Sentinel Asia

Sentinel Asia

-A space-based disaster management support in the Asia-Pacific region-

March 23 , 2021

Shiro Kawakita
Sentinel Asia Steering Committee Secretariat
Japan Aerospace Exploration Agency

Sentinel Asia

Sentinel Asia is a voluntary initiative by a collaboration between space agencies and disaster management agencies, applying remote sensing and Web-GIS technologies to assist disaster management in the Asia-Pacific region.

In Oct 2005, APRSAF-12, in Kitakyushu, Japan, the plan to initiate the pilot project was approved.
http://www.aprsaf.org/data/aprsaf12_data/day3/5_sswg%20sumrepo.pdf

In Feb 2006, Joint Project Team (JPT) was organized and Sentinel Asia has started.
Sentinel Asia is the first initiative under APRSAF.

http://sentinel.tksc.jaxa.jp/

Collaboration among Sentinel Asia Communities

Sentinel Asia

Sentinel Asia

Since 2006

111 Organizations

Space Community

8 organizations

Data Analysis Support Community (universities, research institutions)

39 organizations

International Community

10 organizations

Disaster Management Community (DMO/DMA)

54 organizations

Data Provider Node (DPN)

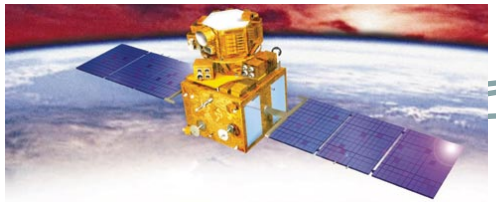
Sentinel Asia Constellation
contributing to Emergency Observations

International Charter

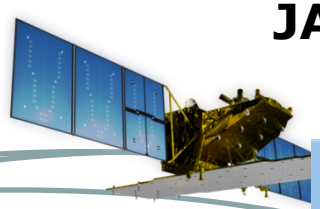
escalation from Sentinel Asia

ISRO

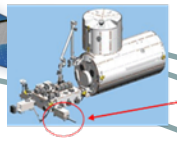
RESOURCESAT-2, OCEANSAT-2/OCM
IMS-1, CARTOSAT-1&2, RISAT-1



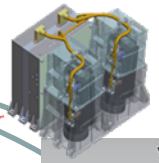
JAXA



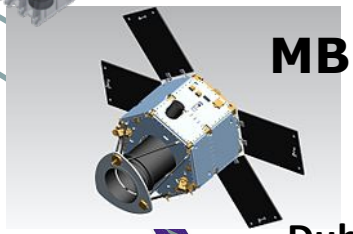
ALOS-2



KIBO HDTV-EF2



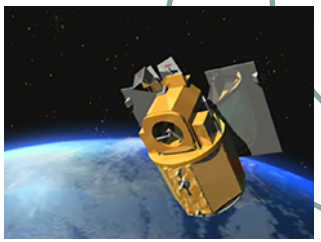
MBRSC



DubaiSat-2

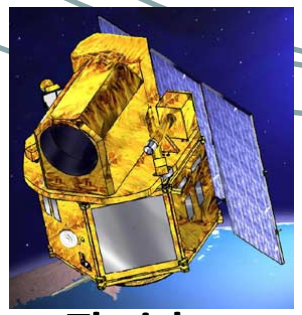
Sentinel Asia Constellation

NARLabs

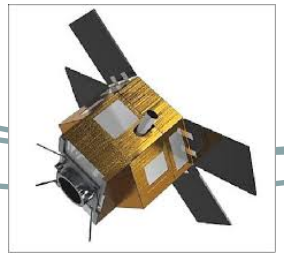


FORMOSAT-5

GISTDA



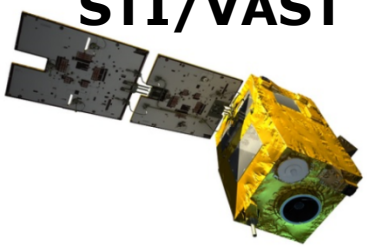
Thaichote (THEOS)



