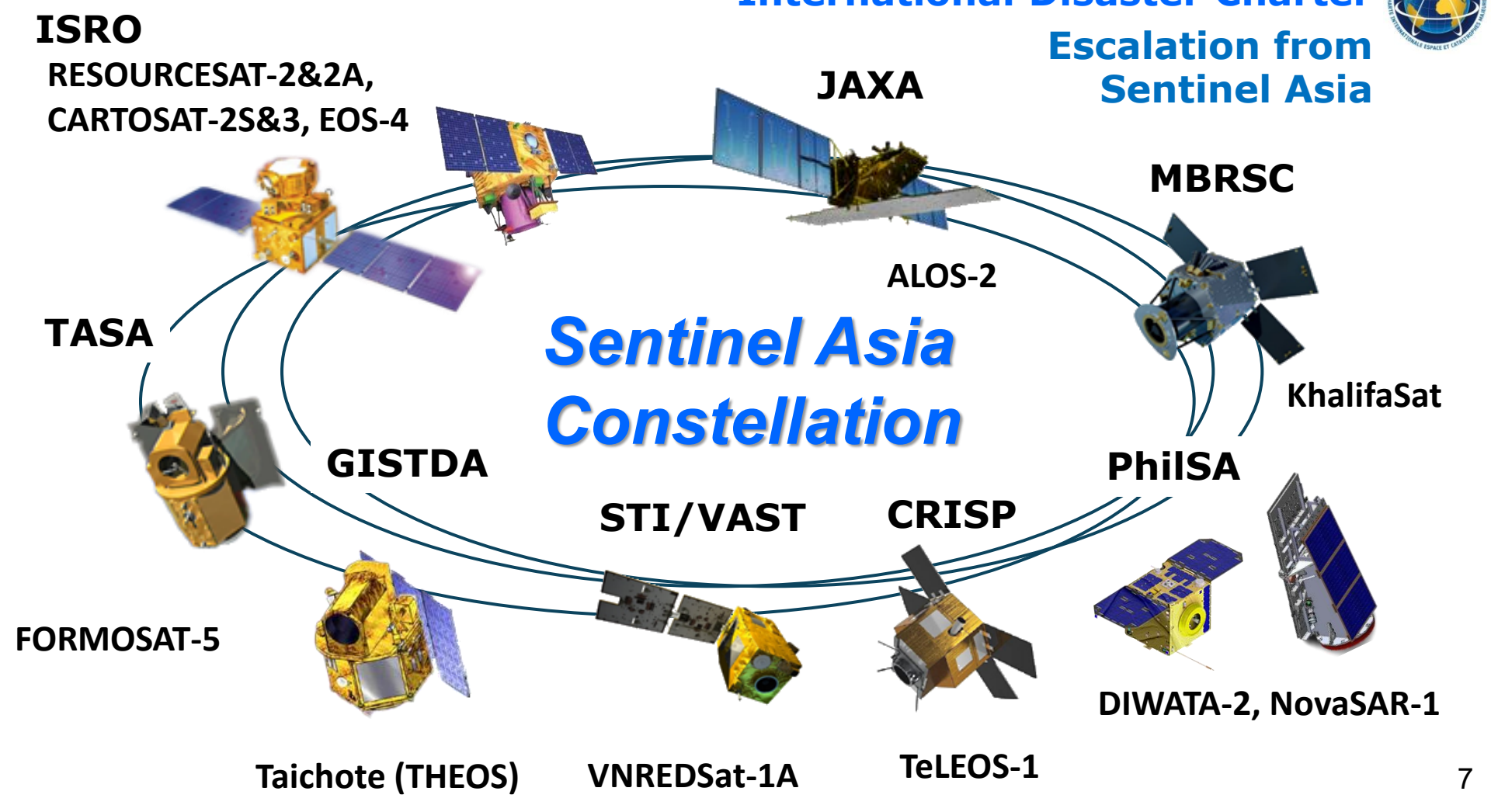
✓ We have 3 member categories

Member Category	Roles	Request emergency observation	Access to satellite imagery	Access to analyzed information	Participate in annual meeting
① Data Provider Node (DPN)	Provides their own satellite imagery and/or data to Sentinel Asia upon the emergency observation request	✓	✓	✓	✓
② Data Analysis Node (DAN)	Has the capability to analyze the satellite data provided by DPN, make damage assessment maps, and disclose the result through the OPTEMIS.	✓	✓	✓	✓
③ Joint Project Team Member (JPTM)	Neither ① nor ②	✓		✓	✓
Public (non-member)	-			✓	

3. Sentinel Asia "Data Provider Node" (DPN) currently contributing to Emergency Observations

- ✓ 8 space agencies/research institutes currently contributing to emergency observation
- ✓ If necessary, escalate Emergency Observation Request (EOR) to the International Disaster Charter (IDC)

International Disaster Charter
Escalation from Sentinel Asia



4.1 Emergency Observation Flow

STEP1
- Disaster occurs

STEP2
- A Sentinel Asia member or Asian Disaster Reduction Center (ADRC) member submits Emergency Observation Request (EOR) to ADRC

STEP3
- ADRC review the EOR and send email to Data Provider Node (DPN) and Data Analysis Node (DAN) to ask their support

STEP4
- DPN conduct emergency observation and provide satellite data
- DAN analyze the satellite data to produce disaster assessment maps

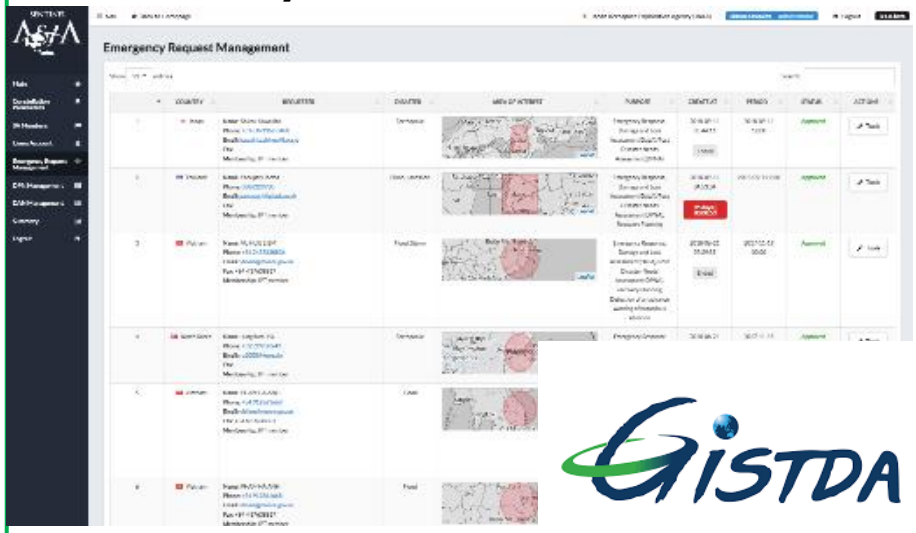
STEP5
- Sentinel Asia provide disaster assessment maps to requester

Emergency Observation lists: https://sentinel-asia.org/EO/EmergencyObservation.html

4.2 OPTEMIS: Emergency Observation Request Management Application

- ✓ OPTEMIS, developed by GISTDA, is an 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).
- ✓ Academia Sinica Grid Computing (ASGC) provided data storage and server for OPTEMIS and SFTP.

