



# SENTINEL ASIA ANNUAL REPORT 2020



# Sentinel Asia

## Annual Report 2020

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## 1. Introduction

### 1.1. Purpose and Scope of the Document

This document describes the activities of Sentinel Asia (SA) in 2020 for member organizations and external relations.

### 1.2. Structure of the Document

This report follows the following structure:

**Chapter 1 Introduction**

**Chapter 2 Sentinel Asia and Major Disasters:** overview and target disaster events related to Sentinel Asia

**Chapter 3 Emergency Observation Operations in 2020:** results of emergency observation activities in 2020

**Chapter 4 External Relations:** explains the integration of new members, progress, external relationships and Cooperating Bodies

**Chapter 5 Conference and Releases:** reports on all communication activities undertaken throughout the reporting period

**Chapter 6 Assessment of Sentinel Asia Operations:** provides an assessment of the overall impact of Sentinel Asia as a service in supporting disaster response, and of system performance, products and services.

**Chapter 7 Conclusions:** outlines significant achievements and conclusions throughout the reporting period.

### 1.3. List of Acronyms

ADPC	Asian Disaster Preparedness Center
ADRC	Asian Disaster Reduction Center
AFAD	Disaster and Emergency Management Presidency in Turkey
AHA Center	ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management
AIT	Asian Institute of Technology
ALOS	Advanced Land Observing Satellite
APRSAF	Asia-Pacific Regional Space Agency Forum
ARMOR	ASEAN Risk Monitor and Disaster Management Review
ASEAN	Association of South-East Asian Nations
CAIAG	Central-Asian Institute for Applied Geosciences
CRISP	Centre for Remote Imaging, Sensing and Processing
DAN	Data Analysis Node
DMH	Department of Meteorology and Hydrology, Myanmar
DPN	Data Provider Node
EOC	Earth Observatory of Singapore
EOR	Emergency Observation Request
GAR	Global Assessment Report on Disaster Risk Reduction
GISTDA	Geo-Informatics and Space Technology Development Agency
ICIMOD	International Center for Integrated Mountain Development
ICT	Information and Communication Technology
IDC	International Disaster Charter
IRS	Indian Remote Sensing Satellite
ISRO	Indian Space Research Organization
IWMI	International Water Management Institute
JAXA	Japan Aerospace Exploration Agency
JICA	Japan International Cooperation Agency
JPTM	Joint Project Team Meeting
KARI	Korea Aerospace Research Institute
LAPAN	National Institute of Aeronautics and Space (Indonesia)
MBRSC	Mohammed Bin Rashid Space Centre
MO	Manila Observatory
NARLabs	National Applied Research Laboratories
NIED	National Research Institute for Earth Science and Disaster Resilience

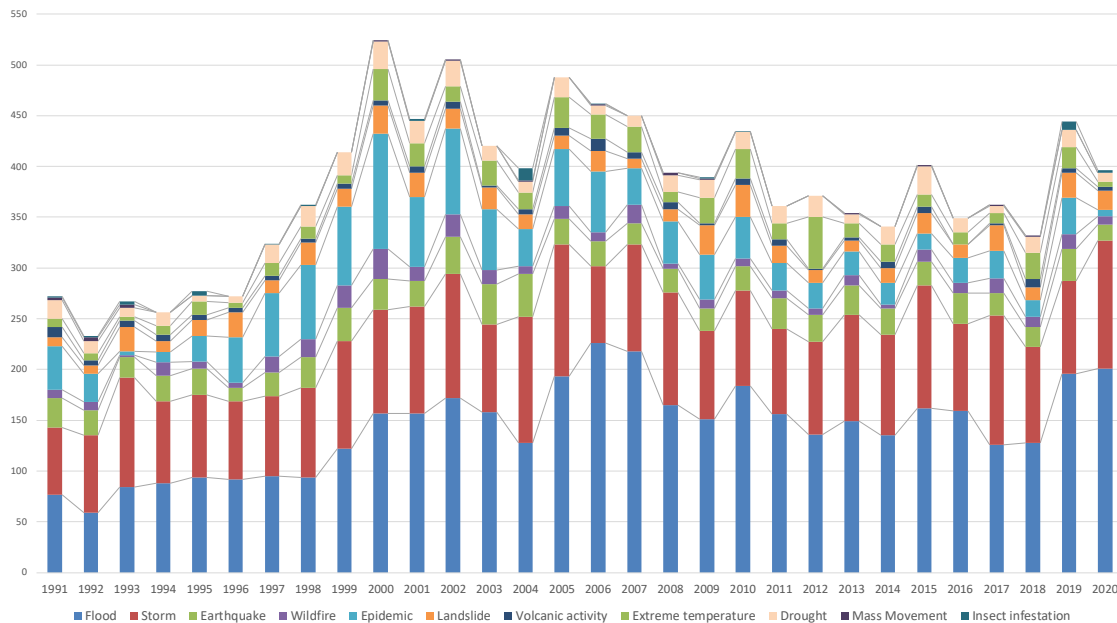
NSPO	National Space Organization
RSO	Regional Support Offices
SA	Sentinel Asia
SAWG	Space Applications Working Group
SEUWG	Space Environment Utilization Working Group
SEWG	Space Education Working Group
SPC	Secretariat of the Pacific Community
STWG	Space Technology Working Group
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNOOSA	United Nations Office for Outer Space Affairs
UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
VAP	Value Added Product
VIGMR	Vietnam Institute of Geosciences and Mineral Resources
WINDS	Wideband Internetworking engineering test and Demonstration Satellite

## 2. Sentinel Asia and Major Disasters

### 2.1. Outline of Sentinel Asia

#### 2.1.1. Background and History of Sentinel Asia

Natural hazards have been on the rise worldwide, including the Asia-Pacific region (Figure 1). The Asia-Pacific region suffers from different types of natural hazards, such as earthquakes, cyclones/typhoons, floods, landslides, droughts, tsunamis, volcanic eruptions and forest fires. Several of them are large-scale, devastating disasters. Given the high population level (about 3 billion) as well as the high frequency and severity of natural hazards in the region, an integrated use of space technology, such as earth observation satellite data and geographic information systems, can be an effective means to reduce the magnitude of the severity, or provide timely management in the event of a large-scale natural hazard or disaster. In light of the increasing frequency of natural hazards and an elevated loss of lives and properties from these events, SA, a collaborative, regional project, was conceptualized in 2005, and began to operate in 2007. It is engaged in activities to share and provide disaster-related information, including earth observation satellite images via the internet, in order to contribute toward disaster management in the Asia-Pacific region. Space agencies from the member countries of the Asia-Pacific Region Space Agency Forum (APRSAF), including the Japan Aerospace Exploration Agency (JAXA), and disaster risk reduction agencies in the Asia-Pacific region, such as the Asian Disaster Reduction Center (ADRC), cooperate in forming a Joint Project Team (JPT) and promoting SA. As of December 2020, it consists of 111-member organizations, including 94 agencies from 28 countries/regions, and 17 international organizations. JAXA has been serving as a secretariat of the JPT.



**Figure 1: Incidence of Natural Hazards by Region (in and after 1990)**

A stepwise approach for the implementation of data and information dissemination systems through SA as proposed by the APRSAF was as follows:

- Step 1:** Implementation of the backbone 'Sentinel Asia' data dissemination system and associated Nodes (Feb. 2006–Dec. 2007)
- Step 2:** Expansion of the dissemination backbone with new Satellite Communication Systems (2008–2012)
- Step 3:** Establishment of a comprehensive 'Disaster Management Support System' in the region (2013 onwards)

Sentinel Asia initiated an emergency observation request system in 2007 to provide image data (and analyzed images) acquired through the satellites operated by participating space agencies on the internet and via JAXA's Wideband Internetworking engineering test and Demonstration Satellite (WINDS), also known as Kizuna, in the event of a disaster in the Asia-Pacific region.

During that time, Sentinel Asia participated in the International Disaster Charter (IDC) in 2010 to expand its activities and cooperation on a global scale. Sentinel Asia

also established the Regional Support Office (RSO) for the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) at the ADRC in June 2009, which serves as a contact (liaison) office for emergency observation requests, to expand the range of its activities and increase international interest.

#### 2.1.2. Aims and Activities of Sentinel Asia in a Nutshell

The SA aims to: (i) improve safety in society with the use of modern Information and Communication Technology (ICT) and space-based technology; (ii) improve the speed and accuracy of disaster preparedness and early warning; and (iii) minimize the number of victims, as well as social and economic losses. To achieve these goals, various activities have been undertaken.