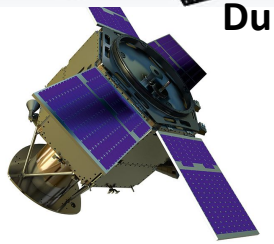
CRISP

TeLEOS-1

STI/VAST



VNREDSat-1A

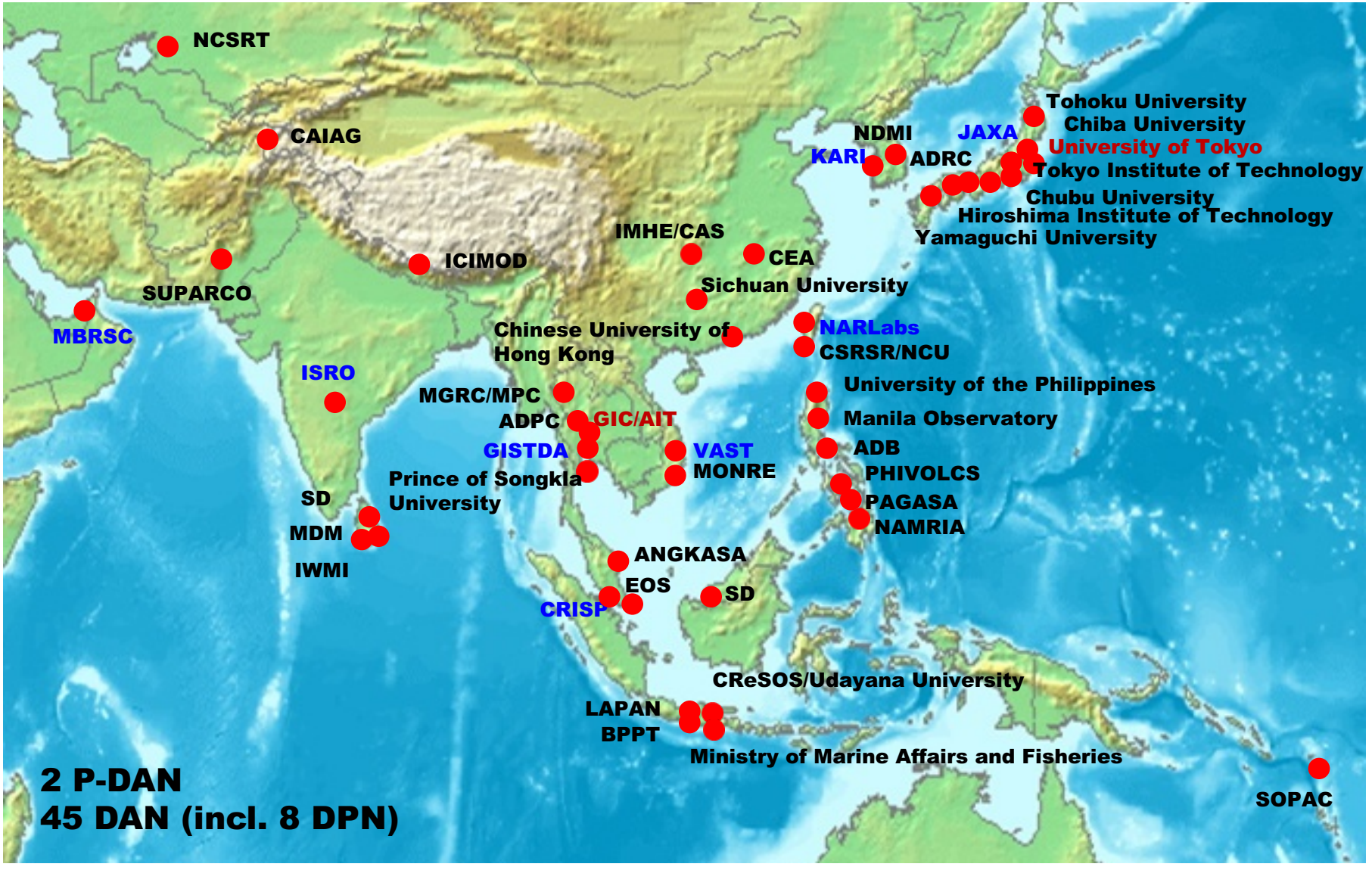


KhalifaSat

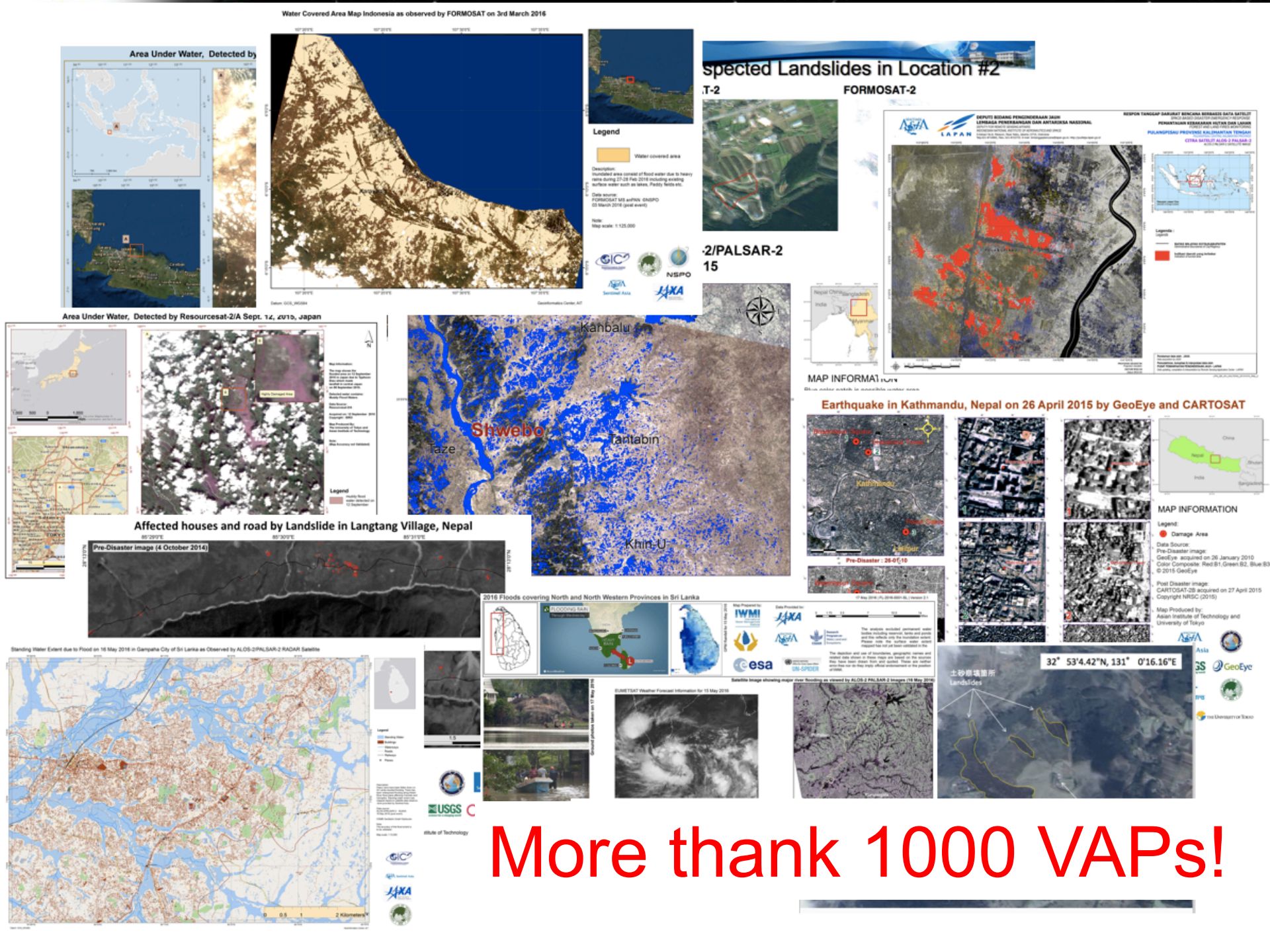
Emergency Observation Flow

Data Analysis Node (DAN)

Framework of satellite data analysis to provide analyzed products



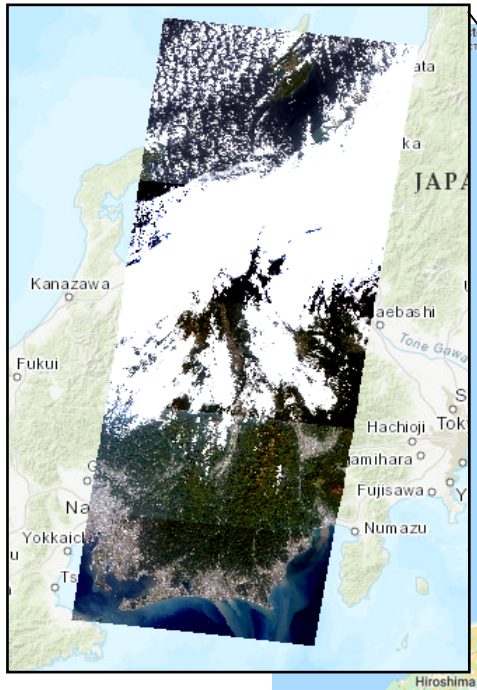
EOR Review, Responded Disaster by Geographical Distribution