OPTEMIS by GISTDA



Sentinel Asia Cloud Storage
(SFTP in Taipei and Mumbai)

NARLabs 國家實驗研究院 National Applied Research Laboratories

JAXA

5. Emergency Observation Review by Geographical Distribution

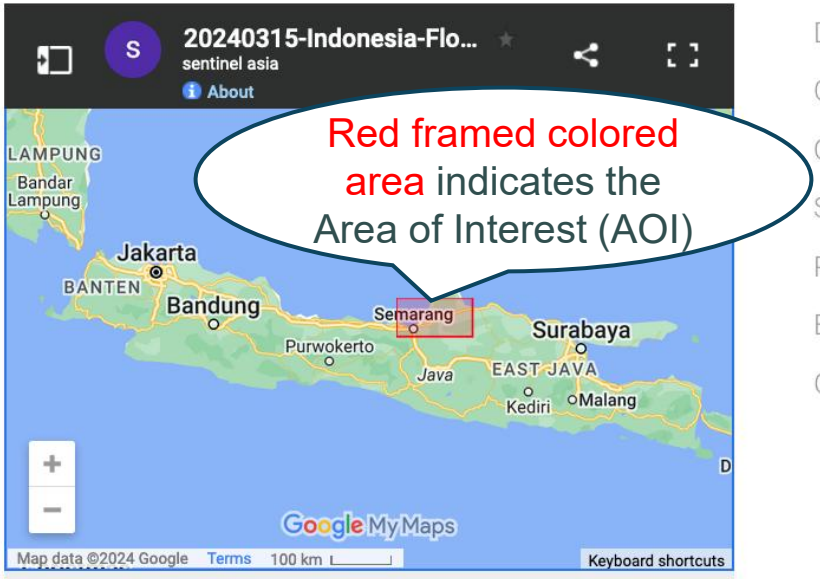
6.1.1 Flood in Indonesia, March 2024

- ✓The northern coastal regions of Java Island have experienced an escalation in the extent of persistent flooding that has lasted for over a week
- ✓BRIN requested emergency observation to Sentinel Asia

2024-03-15

Flood in Central Java Island, Indonesia on 15 March, 2024

Emergency Obs. Request Information



Disaster Type: Flood

Country: Indonesia

Occurrence Date (UTC): 15 March, 2024

SA activation Date(UTC): 20 March, 2024

Requester: National Research and Innovation Agency (BRIN)

Escalation to the International Charter: No

GLIDE Number: FL-2024-000026-IDN

https://sentinel-asia.org/EO/2024/article20240315ID.html

6.1.2 Flood in Indonesia, March 2024

STEP1
- Flood occurred

STEP2
- BRIN submitted Emergency Observation Request (EOR) to ADRC

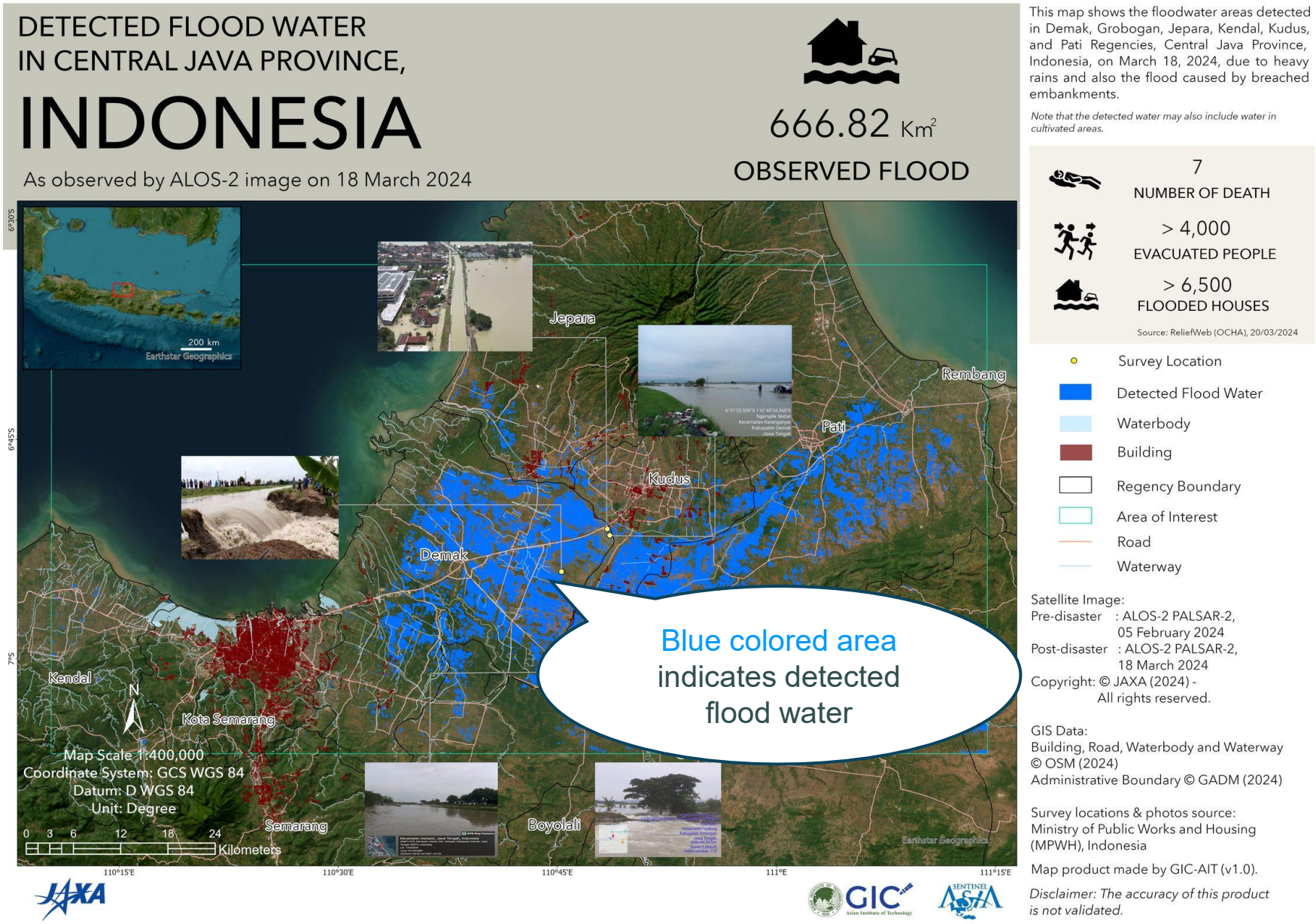
STEP3
- ADRC reviewed the EOR, especially checked the disaster situation and the Area of Interest (AOI)

STEP4
- ADRC activated Sentinel Asia
- DPN conducted emergency observation and provide satellite data via SFTP or OPTEMIS
- DAN analyzed the satellite data to produce disaster assessment maps, and uploaded disaster assessment maps through SFTP or OPTEMIS

STEP5
- Sentinel Asia provide disaster assessment maps to BRIN

6.1.3 Flood in Indonesia, March 2024

✓AIT analyzed ALOS-2 data to extract flooded area



This map shows the floodwater areas detected in Demak, Grobogan, Jepara, Kendal, Kudus, and Pati Regencies, Central Java Province, Indonesia, on March 18, 2024, due to heavy rains and also the flood caused by breached embankments.

Note that the detected water may also include water in cultivated areas.

7	NUMBER OF DEATH
> 4,000	EVACUATED PEOPLE
> 6,500	FLOODED HOUSES

Source: ReliefWeb (OCHA), 20/03/2024

- Survey Location
- Detected Flood Water
- Waterbody
- Building
- Regency Boundary
- Area of Interest
- Road
- Waterway

Satellite Image:
Pre-disaster : ALOS-2 PALSAR-2, 05 February 2024
Post-disaster : ALOS-2 PALSAR-2, 18 March 2024

GIS Data:
Building, Road, Waterbody and Waterway © OSM (2024)
Administrative Boundary © GADM (2024)