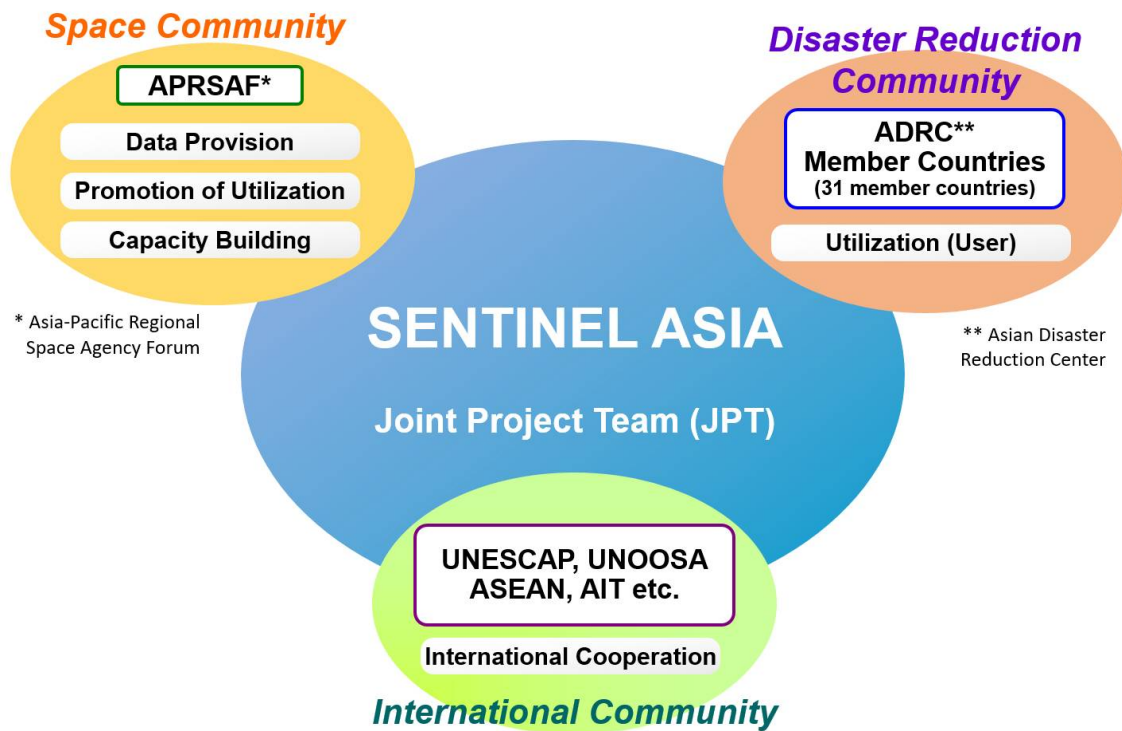
The main activities of the SA are summarized as follows:

- Emergency observation by earth observation satellites (e.g. ALOS-2, FORMOSAT-5, RESOURCESAT-2, OCEANSAT-2/OCM, IMS-1, CARTOSAT-1&2, RISAT-1, THEOS, VNREDSAT, TeLEOS-1, DUBAISAT-2, and KHALIFASAT) in the event of major disasters
- Acceptance of observation requests for major disasters in the Asia-Pacific region from ADRC member organizations and the representative organizations of JPT members to support disaster management in the region
- Working Groups (WGs) for early warning and disaster monitoring: WGs on wildfires, floods, glacial lake outburst floods, and tsunamis are (formed and) in operation
- Capacity building of member organizations (e.g., through training) for the utilization of satellite images for disaster management

The following is an overview of the main data and products provided by SA to its members: (i) satellite imagery (and data permitted by data providers) and value-added images with an extraction of the affected area, etc.; (ii) on-site digital camera images; (iii) wildfire hotspot information and data; (iv) rainfall (short-term and long-term) information and data; and (v) meteorological satellite imagery and data.

### 2.1.3. Framework and Emergency Observation Mechanisms of Sentinel Asia

SA is promoted under cooperation among the following three communities: (i) the Space Community (APRSAF); (ii) the International Community (e.g., UNESCAP, UNOOSA, ASEAN, AIT); and (iii) the Disaster Reduction Community (ADRC and its member countries), as illustrated in Figure 2. The JPT was established to promote the activities of SA, and it is open to all APRSAF member countries, disaster prevention organizations and regional/international organizations who wish to participate in disaster information sharing activities.



**Figure 2: Framework of Sentinel Asia**

SA is composed of two Nodes (Data Provider, and Data Analysis) and four Working Groups (Wildfire, Flood, Glacial Lake Outburst Flood and Tsunami). The Data Provider Node (DPN) provides their own satellite imagery and other relevant data to JPT members upon an Emergency Observation Request (EOR) from a JPT member, to the extent permitted by the data policy of each DPN when a disaster occurs; while the Data Analysis Node (DAN) analyzes the satellite data provided by DPN, makes a value-added product and uploads and shares the result through the new Sentinel Asia EOR system





The key features of Step 3 are:

- Covering all phases in a disaster management cycle
- Employing a wide variety of satellites, including earth observation satellites, communication satellites and navigation satellites
- Being managed as a joint project by participating agencies, through the planned construction of a joint management system
- Promoting the use of services by expanding human networks through capacity development and outreach activities

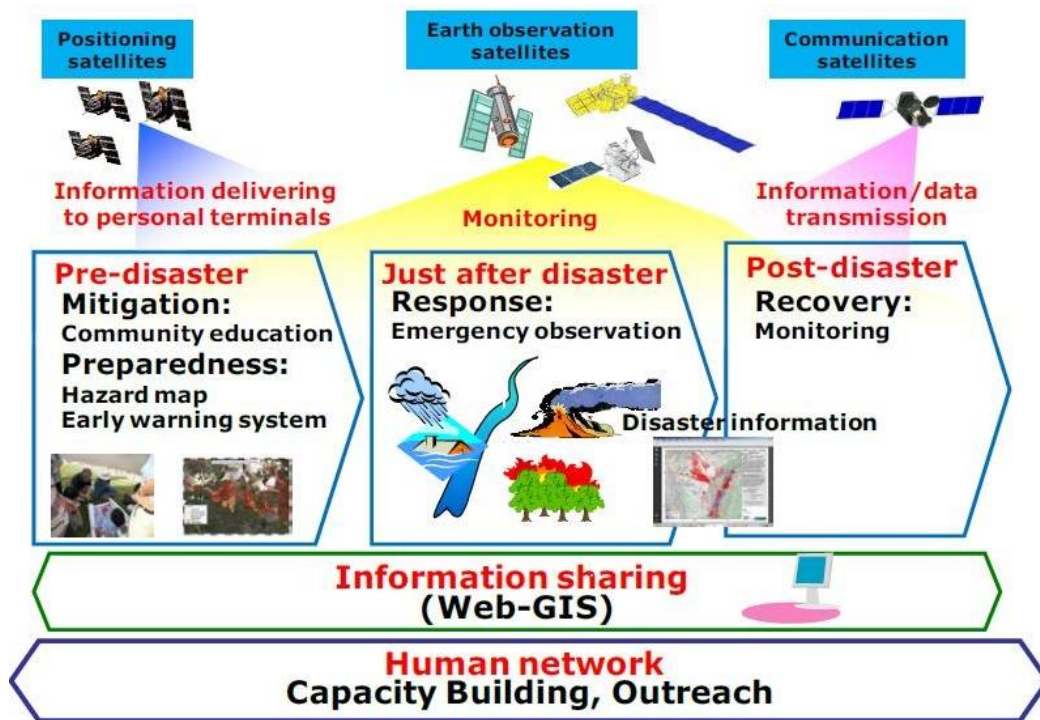
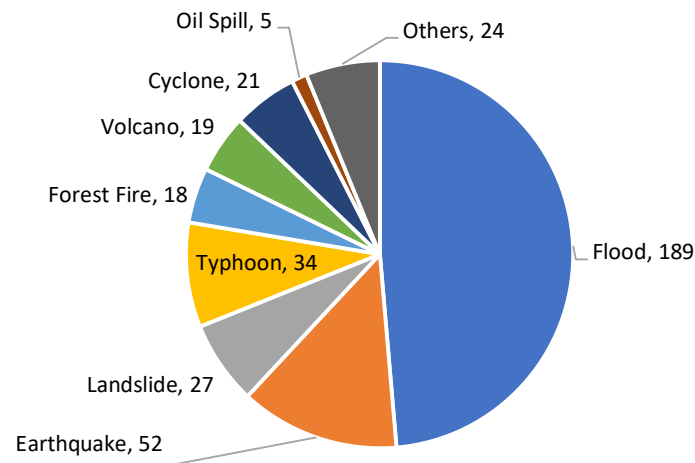


Figure 4: Current Phase (Step 3) and Actions of Sentinel Asia

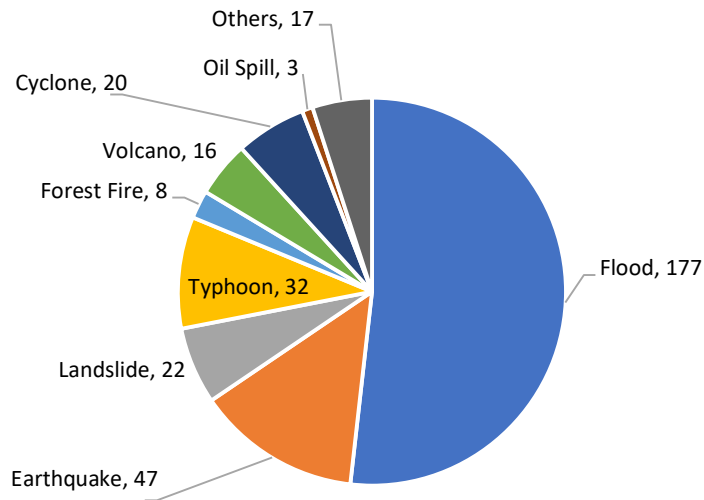
## 2.2. Major Disasters with Emergency Observation (2007-2020)

Figures 5 and 6 show a breakdown of emergency observations with requests and emergency observations with activation by disaster. Table 1 shows the number of requests, activations, and rejections for each disaster. Floods represent the largest number of disasters with 189 requests (48.6%), followed by earthquakes at 52 (13.4%), landslides at 27 (6.9%), typhoons at 34 (8.7%), forest fires and fires at 18 (4.6%), volcanic eruptions at 19 (4.9%), and cyclones at 21 (5.4%). Generally, activation is made for around 88% of requests for most disasters.