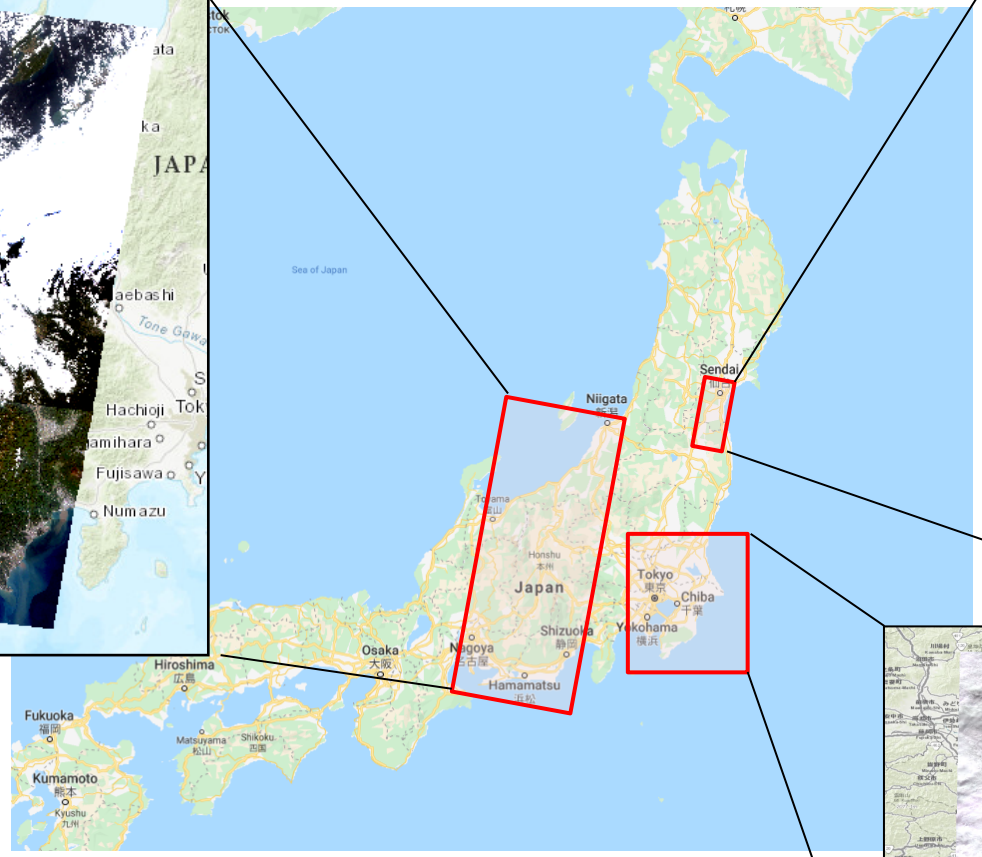

Water Covered Area Map Indonesia as observed by FORMOSAT on 3rd March 2016
Area Under Water, Detected by
Legend
Water covered area
spected Landslides in Location #2
T-2
FORMOSAT-2
·2/PALSAR-2
15
Area Under Water, Detected by Resourcesat-2/A Sept. 12, 2015, Japan
Legend
Kahbalu
Shwebo
Taze
Tantabin
Khin-U
MAP INFORMATION
Earthquake in Kathmandu, Nepal on 26 April 2015 by GeoEye and CARTOSAT
Pre-Disaster : 26-01-10
MAP INFORMATION
Legend:
Damage Area
Data Source:
Pre-Disaster image:
GeoEye acquired on 26 January 2010
Color Composite: Red:B1,Green:B2, Blue:B3
© 2015 GeoEye
Post Disaster image:
CARTOSAT-2B acquired on 27 April 2015
Copyright NRSC (2015)
Map Produced by:
Asian Institute of Technology and
University of Tokyo
Affected houses and road by Landslide in Langtang Village, Nepal
Pre-Disaster image (4 October 2014)
2016 Floods covering North and North Western Provinces in Sri Lanka
Standing Water Extent due to Flood on 16 May 2016 in Gampaha City of Sri Lanka as Observed by ALOS-2/PALSAR-2 RADAR Satellite
32° 53'4.42"N, 131° 0'16.16"E
Landslides
More thank 1000 VAPs!

Typhoon Hagibis, Japan

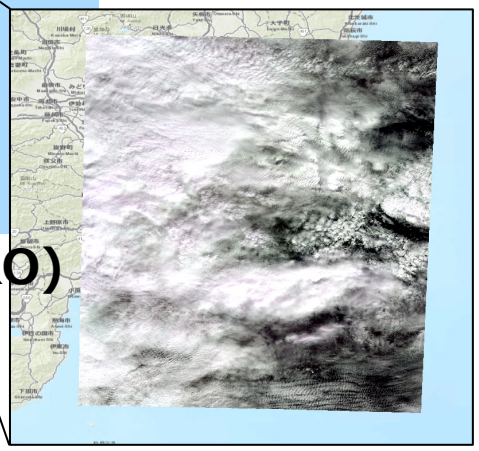
Thaichote (GISTDA)
13/Oct/2019 00:40

FORMOSAT-5 (NARL)
16/Oct/2019 02:08





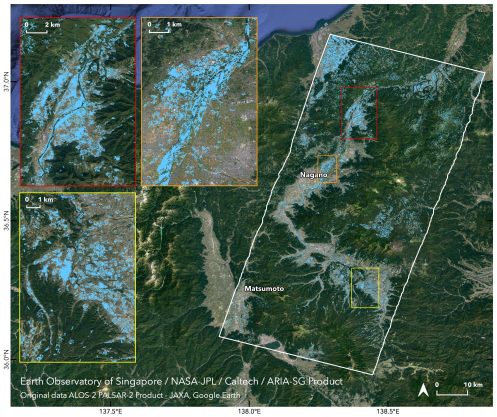
Resourcesat-2 (ISRO)
10/Oct/2019 10:30



These data are shared with our users via Web-GIS.