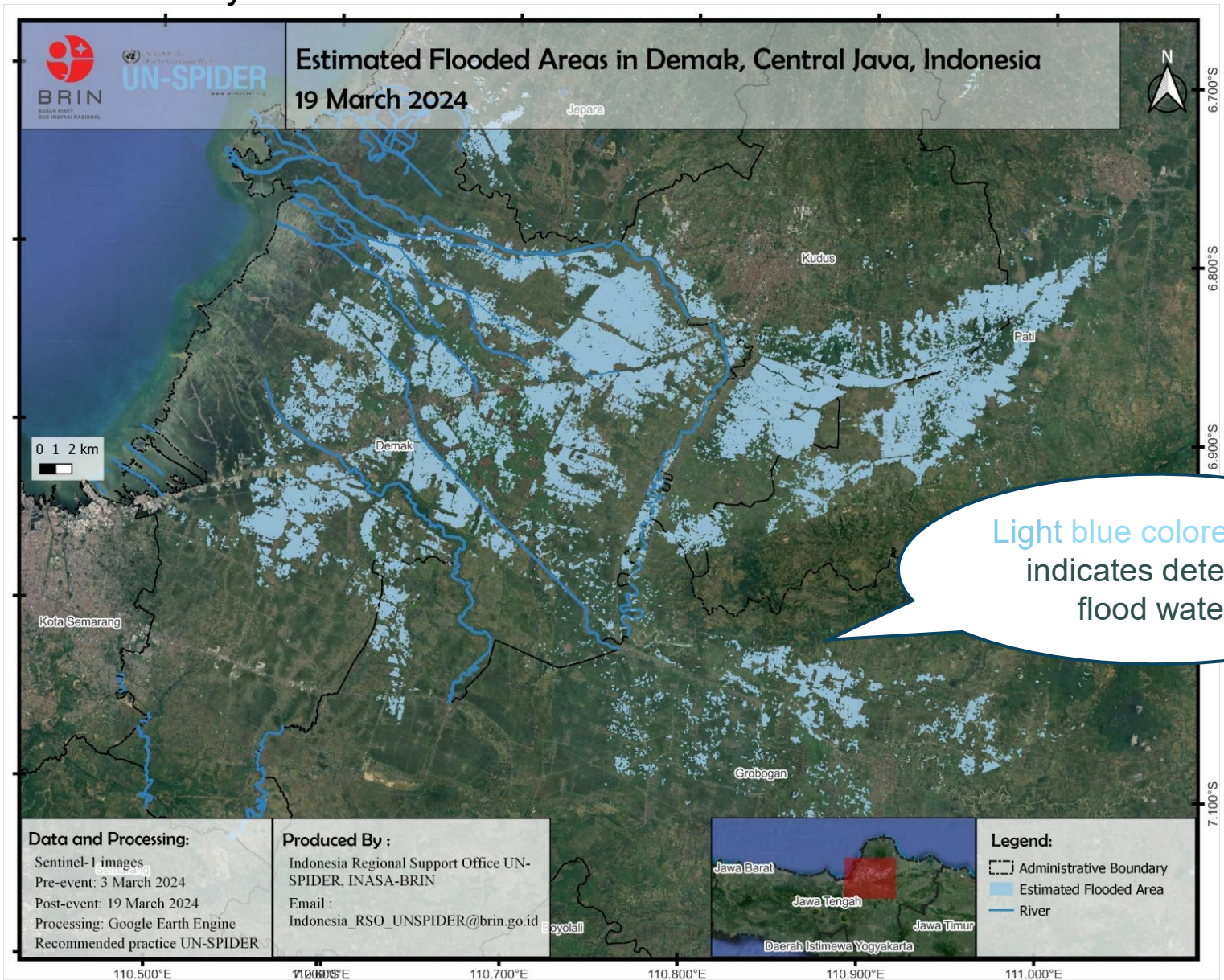
Survey locations & photos source:
Ministry of Public Works and Housing (MPWH), Indonesia

Map product made by GIC-AIT (v1.0).

Disclaimer: The accuracy of this product is not validated.