**Figure 5: Breakdown of Emergency Observations by Disaster (2007 - 2020)**

**\*Requests (N=389)**



**Figure 6: Breakdown of Emergency Observations by Disaster (2007 - 2020)**  
**\*Activations (N=342)**

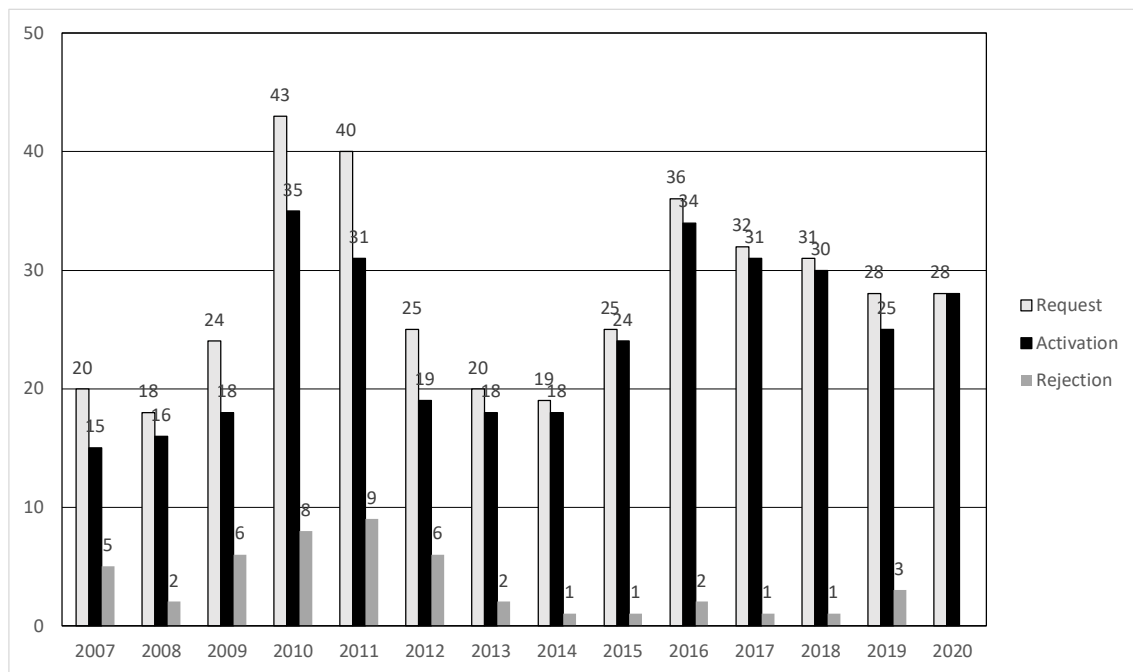
**Table 1: Number of Requests, Activations, and Rejections for Emergency Observations by Disaster (2007 - 2020)**

	Number of Request	Number of Activation	Number of Rejection	Activation/Request (%)
Flood	189	177	12	93.7%
Earthquake	52	47	5	90.4%
Landslide	27	22	5	81.5%
Typhoon / Storm	34	32	2	94.1%
Forest Fire	18	8	10	44.4%
Volcano	19	16	3	84.2%
Cyclone	21	20	1	95.2%
Oil Spill	5	3	2	60.0%
Others	24	17	7	70.8%
<b>Total</b>	<b>389</b>	<b>342</b>	<b>47</b>	

### 3. Emergency Observation Operations in 2020

#### 3.1. Emergency Observation Requests

Figure 7 shows the number of requests, activations and rejections involving emergency observations from 2007 to 2020. The number of requests and activations peaked in 2010 and 2011, with the number declining subsequently thereafter, but the number increased once again from 2015 to 2016. The number has begun decreasing gradually once more since 2016.

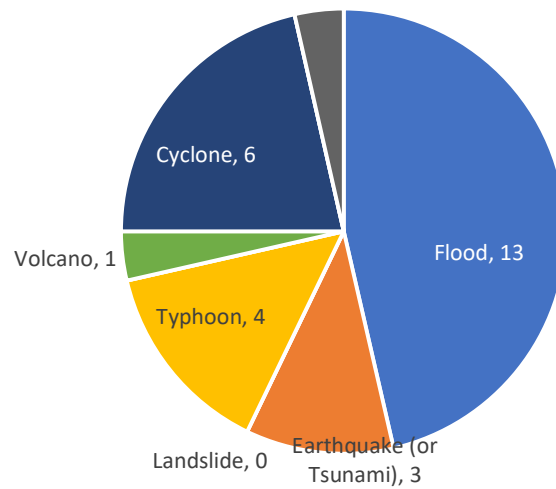


**Figure 7: Comparison of the Number of Requests, Activations and Rejections for Emergency Observations**

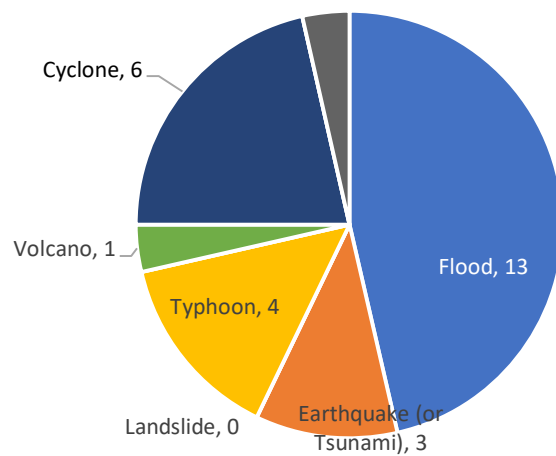
Figures 8 and 9 show a breakdown of emergency observations with requests and emergency observations with activation by disaster. On a request basis, floods represented the largest number of disasters, with 13 requests (46.4%), followed by cyclones at 6 (21.4%), and typhoons at 4 (14.3%).

**Table 2: List of 2020 Activations**

Activation Number	Country	Disaster Type	Implementation	Requester
362	Indonesia	Flood	2020/1/1	AHA Center, BNPB
363	Philippines	Volcanic Eruption	2020/1/13	PHIVOLCS
364	Iran	Flood	2020/1/20	UNSCAP
365	Turkey	Earthquake	2020/1/25	AFAD
366	Indonesia	Flood	2020/2/25	JICA, PUPR
367	Vanuatu	Cyclone	2020/4/7	SPC, NDMO(Vanuatu)
368	Indonesia	Flood	2020/5/9	AHA Center, BNPB
369	India	Cyclone	2020/5/18	ISRO, DMS
370	Bangladesh	Cyclone	2020/5/18	IWMI, DMD (Bangladesh)
371	India	Cyclone	2020/6/3	ISRO, DMS
372	Japan	Flood	2020/7/6	ADRC, MLIT
373	India	Flood	2020/7/13	ISRO
374	India	Flood	2020/7/13	ISRO
375	Indonesia	Flood	2020/7/16	LAPAN, BNPB
376	Vietnam	Flood	2020/7/22	MONRE
377	Lebanon	Industrial Accident	2020/8/8	AFAD (Turkey)
378	Philippines	Earthquake	2020/8/19	PHIVOLCS
379	Japan	Typhoon	2020/9/4	ADRC, MLIT
380	Vietnam	Flood	2020/9/17	MONRE
381	Vietnam	Flood	2020/10/7	MONRE
382	Vietnam	Flood	2020/10/27	MONRE
383	Cambodia	Flood	2020/10/30	AHA Center, NCDM
384	Philippines	Typhoon	2020/11/1	AHA Center, NDRRMC, PHIVOLCS
385	Turkey	Earthquake	2020/11/2	ADRC, AFAD
386	Philippines	Typhoon	2020/11/12	MO, PHIVOLCS
387	Vietnam	Typhoon	2020/11/13	MONRE
388	India	Cyclone	2020/11/24	ISRO
389	Sri Lanka	Cyclone	2020/12/2	DMC



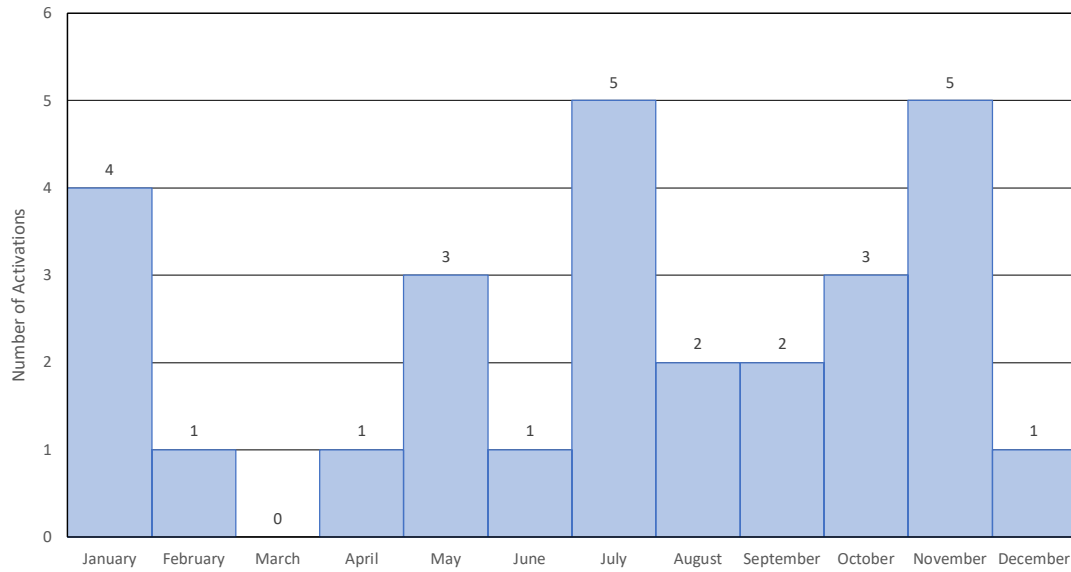
**Figure 8: Breakdown of Emergency Observations by Disaster \*Requests in 2020**  
**\*Requests (N=28)**