Typhoon Hagibis, Japan

EOS

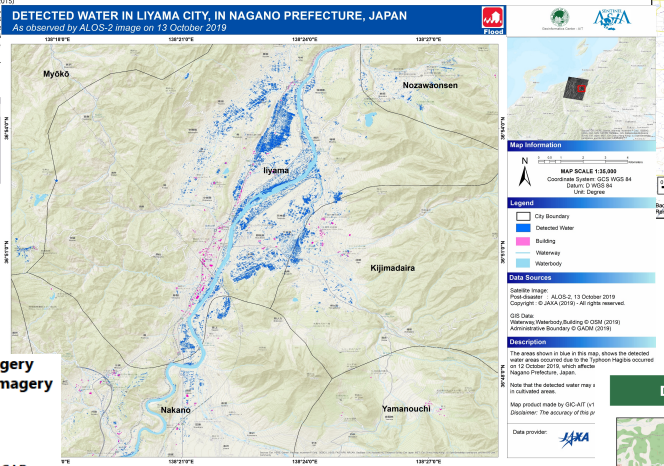


ARIA-SG Flood Proxy Map: Japan Typhoon Hagibis, 15 Oct 2019, v0.1

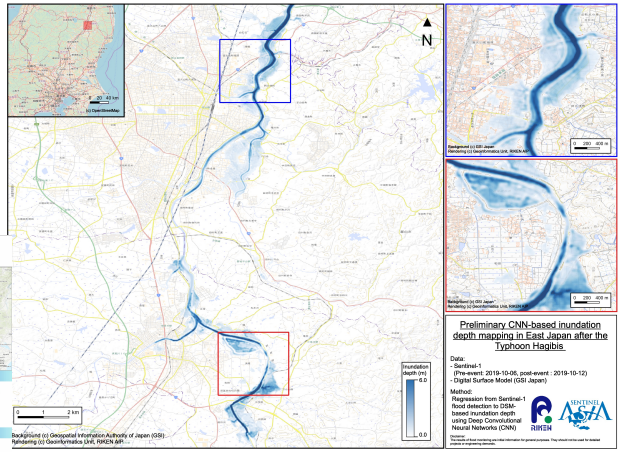
This preliminary map shows areas that are likely flooded (shown by light blue pixels of 25 m in size) in Nagano Prefecture, Japan due to heavy rains brought by Typhoon Hagibis. The map extents are indicated by the white polygon. This map should be used as a guidance to identify areas that are likely flooded, and is less reliable over URBAN and vegetated areas.

Derived from synthetic aperture radar data acquired by the ALOS-2 satellites operated by the Japan Aerospace Exploration Agency (JAXA) before (16 June 2015) and during (15 Oct 2019 03:37) the event. Data w provided by Sentinel Asi Analysed by the ARIA-SG at the Earth Observatory Singapore (EOS) in collaboration with NASA and Caltech.

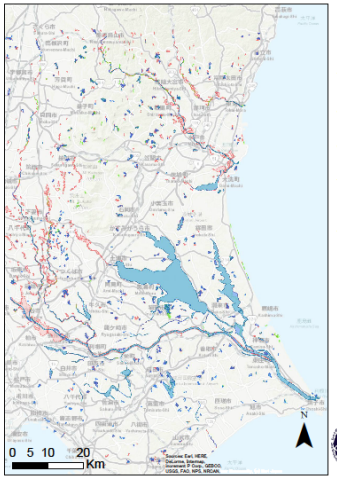
AIT



RIKEN



CHIBA



Sentinel-1 (S1) imagery
TerraSAR-X (TSX) imagery

ID: 2019-038-JPN
Typhoon No. 19 in 2019

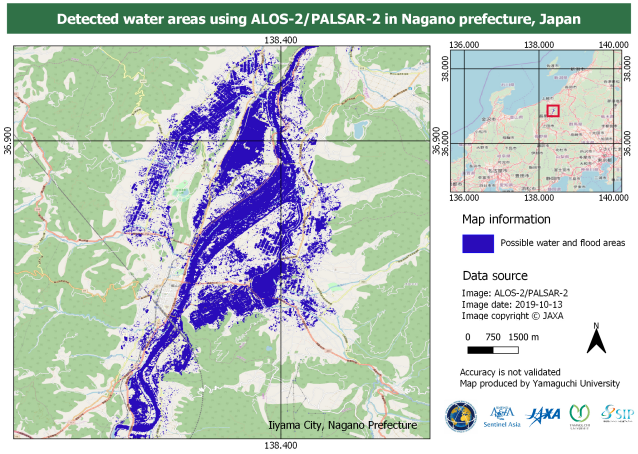
Water extraction from three-temporal SAR intensity images.
Water was extracted by the thresholding value
$W_{dB} > \mu_w + 2\sigma_w$
The water sample was selected from Kasumigaura Lake.

TerraSAR-X/TanDEM-X © DLR e. V. 2019, Distribution Airbus DS GEO GmbH
SentienI-1 image was owned by ESA, downloaded from OpenHub.

Water regions
- S1 (17:33 JST on Oct. 7, 2019)
- TSX (05:44 JST on Oct. 12, 2019)
- S1 (17:34 on Oct. 13, 2019)