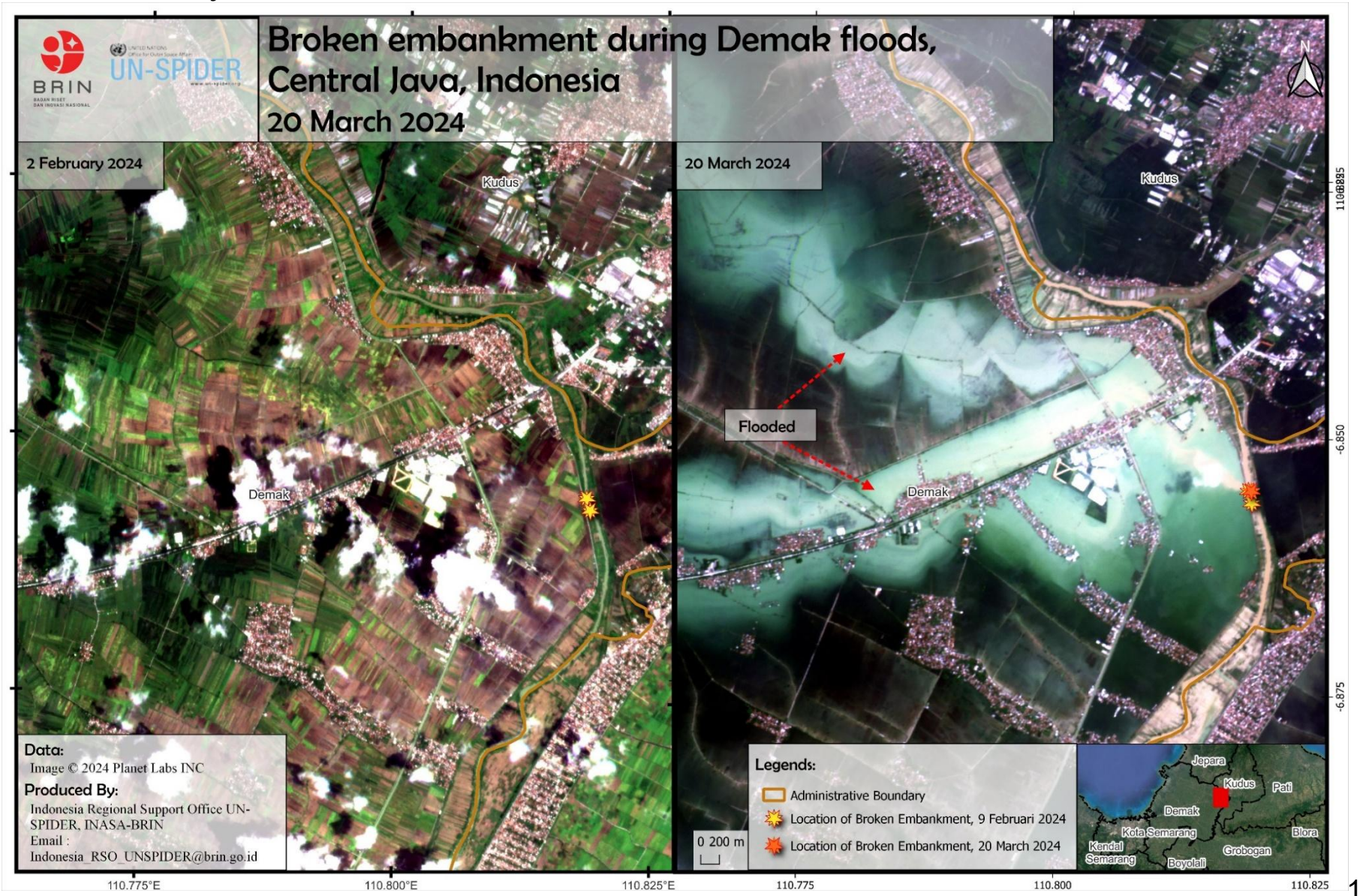
6.1.4 Flood in Indonesia, March 2024

✓BRIN analyzed Sentinel-1 data to estimate flooded area



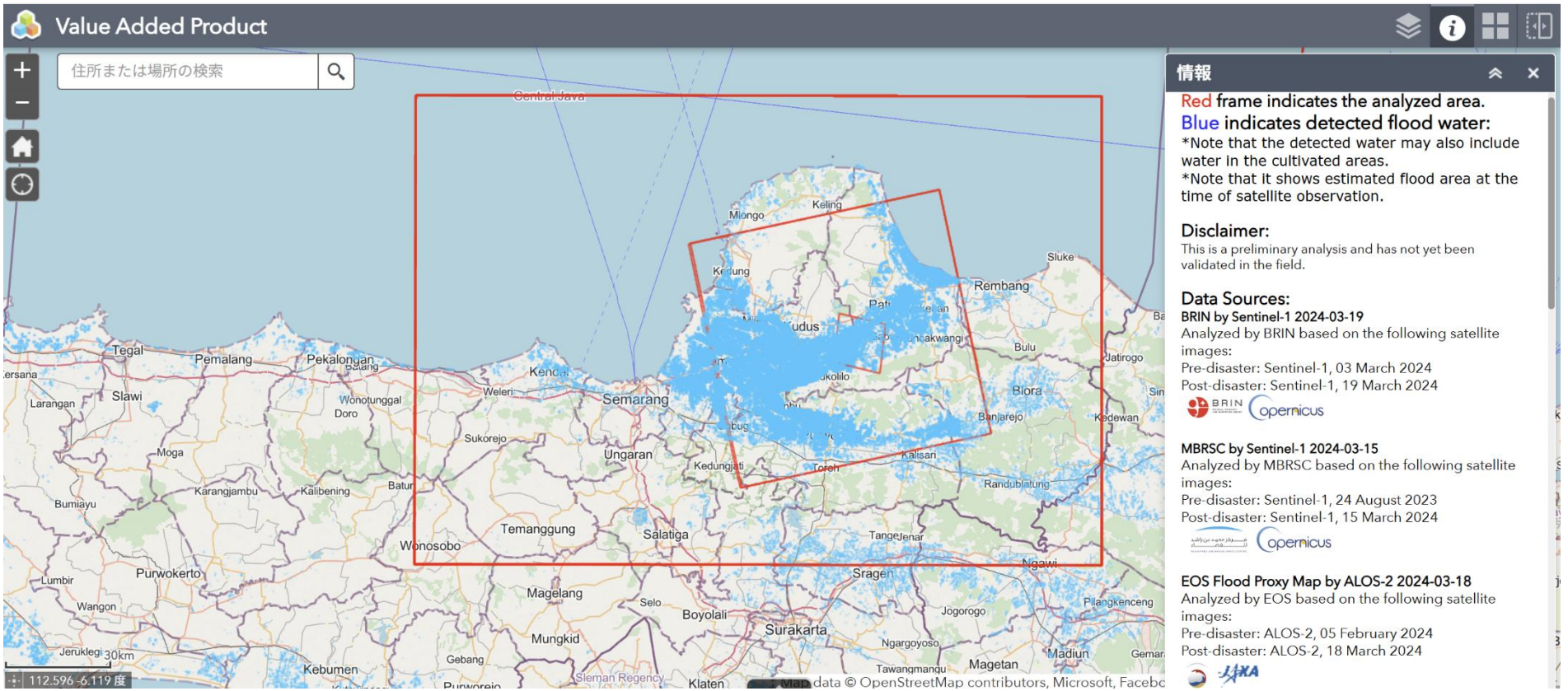
6.1.5 Flood in Indonesia, March 2024

✓BRIN analyzed Planet data to detect flooded area



6.1.6 Flood in Indonesia, March 2024: Web-GIS

- ✓ By overlaying potentially flooded areas and maps, Web-GIS enables zoom in and out potentially flooded areas
- ✓ It may be possible to determine whether main social infrastructures such as main roads, hospitals, and evacuation shelters are potentially affected or not

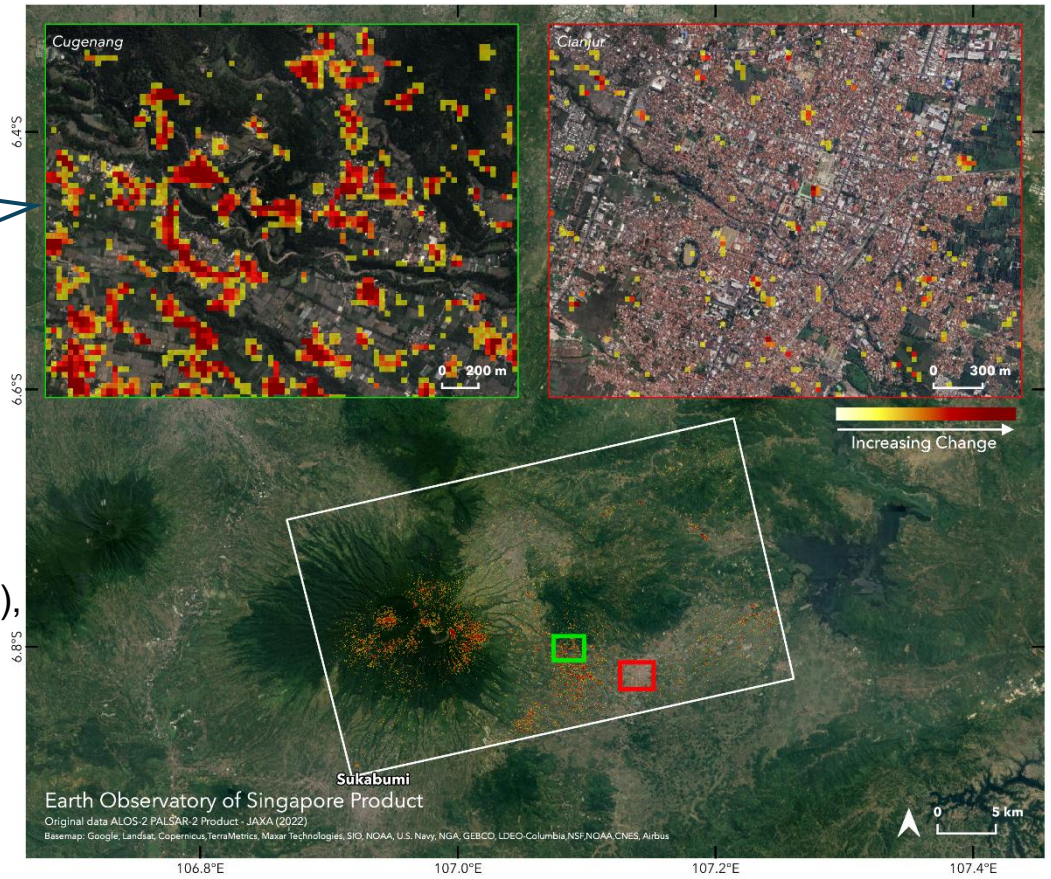


https://storymaps.arcgis.com/collections/cd9e401401b14e17be392a9cc536be29?item=1

6.2 Earthquake in Indonesia, Nov 2022

- ✓An earthquake of M 5.6 at a depth of 10 km occurred in West Java Province, Indonesia on 21 November 2022
- ✓According to BNPB, more than 300 casualties due to this earthquake
- ✓BRIN requested emergency observation to Sentinel Asia

The color gradient from yellow to red indicates increasingly significant surface change



EOS-RS Damage Proxy Map: Indonesia, Earthquake, 21 Nov 2022, v0.51

The Earth Observatory of Singapore - Remote Sensing Lab (EOS-RS) created this preliminary Damage Proxy Map (DPM) depicting areas that are likely damaged in West Java, Indonesia due to the M5.6 Earthquake that occurred on 21 Nov 2022. This map was derived from synthetic aperture radar (SAR) images acquired by the ALOS-2 satellite operated by the Japan Aerospace Exploration Agency (JAXA) before (24 Oct 2022 and 7 Nov 2022) and after (21 Nov 2022) the event.

The image covers an area indicated by the large white polygon. Each pixel measures about 30 meters across. The colour variation from yellow to red indicates increasingly more significant surface change. Preliminary validation was done by comparing with media reports. This map could be used as a guidance to identify damaged areas, and may be less reliable over vegetated areas. Scattered pixels over vegetated areas may be false positives, and a lack of colored pixels over vegetated areas may not mean no damage.

Data were provided by Sentinel Asia and analyzed by the Earth Observatory of Singapore - Remote Sensing Lab (EOS-RS).