**Figure 9: Breakdown of Emergency Observations by Disaster \*Activations in 2020**  
**\*Activations (N=28)**

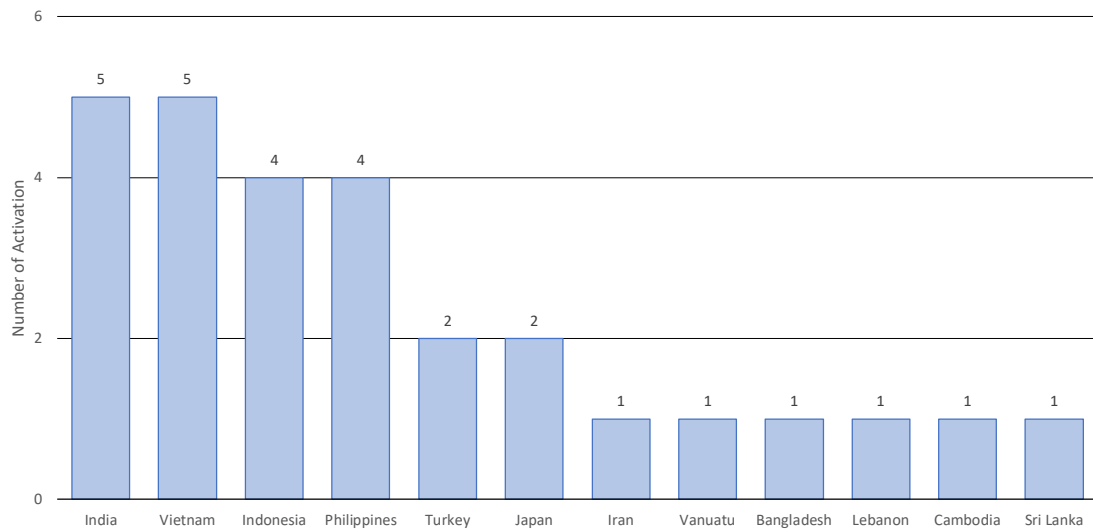
### 3.2. Results of Emergency Observations

During 2020, the monthly average of activations was 2.1. Figure 10 shows the monthly distribution of activations throughout 2020. The highest number of activations occurred in July and November, corresponding to 35.7% of the total number.



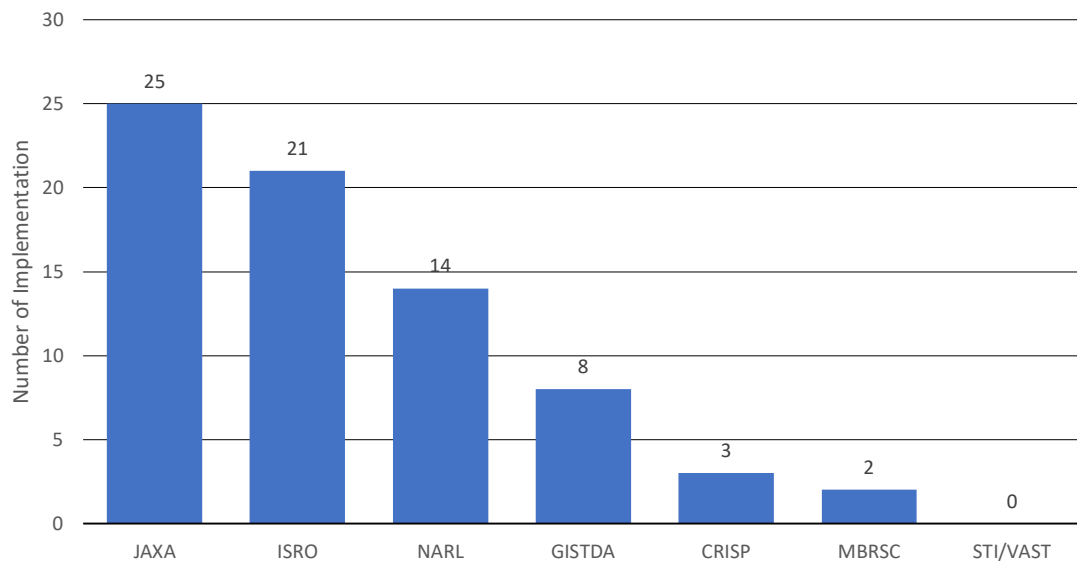
**Figure 10: Number of Monthly Activations in 2020**

Figure 11 shows the number of emergency observations by country. Countries and regions with a large number of requests are mostly located in Southeast Asia, including the Philippines, Vietnam, Indonesia, and India. Countries with the highest number of activations were India and Vietnam, at 5 activations each.



**Figure 11: Number of Activations by Country in 2020**

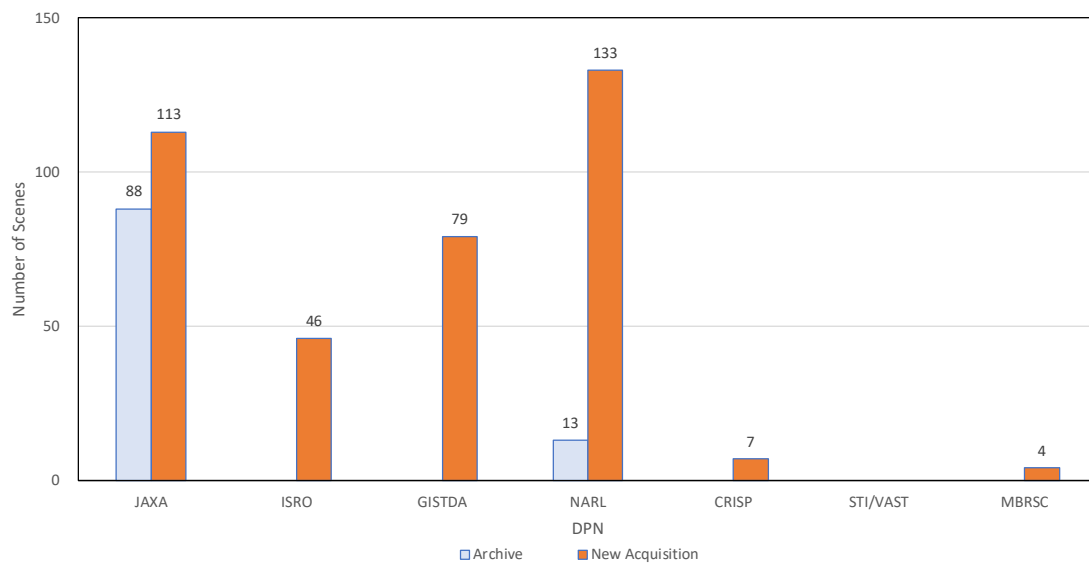
Figure 12 shows the number of implementations by DPN. In total, 73 implementations were made in 2020, and satellite data was provided to the requesters.



**Figure 12: Number of Responses by DPN in 2020**

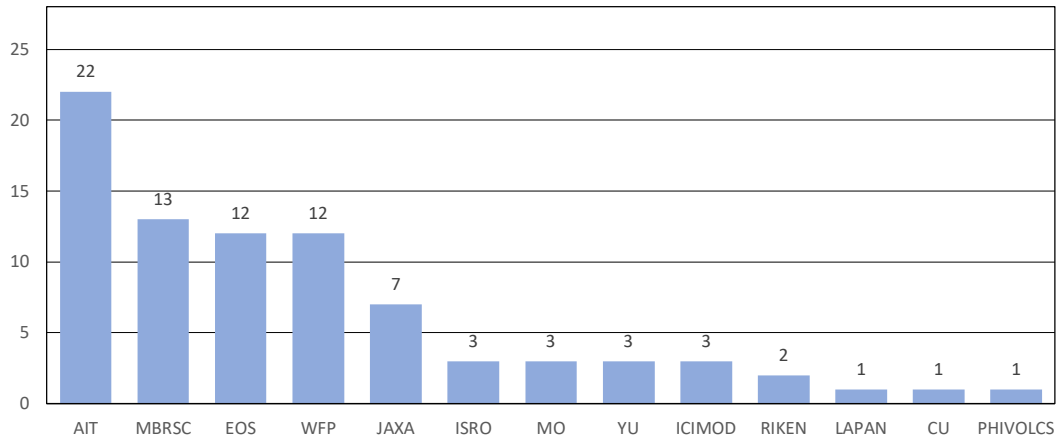


DPN has been providing a lot of satellite images, including optical and radar data, when an EOR is activated. DAN have also been supportive by providing Value Added Products (VAP), including KMZ files and shapefiles for GIS. This data is uploaded to OPTEMIS and the SA website (<https://sentinel-asia.org/index.html>). Figure 13 shows the number of optical and radar data by DPN which were uploaded to the SA website.