DLR
esa European Space Agency
CHIBA UNIVERSITY

JPYU

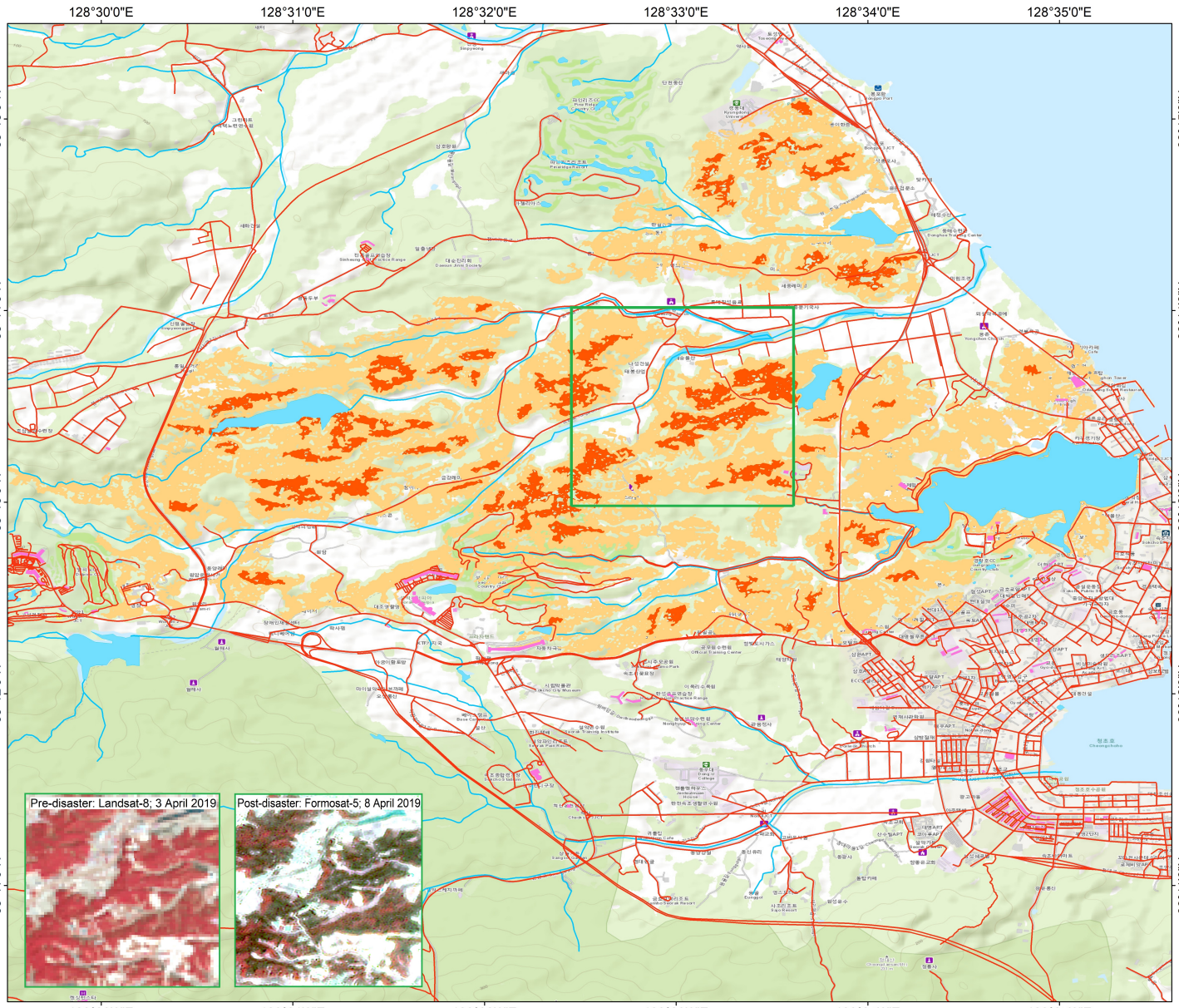


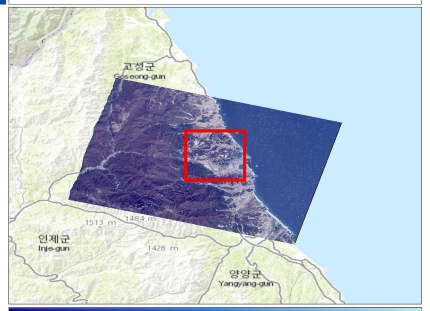
FOREST FIRE IN GOSEONG COUNTY, GANGWON PROVINCE, KOREA

As observed by FORMOSAT-5 image on 8 April 2019

Fire

Geoinformatics Center - AIT





Map Information

0 0.55 1.1 1.65 2.2

Kilometers

N

MAP SCALE 1:18,000

Coordinate System: GCS WGS 84
Datum: D WGS 84
Unit: Degree

Legend

- Road
- Building
- Water body
- Burnt area
- Potentially burnt area

Data Sources

Satellite image:
Pre-disaster : LANDSAT-8, 3 April 2019
Post-disaster : FORMOSAT-5, 8 April 2019
Copyright : © NSPO (2019) - All rights reserved
© USGS (2019) - All rights reserved

GIS data:
Water body, Road, Building © OSM 2019

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO,

Description

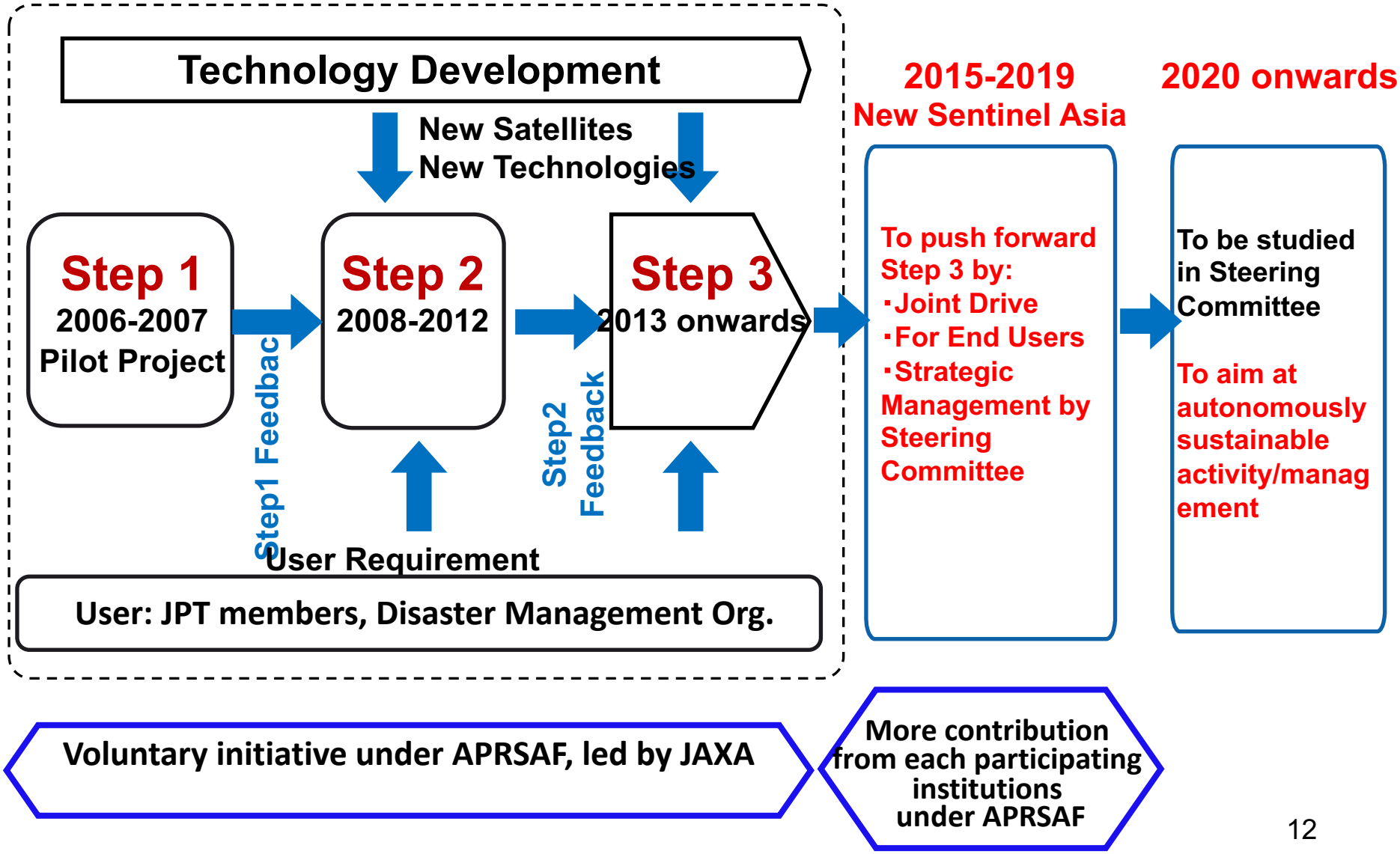
This map shows possible burnt and potentiall burnt areas from forest fire on 4 April 2019, which has affected Goseong county, Gangwon province.
Note that burnt and potentiall burnt areas may also include forest areas.