More map details and files at: http://eos-rs-products.earthobservatory.sg/EOS-RS_202211_Indonesia_Earthquake/

Credits: Earth Observatory of Singapore - Remote Sensing Lab (EOS-RS), Original data ALOS-2 PALSAR-2 Product - JAXA (2022)

EOS-RS Twitter: @eos_rs

Earth Observatory of Singapore (EOS), Nanyang Technological University analyzed ALOS-2 data to detect potentially damaged area

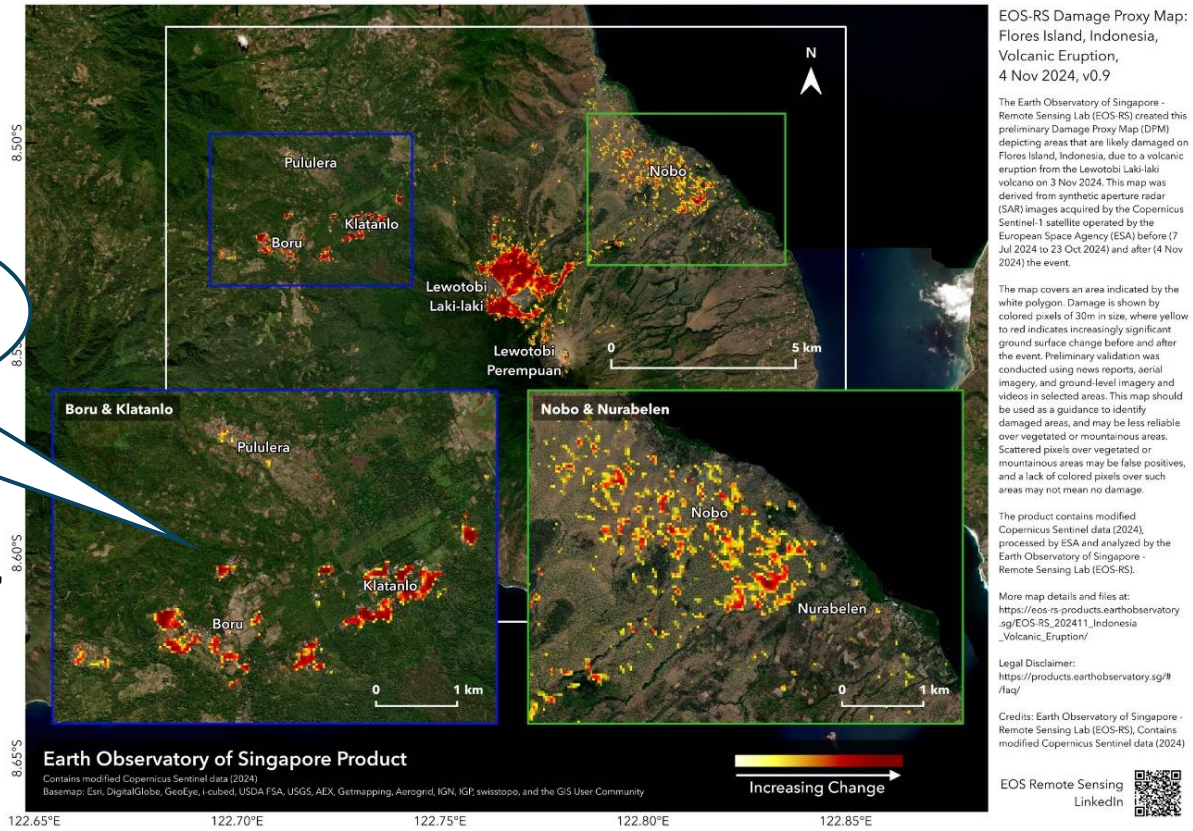
https://sentinel-asia.org/EO/2022/article20221121ID.html

6.3.1 Volcano Eruption in Indonesia, Nov 2024

- ✓Mt. Lewotobi Laki-laki erupted on 3 November 2024
- ✓Flores Timur Government has declared an Emergency Response Status starting from 3 November until 31 December 2024
- ✓Considering the above situation, BRIN and AHA Centre requested emergency observation for volcano eruption of Mt. Lewotobi Lakilaki on 5 November 2024
- ✓It was escalated to IDC

The color gradient from yellow to red indicates increasingly significant surface change

Earth Observatory of Singapore (EOS), Nanyang Technological University analyzed Sentinel-1 data to detect potentially damaged area



EOS-RS Damage Proxy Map: Flores Island, Indonesia, Volcanic Eruption, 4 Nov 2024, v0.9

The Earth Observatory of Singapore - Remote Sensing Lab (EOS-RS) created this preliminary Damage Proxy Map (DPM) depicting areas that are likely damaged on Flores Island, Indonesia, due to a volcanic eruption from the Lewotobi Laki-laki volcano on 3 Nov 2024. This map was derived from synthetic aperture radar (SAR) images acquired by the Copernicus Sentinel-1 satellite operated by the European Space Agency (ESA) before (7 Jul 2024 to 23 Oct 2024) and after (4 Nov 2024) the event.

The map covers an area indicated by the white polygon. Damage is shown by colored pixels of 30m in size, where yellow to red indicates increasingly significant ground surface change before and after the event. Preliminary validation was conducted using news reports, aerial imagery, and ground-level imagery and videos in selected areas. This map should be used as a guidance to identify damaged areas, and may be less reliable over vegetated or mountainous areas. Scattered pixels over vegetated or mountainous areas may be false positives, and a lack of colored pixels over such areas may not mean no damage.

The product contains modified Copernicus Sentinel data (2024), processed by ESA and analyzed by the Earth Observatory of Singapore - Remote Sensing Lab (EOS-RS).

More map details and files at: https://eos-rs-products.earthobservatory.sg/EOS-RS_202411_Indonesia_Volcanic_Eruption/

Legal Disclaimer: https://products.earthobservatory.sg/#/faq/

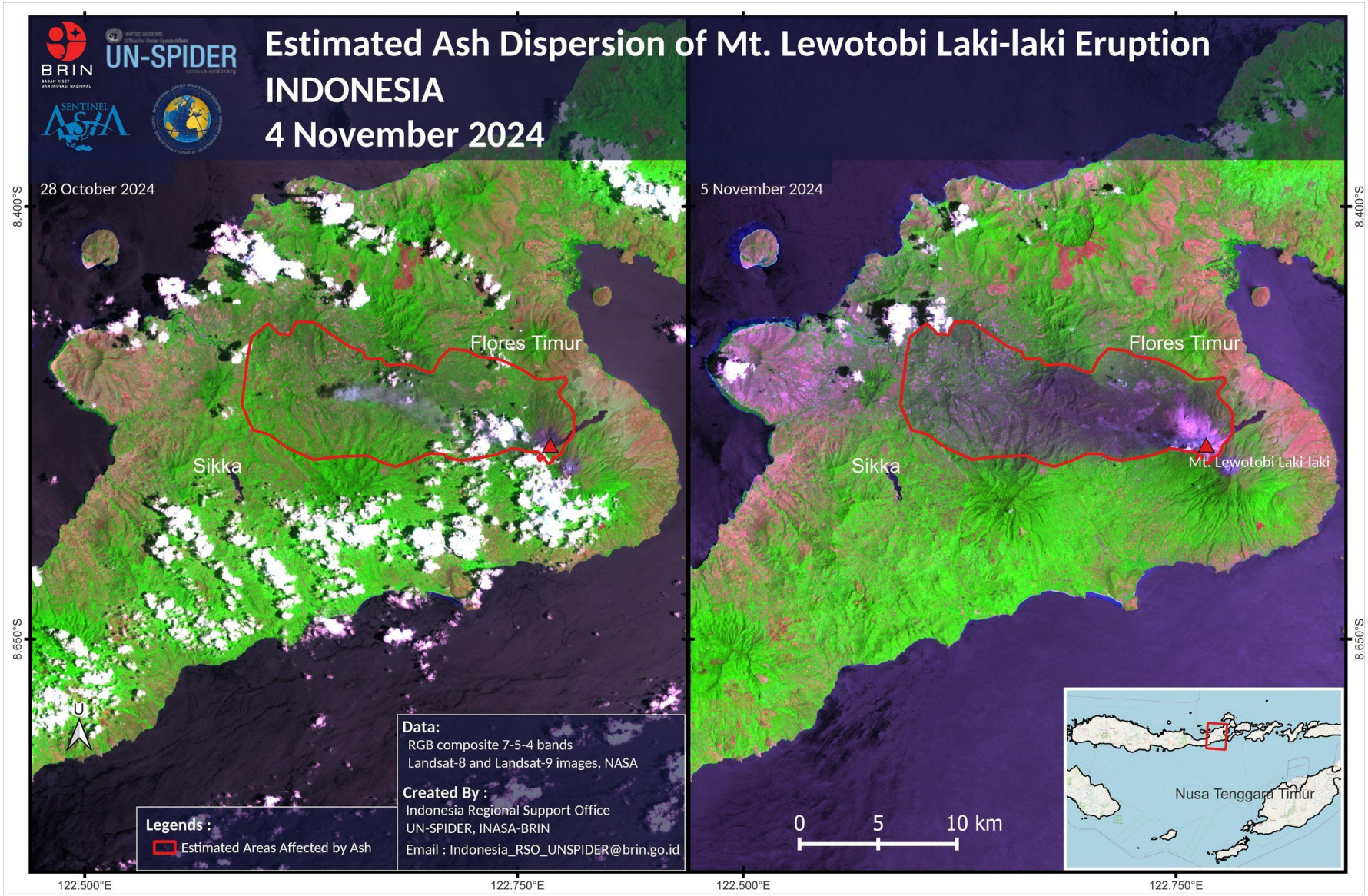
Credits: Earth Observatory of Singapore - Remote Sensing Lab (EOS-RS), Contains modified Copernicus Sentinel data (2024)