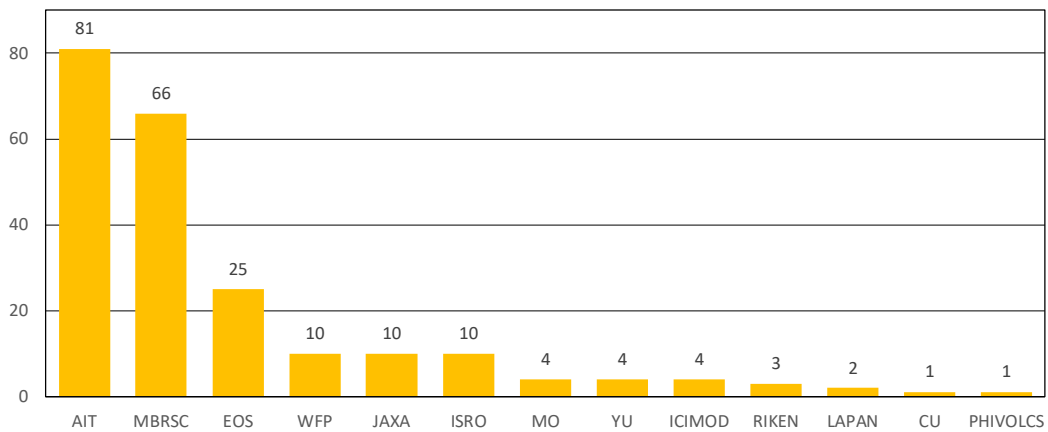


**Figure 13: Data Consumption (Archive and New Acquisition) by DPN in 2020**

Figure 14 shows the number of implementations by DAN in 2020. In total, 83 were implemented, and VAP were provided to requesters. Figure 15 shows the number of provided VAP in 2020.



**Figure 14: Number of responses by DAN in 2020**



**Figure 15: Number of VAP by DAN in 2020**

### 3.3. Good Practices

#### 3.3.1. Flood in Indonesia (February 2020)

[EOR Requester] Japan International Cooperation Agency (JICA)

[SA website URL] <https://sentinel-asia.org/EO/2020/article20200225ID.html>

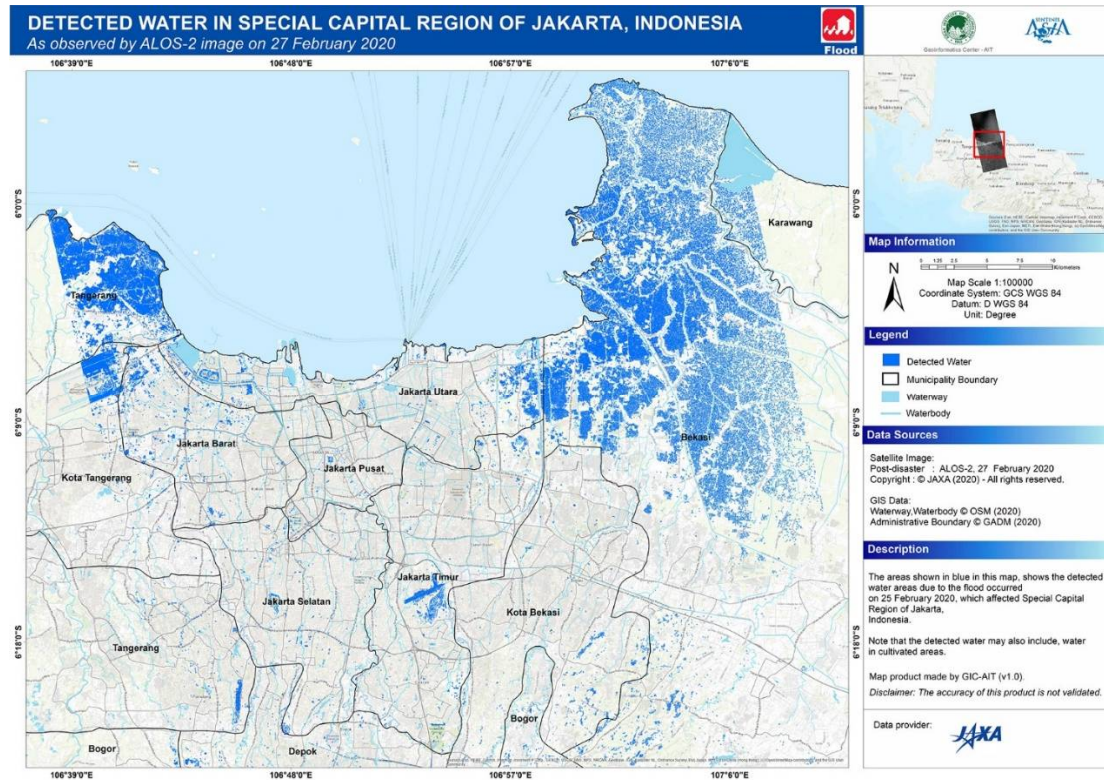
Indonesia is located in a disaster-prone area, and being susceptible for various types of natural hazards, it can be considered as a kind of “laboratory of disasters” due to its geographical, geological and demographic condition. Indonesia is situated in the “Pacific Ring of Fire”, an area located between three tectonic plates (Indo-Australia, Eurasian and Pacific) encircling the Pacific Ocean where frequent earthquakes and volcanic activity result from the movements of said tectonic plates. In particular, floods due to heavy rain have been occurring every year across all Indonesian islands.

A massive flood hit parts of Jakarta and provinces in Indonesia on 24 February 2020. According to the report by UNOCHA, the death toll from the flooding and landslides caused by the heavy rain reached 9 and more than 222,000 residents suffered from the inundation. Focusing on the Jakarta area and West Java, over 80,000 residents took refuge on drier grounds and over 85,000 residents were affected. The Japan International Cooperation Agency (JICA) decided to send an EOR related to the disaster through their strong network of JICA branch offices in Indonesia and the Ministry of Public Works and Housing (PUPR) in Indonesia.

The ADRC received the EOR from JICA and transferred a DPN/DAN on the 25<sup>th</sup> of February. The first satellite images from the DPN were provided on the 28<sup>th</sup> of February, 3 days after the occurrence of the disaster. Finally, 27 satellite images were provided by GISTDA, JAXA, and ISRO, and the first VAP from the DAN was provided on the 28<sup>th</sup> of February. 5 VAPs were provided by RIKEN and AIT. This valuable information was utilized to outline the situation in the affected area.

This EOR case demonstrated good utilization of the JICA network for providing information updates as the situation unfolded, as well as detailing the needs of the local sector. When disasters occur, JPT members and ADRC countries sometimes may not be able to manage the preparation of an EOR due to emergency operations in the affected area. Therefore, JICA’s existing network is expected to support the provision of an EOR

on behalf of other organizations during Sentinel Asia's next activity.



**Figure 16: VAP (provided by AIT)**

(UNOCHA: <https://reliefweb.int/report/indonesia/asia-and-pacific-weekly-regional-humanitarian-snapshot-25-february-02-march-2020>)

(UNOCHA: <https://reliefweb.int/report/indonesia/indonesia-floods-and-landslides-update-bnpb-bmkg-media-echo-daily-flash-27-february>)

### 3.3.2. Flood in Indonesia (July 2020)

[EOR Requester] Indonesian National Institute of Aeronautics and Space (LAPAN)

[SA website URL] <https://sentinel-asia.org/EO/2020/article20200716ID.html>

LAPAN is the Indonesian National Institute of Aeronautics and Space, established in November 1963 by former Indonesian president Sukarno, with the aim of facilitating long-term civilian and military aerospace research. LAPAN has been an active participant in the activities of Sentinel Asia as one of the major Data Analysis Nodes (DANs) in Indonesia. There are a lot of hazards in Indonesia every year, and LAPAN has been supportive in issuing an Emergency Observation Request (EOR) when a disaster occurs in Indonesia, as well as collaborating with disaster management organizations within Indonesia.

LAPAN confirmed an occurrence of heavy rain which hit the south of Sulawesi in Indonesia during July 2020. LAPAN made the decision to send an EOR, and collaborate with a national disaster management organization (BNPB) in Indonesia.

The ADRC received the EOR from LAPAN and transferred a DPN/DAN on the 13<sup>th</sup> of July. The first satellite images from the DPN were provided on the 17<sup>th</sup> of July. Finally, 10 satellite images were provided by JAXA, ISRO, NARL, and CRISP. This was the first time that satellite images from TeLEOS-1 had been provided by CRISP. The first VAP from the DAN was provided on the 17<sup>th</sup> of July. 5 VAPs were provided by JAXA and MBRSC. The EOR was escalated to the International Disaster Charter, and AIT was appointed Project Manager for the Charter Activation.

LAPAN shared the provided data (satellite images and VAPs) to the national disaster management organization (BNPB) in Indonesia, as well as to a local disaster management organization in Sulawesi (BPBD) in order to conduct emergency response activities in the affected area. LAPAN also developed an original analysis map by using the provided satellite images, and shared it with other agencies.