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

Disclaimer: The accuracy of this product is not validated.

Data provider: NSPO USGS

Sentinel Asia Evolution Image



Concept of SA 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

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

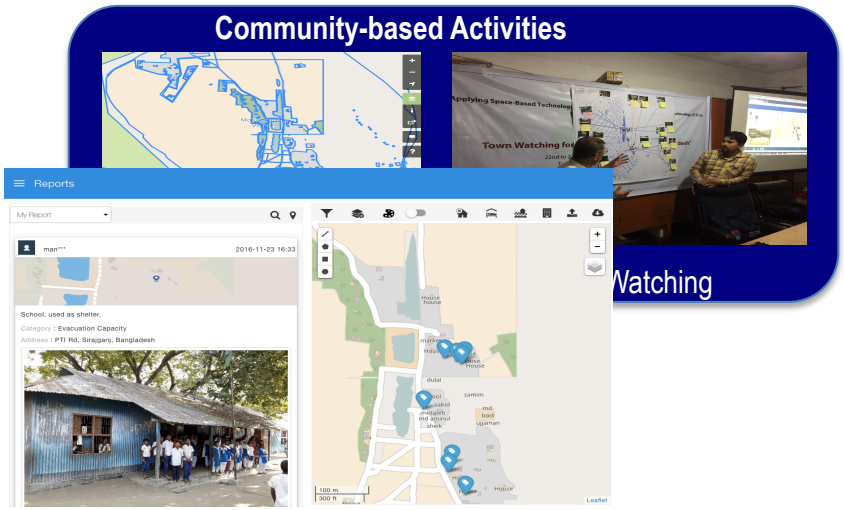
RECOVERY
- Mid/Long-term monitoring
- Recovery Status

RESPONSE
- Emergency Observation
- Data Analysis
- Damage Assessment

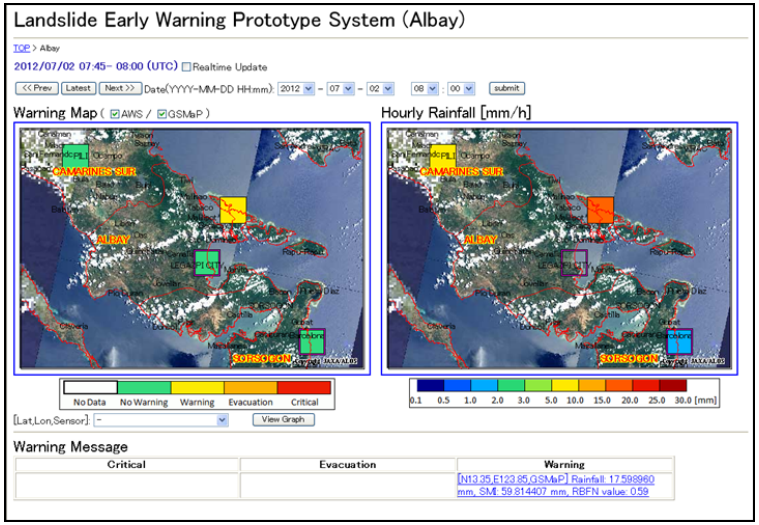
Mitigation/Preparedness

Key points;

- Recognition of Disaster occurrence spots by Hazard Map produced by space-based information.
- Expand Philippines Success Story, (Hazard maps, Early warning system of landslide etc.) to other countries.
- Development of new early warning system as a result of WGs activity.
- User enhancement by show-case, use-case of Sentinel Asia activity
- Capacity building for organization/agency ,(not individual person) on remote-sensing and GIS technology. One DAN in each country.



Applying Space-Based Technology and ICT to Strengthen Disaster Resilience (GIC-AIT)



Landslide Early Warning System in Philippines

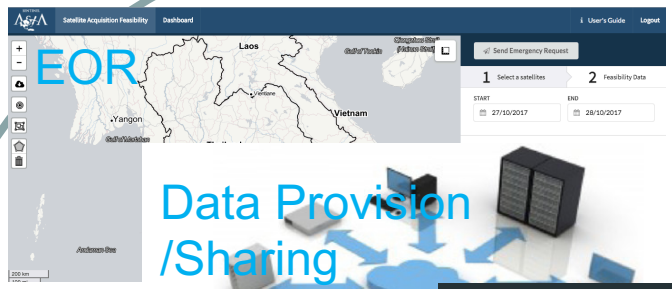
Response

Key points;

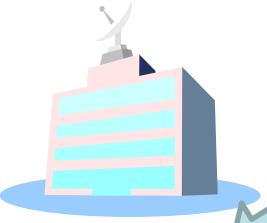
- Sharing all information on the Web
- Easy registration of EOR
- Visualization on the Status of DPN and DAN activity
- Quick response from requirement to data provision
- More useful and helpful products and information

DPN

All Web-based System



Data Provision /Sharing



USER (DMO/DMA)

DAN

Sentinel Asia Members/Users

Sentinel Asia Member (Disaster Management Organization/Agency)