EOS Remote Sensing LinkedIn

https://sentinel-asia.org/EO/2024/article20241103ID.html

6.3.2 Volcano Eruption in Indonesia, Nov 2024

✓BRIN analyzed landsat-8 and landsat-9 data to estimate ash dispersion



6.3.3 Volcano Eruption in Indonesia, Nov 2024

✓AIT analyzed Sentinel-2 data to detect volcanic ash clouds

This map shows the volcano eruption at Mount Lewotobi Laki-laki in the Flores Timur and Sikka regencies, Indonesia, on November 3, 2024.

10
NUMBER OF DEATHS

10,300
AFFECTED PEOPLE

Source: AHA Centre, 04/11/2024

Volcanic ash clouds

Regency Boundary

Satellite Image:
Pre-disaster image :
Sentinel-2, 09 October 2024

Post-disaster image :
Sentinel-2, 13 November 2024

Contains modified Copernicus Sentinel data (2024)

GIS Data:
Administrative Boundary © GADM (2024)

Map product made by GIC-AIT (v1.0).

Disclaimer: The accuracy of this product is not validated.

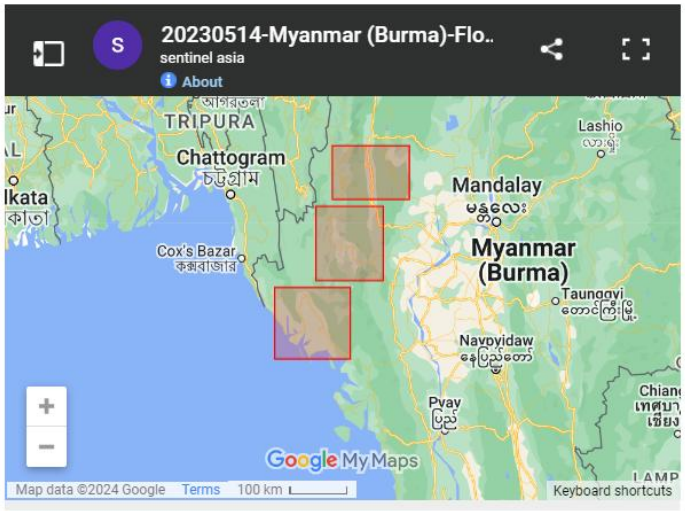
7.1 Establishment of the Standard Operating Procedures (SOPs)

- ✓ SOPs for making Emergency Observation Requests (EORs) to Sentinel Asia were established in below countries and regions:
  Cambodia, Laos, Myanmar, Nepal, Thailand, Turkey, Vietnam
  Central Asia and Caucasus, and Pacific region

- ✓ For prompt EORs to Sentinel Asia including escalation to the Charter, AHA Centre is to play hub roles in making EORs through close communication with local Disaster Management Organizations

  Ex. AHA Centre made EOR for Cyclone in Myanmar in May 2023

Emergency Obs. Request Information



Disaster Type: Storm

Country: Myanmar

Occurrence Date (UTC): 14 May, 2023

SA activation Date(UTC): 11 May, 2023

Requester: ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre)