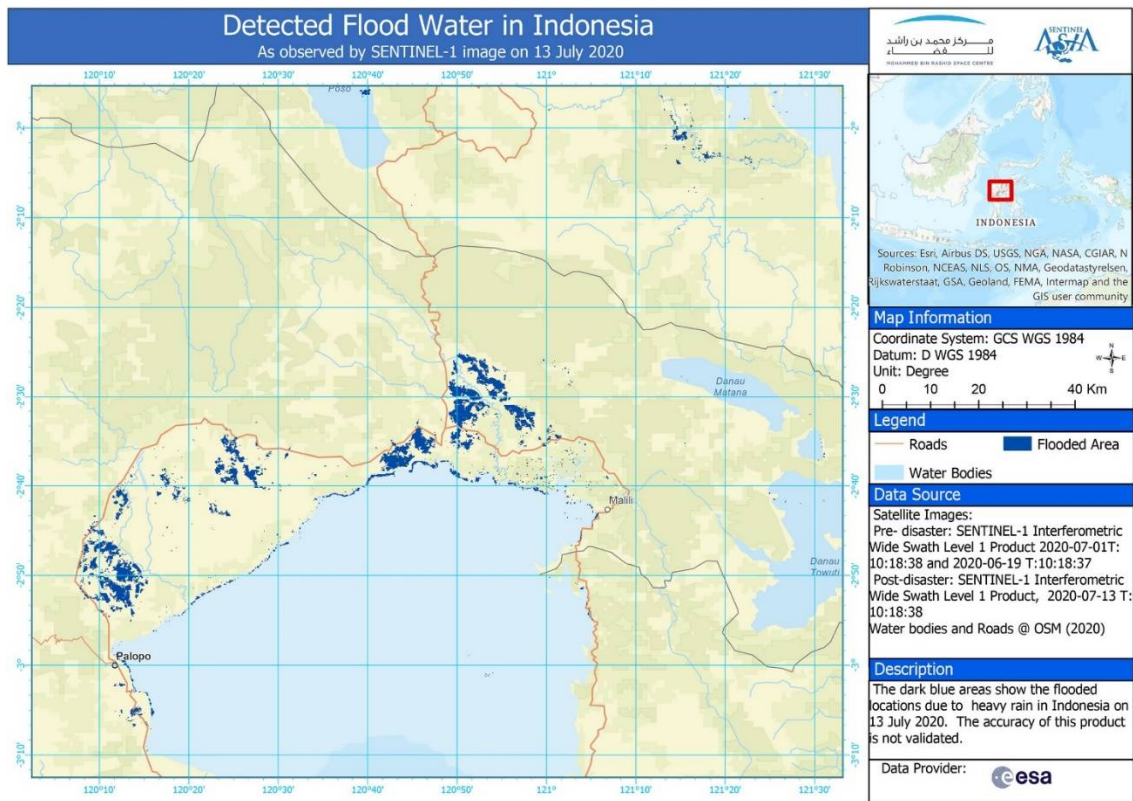


Figure 17: VAP (provided by MBRSC)

### 3.3.3. Explosion in Lebanon (August 2020)

[EOR Requester] Disaster and Emergency Management Authority of Turkey (AFAD)

[SA website URL] <https://sentinel-asia.org/EO/2020/article20200808LB.html>

Sentinel Asia have received 389 EORs between 2006 and 2020, among which 342 have been accepted, for which they provide data and products to members of the requestees in support of disaster management. An EOR is primarily focused on natural hazards which hit the Asia and Pacific region, in line with Sentinel Asia activities. However, Sentinel Asia is able to accept an EOR related to a manmade disaster, depending on the situation and international needs.

A large-scale explosion occurred at the Port of Beirut in the capital city of Lebanon on August 4, 2020. The Lebanese government reported that the explosion was caused by a large amount of ammonium nitrate stored at the Port of Beirut, and that it caused at least 218 deaths and 7,000 cases of injury. The AFAD decided to send an EOR for the incident as an international support activity. The Secretariat of Sentinel Asia discussed the necessity and significance of this request, and made a confirmation to activate it.

The ADRC received the EOR from the AFAD and transferred a DPN/DAN on the 8th of August, 2020. The first satellite images from the DPN were provided on the 10th of August. Finally, 20 satellite images were provided by GISTDA, JAXA, ISRO, MBRSC, and NARL. These were the first satellite images contributed by the KhalifaSat from the MBRSC. The first VAP from the DAN was provided on the 8th of August. Finally, 8 VAPs were provided by AIT, EOS, and MBRSC.

The AFAD shared the provided data (satellite images and VAPs) to the response department of the AFAD in order to confirm the estimated damage incurred by the disaster. Also, the AFAD used the data in considering the provision of emergency relief supplies to Lebanon.



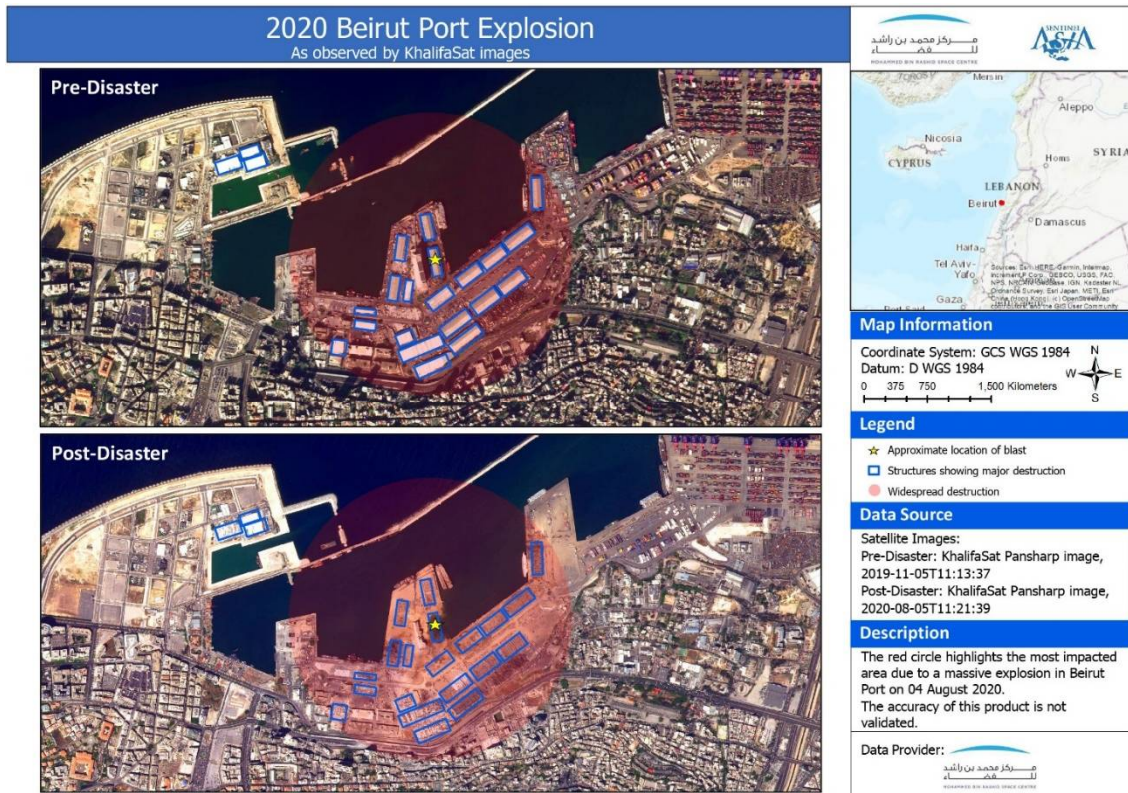


Figure 18: VAP (provided by MBRSC)



#### 3.3.4. Flood in Cambodia (October 2020)

[EOR Requester] The ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre)

[SA website URL] <https://sentinel-asia.org/EO/2020/article20201017KH.html>

The AHA Centre is an intergovernmental organization established by the ten ASEAN Member States, with the aim of facilitating cooperation and coordination of disaster management amongst ASEAN Member States. The AHA Centre has been an active participant in the activities of Sentinel Asia. For instance, the AHA Centre participated in JPTM and made a presentation entitled “Emergency Response and Relief Support in the Spirit of One ASEAN One Response”, where they shared information about their activities. The AHA Centre also makes Emergency Observation Requests (EORs) when disasters occur in ASEAN countries. These proactive activities and the active sharing of information have helped Sentinel Asia to promptly respond to such events.

The AHA Center confirmed a flood which hit Cambodia in the middle of October 2020. The experience and knowledge held by the AHA Center contributed toward the creation of an EOR for this disaster, after a gap of around 9 years since the last disaster in Cambodia. The AHA Center made the decision to send an EOR, and collaborate with the National Committee for Disaster Management (NCDM) in Cambodia.

The ADRC received the EOR from the AHA Centre and transferred a DPN/DAN on the 30<sup>th</sup> of October. The first satellite images from the DPN were provided on the 2<sup>nd</sup> of November. Finally, 29 satellite images were provided by GISTDA, JAXA, ISRO, NARL, and CRISP. The first VAP from the DAN was provided on the 31<sup>st</sup> of October. Finally, 8 VAPs were provided by YU, AIT, WFP, and MBRSC. This was the first data contribution by WFP. JAXA also provided a WEB-GIS system that was unable to confirm the provided satellite images.

The AHA Centre shared the provided data (satellite images and VAPs) to the National Committee for Disaster Management (NCDM) in Cambodia, as well as local disaster management agencies, in order to confirm the current disaster situation in the affected area. Also, the AHA Centre used the data for making internal reports and documents in the interest of sharing information.