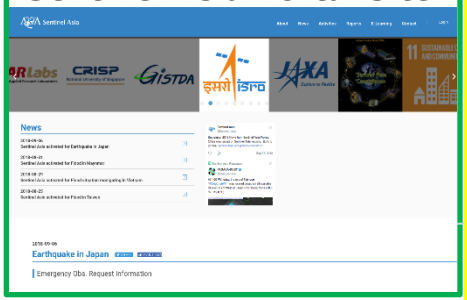
Notification/Communication by ADRC

Emergency Observation Request

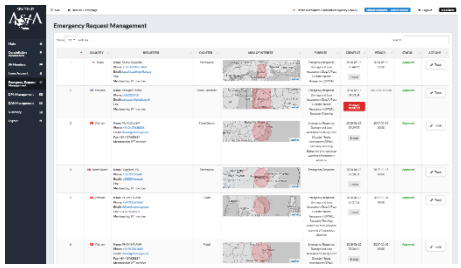
Confirmation

Satellite images , VAPs and Information

Sentinel Asia Portal Site

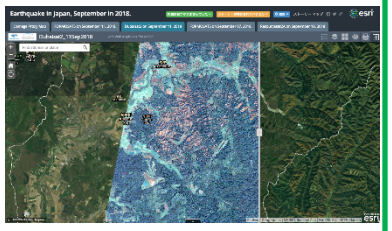


Sentinel Asia OPTEMIS @GISTDA



Sentinel Asia Cloud Storage /Analysis @ASGC

Web-GIS online



Emergency Observation Request

Status Report

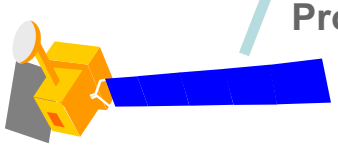
Observation Data Download

VAP Upload

Observation Data Provision

Data Provide Node

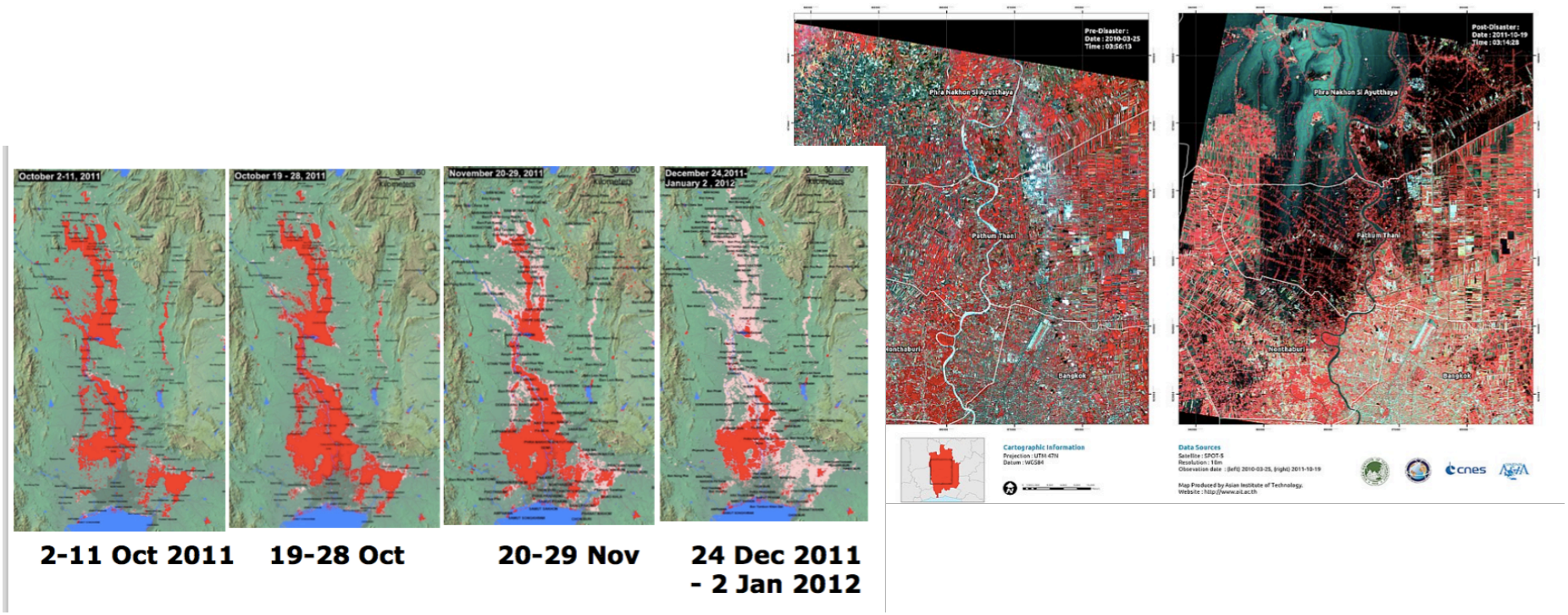
Data Analysis Node



Recovery

Key points;

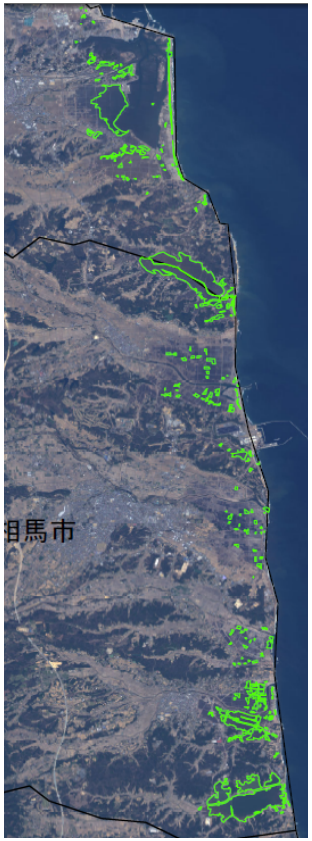
- Monitor devastating damage, like huge flood, caused by big disaster in regular.
- Monitor the situation related to secondary disaster, like landslide dam, in regular.

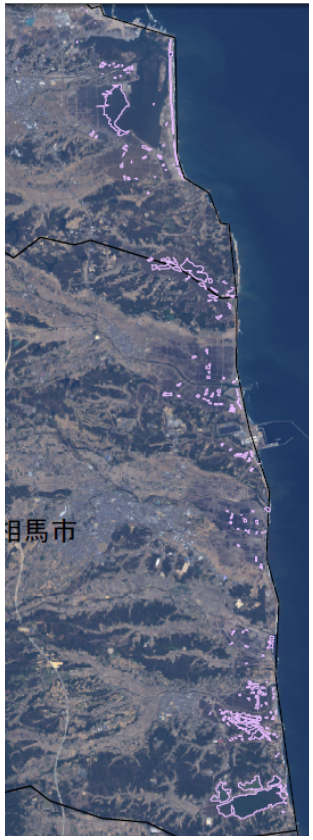


Huge Flood in Thailand, 2012

Flood Analysis using AVNIR-2 image

Background image: Apr. 17, 2011





As of Mar. 14 25.902 [km²]

As of Mar. 19 21.521 [km²]

As of Apr. 5 13.943 [km²]

As of Apr. 10 11.025 [km²]

As of Apr. 17 5.847 [km²]

As of Apr. 20 0.094 [km²]

- ✓ Generating flooded area polygon at regional government
- ✓ Calculating surface at flooded area
- ✓ Providing those data to Government of Japan and local governments

Surface : Fukushima Pref.