Escalation to the International Charter: Yes

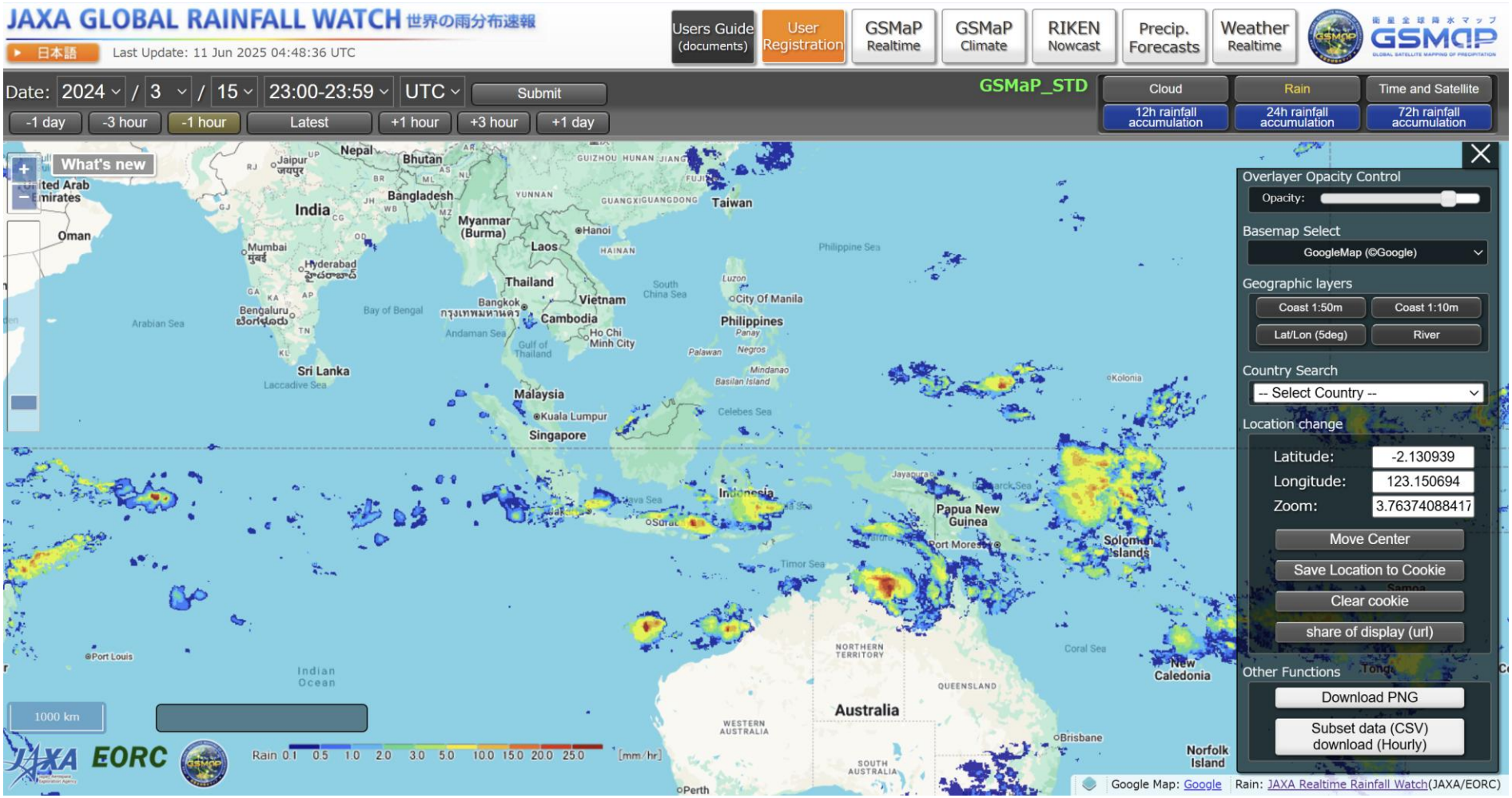
GLIDE Number: TC-2023-000069-MMR

7.2 SOPs Established Countries/Regions

Country/ Region	Established Year	Criterion for Cyclone	Criterion for flood		Criterion for Earthquake	Requester ※Main requester
		Saffir-Simpson Scale	24 hours accumulated rainfall	72 hours accumulated rainfall	MMI	
Cambodia	2022	3 or more	200mm or more	400mm or more	VII or more	NCDM, AHA Centre
Thailand	2017 Revised 2021	3 or more				ADPC, AHA Centre DDPM, GISTDA
Myanmar	2017 Revised 2021	2 or more				DDM, AHA Centre DHM, MEC
Laos	2022	3 or more				MLSW, AHA Centre MONRE
Vietnam	2017 Revised 2021	3 or more				MONRE, AHA Centre MARD, STI/VAST
Nepal	2023	3 or more				DHM ICIMOD, MoHA, NDRRMA
Türkiye	2023 Revised 2025	N/A				AFAD METU
Central Asia Caucasus	2022	N/A				CAIAG MoES (Kyrgyz, Tajikistan, Uzbekistan)
Pacific Islands	2022 Revised 2025	3 or more				SPC NDRMOs (Fiji, Solomon)

7.3 Global Satellite Mapping of Precipitation

- ✓ Institutionalized use of Global Satellite Mapping of Precipitation (GSMaP) as reference information for making EORs



https://sharaku.eorc.jaxa.jp/GSMaP/index.htm

7.4 Example of SOP in Myanmar

i) Outline

If a disaster occurs, or is expected to occur, parties hereto will consider making an Emergency Observation Request (EOR) to Sentinel Asia. If the disaster could cause severe damage that meets the following criteria, parties will promptly make an EOR to Sentinel Asia.

[Criteria]

- Typhoon : Saffir-Simpson Scale 2 or more
- Flood : (i) an accumulated 24-hour rainfall amount of 200 mm or more;
  or (ii) an accumulated 72-hour rainfall amount of 400 mm or more
- Earthquake : Modified Mercalli Intensity (MMI) VII or more

[Main requestor for each disaster]

- Typhoon, Flood, Landslide: DDM, to be supported by DMH and MIMU
- Earthquake, Tsunami: DDM, to be supported by DMH and MIMU
- Others (forest fire, oil spill, etc.) : DDM, to be supported by DMH and MIMU

In the event that an EOR is not made promptly despite the fact that (a) the criteria stated above seem to have been fulfilled, or (b) the occurrence of a disaster and possible need for rescue and relief aids are already reported by the foreign and international media, including relief.web and floods.list, ADRC will contact and urge the competent organization in accordance with this SOP to make an EOR, in which case Parties agree hereby in advance, that International Organizations of the Sentinel Asia community, including the AHA Centre and ADRC, will make an EOR on behalf of the competent organization, unless explicit rejection is expressed within 2 hours of contact by ADRC.

AHA Centre is described as alternative requester of the competent organizations

7.5 Good Practice of using SOP : Cyclone MOCHA in Myanmar, May 2023

May 11

- ADRC received **RED alert** from GDACS on Cyclone MOCHA, which was forecasted **to landfall on May 14 in Myanmar**
- ADRC sent an email to AHA Centre to check their potential activation
- **AHA Centre requested emergency observation** to Sentinel Asia

May 14

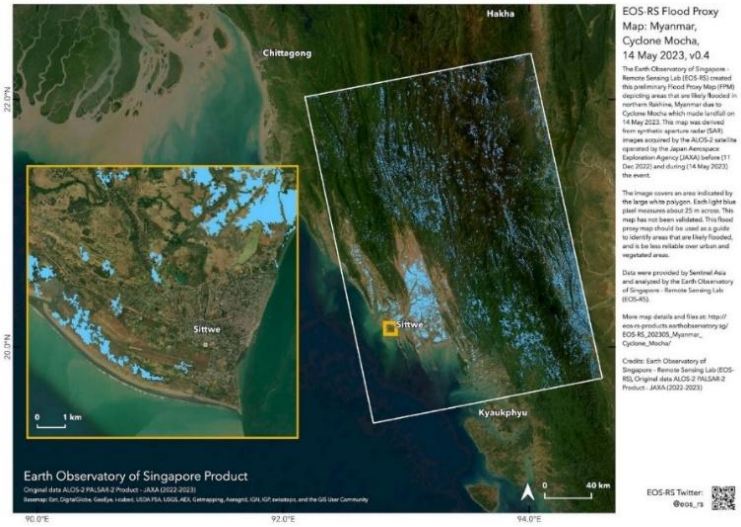
- Cyclone MOCHA landed on the west side of Myanmar
- JAXA provided ALOS-2 data and EOS provided Flood Proxy Map
- **Sentinel Asia provided the Flood Proxy Map to AHA Centre**

May 16

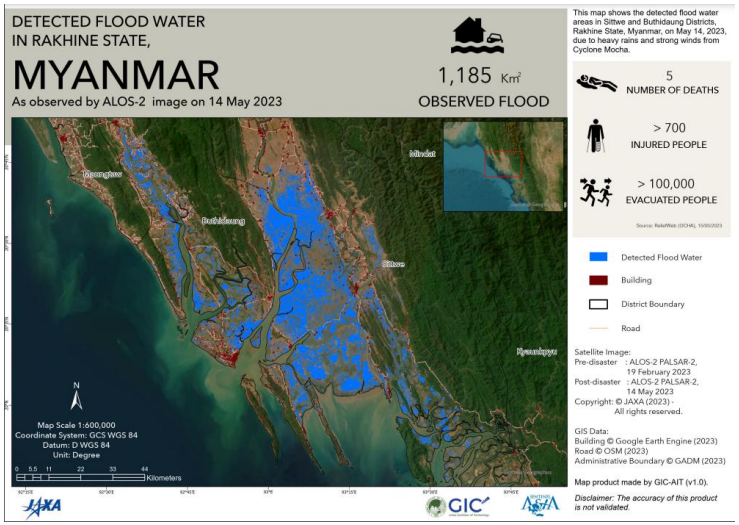
- AHA Centre used Flood Proxy Map to monitor the impact of the Cyclone and published their situation report including the map

7.6 Cyclone Mocha in Myanmar, May 2023

- ✓ AHA Centre could monitor the impact of the cyclone thanks to flooded area maps
- ✓ The flood proxy map provided by EOS was introduced on the report of AHA Centre

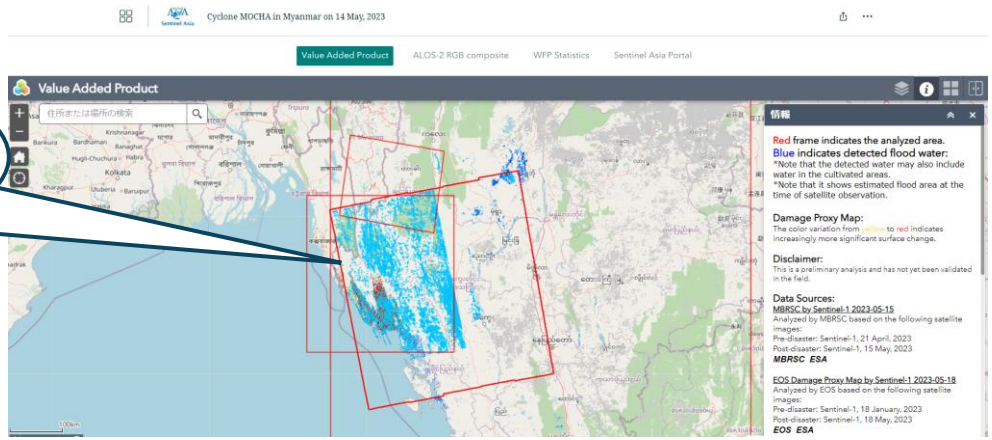


Flood Proxy Map
by Earth Observatory of Singapore(EOS)



Flooded area map
by Asian Institute of Technology (AIT)