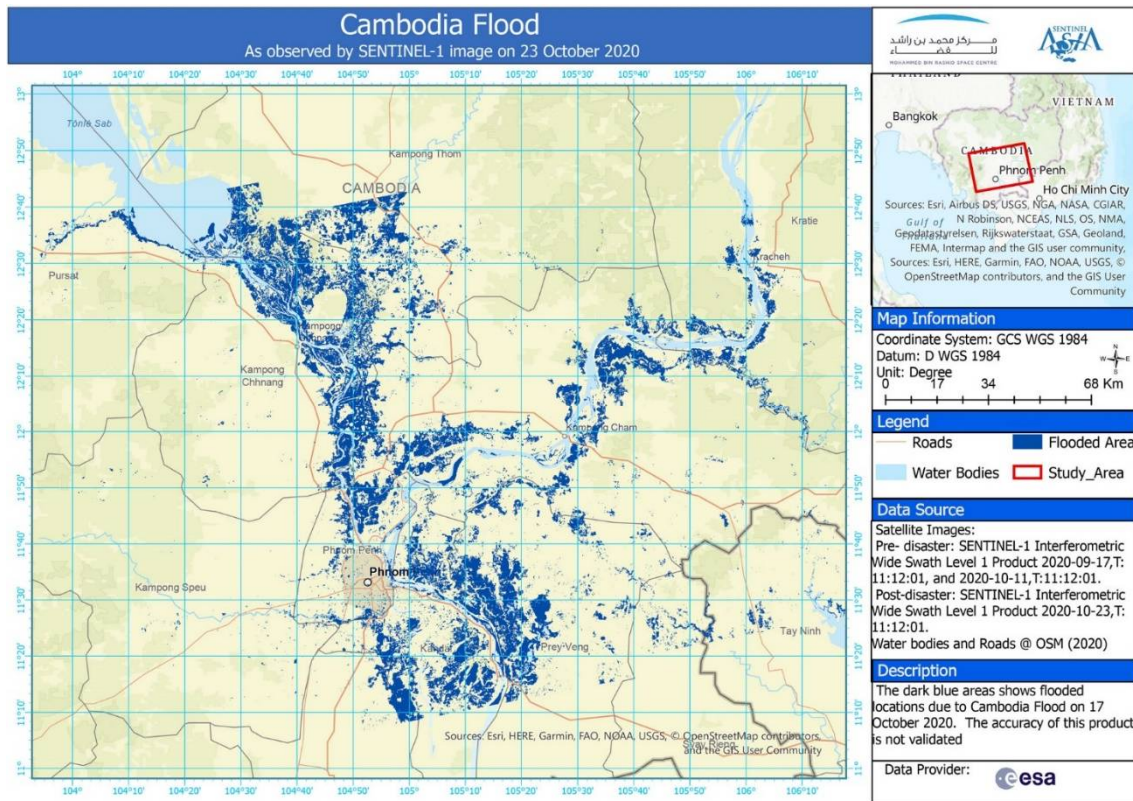


Figure 19: VAP (provided by MBRSC)

### 3.3.5. Earthquake in Turkey (October 2020)

[EOR Requester] Disaster and Emergency Management Presidency (AFAD)

[SA website URL] <https://sentinel-asia.org/EO/2020/article20201030TR.html>

Turkey is located in a high-risk area that is heavily affected by disasters due to its geological structure, topography and climatic characteristics. Turkey has learned some bitter lessons from the disasters it has experienced, and has consequently abandoned its previous crisis management mentality and taken the necessary steps to prioritize risk management when dealing with disasters.

The Disaster and Emergency Management Authority, an institution working to prevent disasters and minimize disaster-related damages, plans and coordinates post-disaster responses, and promotes cooperation among various government agencies. They introduced a novel disaster management model which prioritizes Turkey's transition from crisis management to risk management, which came to be known as the Integrated Disaster Management System. AFAD currently has 81 provincial branches across Turkey, in addition to 11 search and rescue units. According to its position as the sole authority on disasters and emergencies, AFAD cooperates with a range of government institutions and non-governmental organizations depending on the nature and severity of individual cases.

The AFAD confirmed an earthquake located in the Aegean Sea with a magnitude of 7.0, which hit the western province of İzmir on October 30, 2020. This tragic earthquake generated a small tsunami and resulted in 119 casualties. The AFAD was not a JPT member at the time, but they submitted an EOR to ADRC on the 2nd of November as an ADRC member country. This response was in line with Sentinel Asia activities.

After that, the ADRC transferred the AFAD's EOR to DPN/DAN on the 2nd of November. The first satellite images from the DPN were provided on the same day. Finally, 95 satellite images were provided by GISTDA, JAXA, ISRO, NARL, and MBRSC, and the first VAP from the DAN was provided on the 4th of November. Finally, 5 VAPs were provided by AIT, EOS, and MBRSC.

The AFAD shared the provided data (satellite images and VAPs) to the Response Department at the AFAD. All remotely sensed data and analysis are used for preliminary damage estimation, evaluation of the severity of the disaster, and extent of the affected

area. Also, the AFAD used provided data to understand the big picture of the disaster for both emergency relief and preliminary recovery planning.

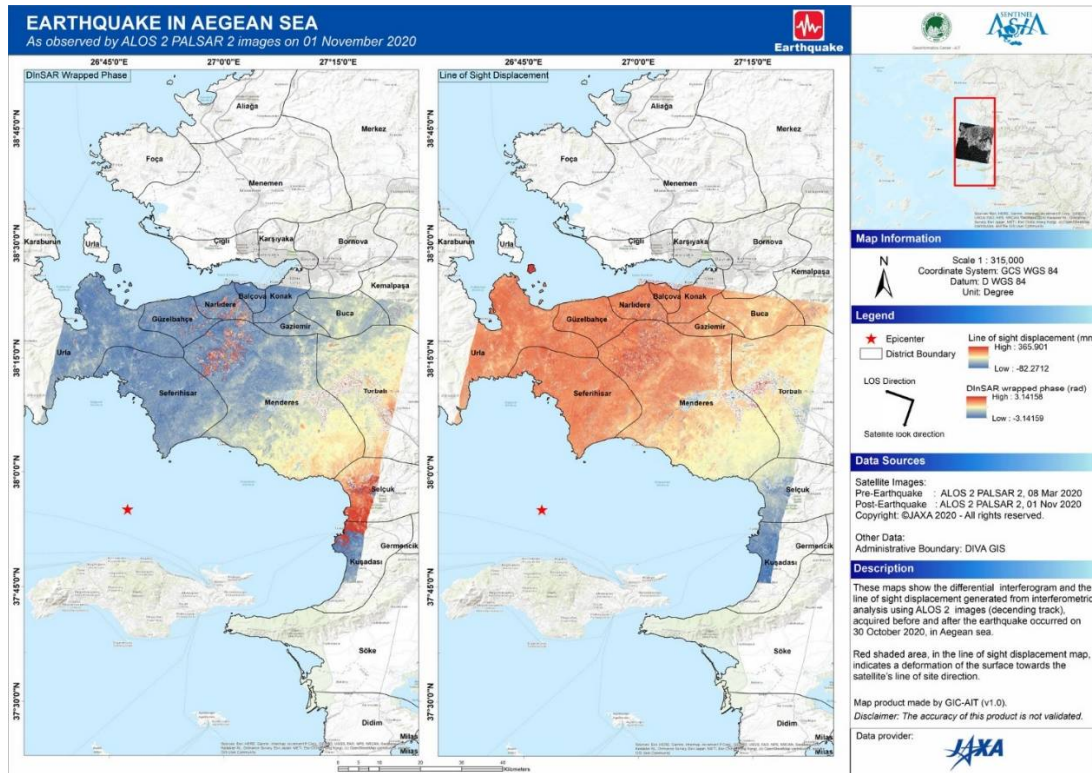


Figure 20: VAP (provided by AIT)

## 4. External Relations

### 4.1. Accession of New Members

In 2020, the following three organizations joined SA.

- **Research Center for Urban Safety and Security (RCUSS) at Kobe University**
- **The United Nations World Food Programme (WFP)**
- National Research Institute for Earth Science and Disaster Resilience (NIED)

\*joined as a new DAN (joined as a JPT member in 2016)

#### 4.1.1. Research Center for Urban Safety and Security (RCUSS) at Kobe University

The Research Center for Urban Safety and Security (RCUSS) at Kobe University in Japan became a Joint Project Team member of Sentinel Asia, as well as a member of DAN, in April 2020. The RCUSS was established in 1996, about one year after the Great Hanshin-Awaji Earthquake. The RCUSS's mission is to make contributions toward building and envisioning a safe and secure urban society, and by conducting research and education on suitable methodologies and frameworks in realizing such a society. Regarding their participation in SA, Professor Kenichio KOBAYASHI of the RCUSS comments, "We are delighted to be a member of Sentinel Asia and are excited to support our SA colleagues by generating and providing VAPs in upcoming EORs".

#### 4.1.2. The United Nations World Food Programme (WFP)

The United Nations World Food Programme became a new Joint Project Team member of Sentinel Asia, as well as a member of DAN, in September 2020. The WFP is the leading humanitarian organization saving and changing lives, delivering food assistance in emergencies and working with communities to improve nutrition and build resilience. The WFP's Emergency Division (EMEG) operates different units active in GIS, Earth Observation and modeling. The WFP actively supports various emergency relief efforts around the world with GIS analysis, to assist in logistical planning for food distribution and humanitarian assistance.