Flooded areas decreasing with time

Current Status of the Strategic Plan

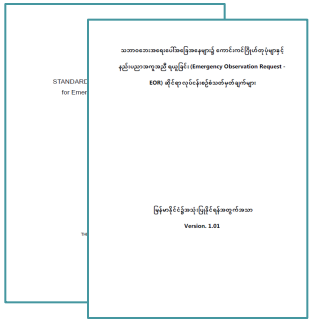
- Currently the first draft of long-term plan is drafted,
- Action items identified during the discussions are summarized and shared with SC members to identify possible contribution of partners and the time frame of achieving them,
- Action plan was summarized into 5 main themes and supported by 5 leading agencies with their voluntary worked;

I. New Satellite Data Provisions and Systems: JAXA
II. Value Added Product(VAP): Yamaguchi University
III. End-user Enhancement: GIC-AIT
IV. Step-3 Activities (Complete DRR cycle): ADRC, IWMI and GIC-AIT
V. Communication, Collaboration and Cooperation: ADRC

And Concept Paper on SDG, Sendai-framework and the relationship/benefit/usage of Sentinel Asia is being prepared by IWMI and GIC-AIT

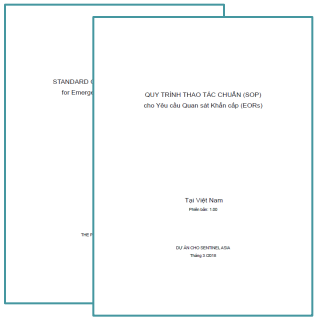
Developing Standard Operation Procedure (SOP) for Sentinel Asia

The purpose of SOP is to make clear each role and to strengthen the network between JPT members and other agencies in Myanmar, Thailand and Viet Nam.



English and Myanmar language

English and Thai language



English and Vietnam language

[Table of Contents (Myanmar version)]

Conducting workshops in 3 countries for SOP

In Myanmar

Date: 30 January 2018

Venue: Horizon Lake View Resort

Participants: 39
(RRD, DMH, ADPC, MIMU, One map Myanmar, etc.)

In Thailand

Date: 22 February 2018

Venue: Wayupak Convention Center

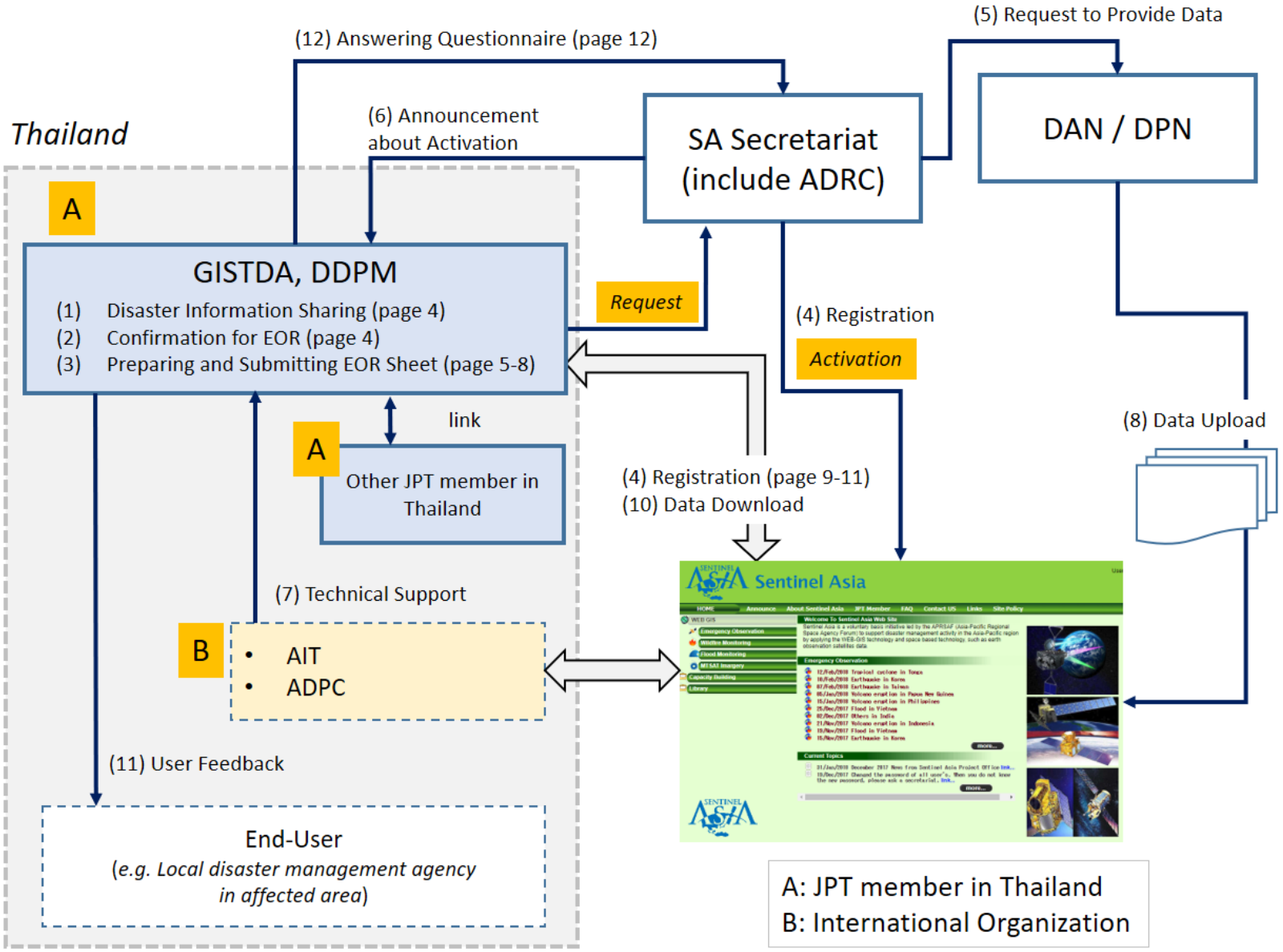
Participants: 21
(DDPM, GISTDA, MOI, RID, DWR, RFD, ADPC, etc.)

In Vietnam

Date: 19-20 March 2018

Venue: STI building

Participants: 36
(STI, MONRE, DMPTC, etc.)



This figure was confirmed by participants in each workshop.

Summary

- Sentinel Asia（SA) is a voluntary initiative by a collaboration between space agencies and disaster management agencies to reduced disaster risk in Asian-Pacific region.
- SA has responded over 300 requirements from JPT and ADRC members since 2007.
- SA is expected to implement not only emergency observation but activities covering entire disaster management cycle including mitigation/preparedness and recovery phase after a disaster.
- Space-based technology would have great potential to contribute to more activities for “Disaster Risk Reduction” in Asia and the Pacific.