Blue colored areas indicate potentially flooded areas

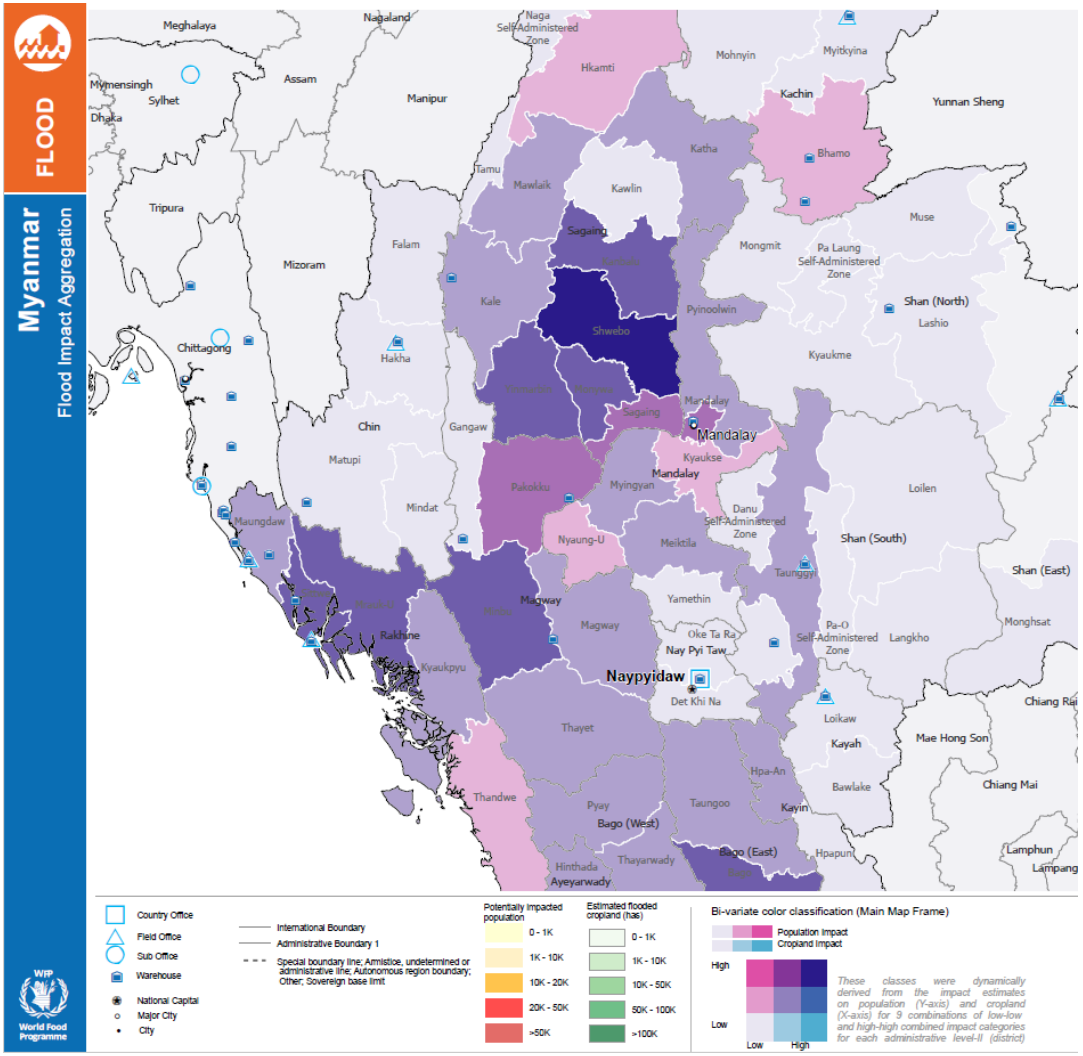


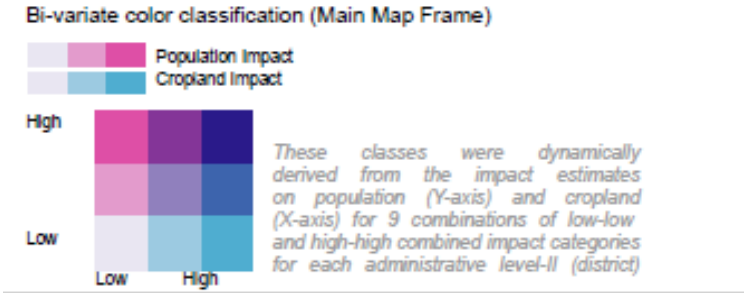
Web-GIS overlaying potentially flooded areas and maps

https://storymaps.arcgis.com/collections/6c2cdd4f4b92434cbb6d343eaa0006db?item=1

7.7 Cyclone MOCHA in Myanmar in May 2023

- ✓ UNWFP provided statistical information, such as affected population and cropland impact map to display social-economic loss assessment





Population and Cropland Impact Map by UNWFP

8.1 Annual Meeting

- **November 5-7, 2024**
- **135 participants from 40 organizations**

✓ Presentations from new Sentinel Asia members, Users, Data Analyzers to share the good practices of Sentinel Asia

✓ Training workshops for Capacity Building

8.2 User's Session

✓BRIN activated Sentinel Asia to monitor the impact of volcano eruption, flood, earthquake, and so on

✓BRIN presented their expectations:

- **Increasing satellite data availability** ex. Some **datasets** are useful
- **Knowledge sharing** and open collaboration among the Asia-Pacific countries and regions

Key Lessons and Insights

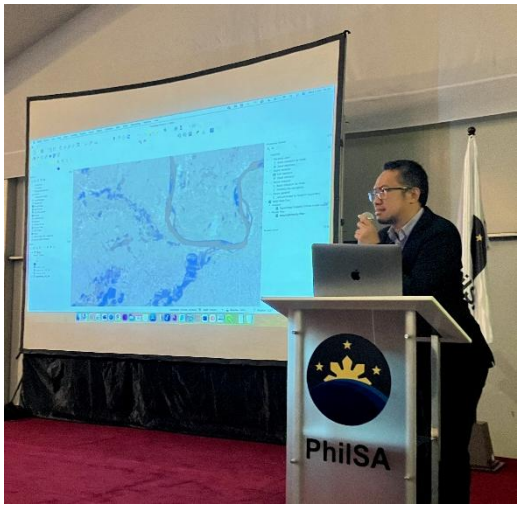
1. PM Charter training has strengthened our team's capacity to lead during national disasters
2. Additional training needed to optimize the use of Charter Mapper
3. Increased data availability:
   - Some datasets are useful
   - Some are limited due to disaster impact size or sensor limitations
4. Close collaboration with stakeholders is critical to maximize the utility of space-based datasets during QR
5. Research and innovation needed to map and analyze space-based information for disaster response, early warning, and risk reduction
6. Emphasis on knowledge sharing and open collaboration among Asia-Pacific countries

Presentation material of BRIN：https://sentinel-asia.org/meetings/SA3JPTM9/agenda/Day1/1505_BRIN_Vetrita.pdf

8.3 Trainings for SAR data analysis

SAR Data Analysis for Flood Detection and Mapping (AIT, Thailand)

Gave a lecture on how to process Sentinel-1 SAR data and extract inundated area from SAR images **by step-by-step instructions using SNAP and QGIS.**



Lecture material of AIT： https://sentinel-asia.org/meetings/SA3JPTM9/agenda/Day2/1300_AIT_Syams.pdf

Flood Mapping using Google Earth Engine (ICIMOD, Nepal)

Gave several hands-on exercises to convey the key points defining important parameters when creating flood map **using Google Earth Engine.**

Lecture material of ICIMOD： https://sentinel-asia.org/meetings/SA3JPTM9/agenda/Day2/1530_ICIMOD_Uddin.pdf

9. To be a member of Sentinel Asia

STEP1
- Submit application form to Sentinel Asia Secretariat

STEP2
- Secretariat share the application form to all Sentinel Asia members and ask their review for two weeks

STEP3
- Approval at unanimous consent by all Sentinel Asia members

STEP4
- Secretariat will send the official letter to the new member

STEP5
- New member will participate in the annual meeting of Sentinel Asia and be welcomed as a new member