## 4.2. Collaboration and Cooperation

### 4.2.1 International Disaster Charter

The rollout to IDC began in February 2010 as required. Eight disasters were escalated through SA in 2020. This figure means that 8 out of 28 EORs, corresponding to 28.6%, were requested to IDC via Sentinel Asia.

**Table 3 List of Charter Escalation in 2020**

Activation Number	Country	Disaster Type	Activation Date	Requester	Project Manager
362	Indonesia	Flood	1-Jan-20	AHA CENTER, BNPB	AIT
363	Phillipnes	Volcanic Eruption	12-Jan-20	PHIVOLCS	PHIVOLCS
370	Bangladesh	Cyclone	18-May-20	IWMI, DMD (Bangladesh)	IWMI
372	Japan	Flood	6-Jul-20	ADRC, MLIT	PHIVOLCS
375	Indonesia	Flood	15-Jul-20	LAPAN, BNPB	Yamaguchi University (YMGU)
378	Phillipnes	Earthquake	18-Aug-20	PHIVOLCS	PHIVOLCS
384	Phillipnes	Typhoon	1-Nov-20	AHA Center, NDRMC, PHIVOLCS	PHIVOLCS
386	Phillipnes	Typhoon	12-Nov-20	MO, PHIVOLCS	AIT



## 5. Conferences and Press Releases

International conferences on space technology and Sentinel Asia's annual meetings have been held every year. However, these conferences were cancelled or postponed due to the COVID-19 pandemic in 2020. For instance, it was decided that due to the pandemic the 27<sup>th</sup> APRSAF and the Joint Project Team Meeting for Sentinel Asia Step3 would be postponed.

### 5.1. Conferences

#### 5.1.1. The 10th Steering Committee meeting of Sentinel Asia

Organizer: Indian Space Research Organisation (ISRO) and Japan Aerospace Exploration Agency (JAXA)

Date: 21-22, January 2020

Venue: Hyderabad, India

The Steering Committee meeting was held in Hyderabad, India, and was hosted by NRSC/ISRO from the 21<sup>st</sup> to 22<sup>nd</sup> of January 2020, in close collaboration with the Japan Aerospace Exploration Agency (JAXA) and ISRO.

The meeting was conducted in 6 sessions over 2 days, with the main targets being a review of the current status of the Strategic Plan document, improvement of user interaction from a DPN/DAN viewpoint, strengthening user interaction within the Sentinel Asia community, reviewing SA Working Groups, and discussing strategies on the private sector's involvement in Sentinel Asia activities.

Furthermore, there was an emphasis on strengthening Sentinel Asia activities by incorporating early warning studies and by enhancing capacity building activities, as well as the need for revamping existing working groups to meet the needs of new disaster activities across Asia.

## 5.2. Documents, Press Releases and Papers

### 5.2.1. Statement by the Executive Secretary of Sentinel Asia

Mr. HIRABAYASHI Takeshi, Executive Secretary of the Sentinel Asia Executive Secretariat, had a statement related to “dual challenges faced during a bout of heavy rain in July in Japan”. His statement is as follows:

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Sincere gratitude for your support during the “Heavy rain of July, Reiwa 2” in Japan, statement of our commitment to Sentinel Asia, and request for your continued support under the COVID-19 pandemic

*For more than several months, we have been faced by unprecedented crises caused by the COVID-19 pandemic. Over the world, more than 10 million people have been infected by COVID-19 and more than 500,000 have perished. The situation seems to keep deteriorating and the numbers are continuously growing. This COVID-19 pandemic has changed the way of our lives completely.*

*A natural disaster amid COVID-19 could be a real nightmare. The local authorities and the people in the affected area will be forced to address “dual challenges”: they will have to combat disasters, while keeping themselves safe from COVID-19. The newly introduced norms such as “social distancing” and “self-seclusion” for containment of the spread of the virus make rescue and evacuation activities much more difficult than ever before.*

*Now, the season has come when water-related natural disasters such as typhoons, monsoons, and tropical cyclones are expected to occur frequently. Particularly, the Asia-Pacific region is prone to such disasters. Moreover, as this region is the most densely populated region, people in this region are more vulnerable to risks caused by the dual challenges than anywhere else.*

*However, looking at the bright side, remote-sensing technologies and our cooperation under “Sentinel Asia” could bring us hope. Satellite observation data provided by Data Provider Nodes (DPNs) of Sentinel Asia enable us to monitor or narrow down the possible affected area remotely, without visiting the area. Then, damage maps generated from satellite data in combination with open street maps provided by Data Analysis Nodes (DANs) of Sentinel Asia could contribute to detecting the area more precisely, local authorities’ identifying appropriate evacuation sites and establishing evacuation plans. Also, members of Sentinel Asia from the international community could appeal to the humanitarian community for solidarity and for support based on the damage maps and contribute to mobilizing relief parties and supplies effectively under the mobility and distancing restrictions imposed by the COVID-19. Furthermore, as Sentinel Asia is mandated to address the entire disaster risk management cycle including the pre-disaster phase, Sentinel Asia could contribute to earning the lead time to respond to possible disasters, which has become particularly crucial*



under the COVID-19 pandemic.

*In fact, now we realize keenly the benefit and blessing of Sentinel Asia. Record-breaking torrential heavy rain hit the prefectures of Kumamoto and Kagoshima in the southern Japanese island of Kyushu on 4 July 2020. The heavy rain, named "Heavy rain of July, Reiwa 2" triggered floods and landslides, which claimed at least 68 people's lives. Many people remain missing and thousands of houses have been destroyed. What is different from ordinary disasters is that we have been confronted by the very dual challenges: The COVID-19 pandemic has complicated the rescue efforts. The need to maintain social distancing has reduced capacity at shelters, and the fear of catching and spreading COVID-19 has dissuaded volunteers from coming to help who would otherwise offer help.*

*Thus, the help from Sentinel Asia has been more precious than ever. In this case, immediately after the emergency observation request (EOR) from JAXA, several DPNs conducted observations, then several DANs analyzed and provided value-added products. Also, the EOR was escalated to the International Disaster Charter with the support of Sentinel Asia colleagues and an expert from the Sentinel Asia community has been supporting as the Project Manager. We are still struggling with the disaster, but we have been greatly encouraged by the thought and the fact that you, Sentinel Asia colleagues, are with us. We would like to take this opportunity to extend our sincere gratitude to all of you who have supported us.*

*As we ourselves have experienced, under this critical situation, Sentinel Asia could not be more helpful and beneficial than ever before. Sentinel Asia could harmonize disaster response approach with the combat against COVID-19 and provide solutions for dual challenges. Albeit the devastating circumstances, through cooperation, we could turn the current adversity into a good opportunity to enhance the value of Sentinel Asia. Sentinel Asia could be a model cooperation platform in the context of global agenda such as Sendai Framework for Disaster Risk Reduction, and the Sustainable Development Goals (SDGs).*

*Therefore, we, the Sentinel Asia Executive Secretariat will be committed to supporting Sentinel Asia and make our best to collaborate with DPNs, DANs, and all Joint Project Team members to ensure the normal operation of Sentinel Asia's emergency observations. At the same time, as solidarity among Sentinel Asia members will be pivotal, we kindly request you for your continued support, just as you have supported us. We believe we can build back better from the crises and we look forward to meeting you again after we have recovered with resilience.*

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#### 5.2.2. New Geospatial Analysis Knowledge materials on the Sentinel Asia website provided by Yamaguchi University, Japan

Yamaguchi University provided new technical materials on Geospatial Analysis for capacity building, for the benefit of the Sentinel Asia community. Regarding the provision of the materials, Professor Masahiko NAGAI, Director, Center for Research and Application of Satellite Research Sensing at Yamaguchi University, said, "We would

like to introduce and share our E-Learning contents with Sentinel Asia members. These technical materials are produced by Yamaguchi University as a Geospatial Analysis Knowledge Portal. We are delighted to contribute to the work done by Sentinel Asia. This work was supported by the Coordination Funds of Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan for Promoting AeroSpace Utilization.”

The materials are available from the Sentinel Asia website: <https://sentinel-asia.org/e-learning/TechnicalMaterials.html>

### 5.2.3. Newsletter

The secretariat of SA publishes a monthly newsletter for member organizations. The following are the topics covered by the newsletters issued in 2020.

#### January 2020

1. [News] Emergency Observation of Disasters Occurring in December 2019
2. [Announcement] Emergency Observation Request (EOR)
3. [Announcement] Requests to JPT Members
4. [Events]

#### February 2020

1. [News] Emergency Observation of Disasters Occurring in January 2020
2. [News] Result of the 10th Steering Committee meeting of Sentinel Asia
3. [Announcement] Emergency Observation Request (EOR)
4. [Announcement] Requests to JPT Members
5. [Events]

#### March 2020

1. [News] Emergency Observation of Disasters Occurring in February 2020
2. [Announcement] Emergency Observation Request (EOR)
3. [Announcement] Requests to JPT Members
4. [Events]

#### April 2020

1. [News] Emergency Observation of Disasters Occurring in March-April 2020
2. [Your input is needed!] Questionnaire on Web-GIS
3. [Events]
4. [Announcement] Emergency Observation Request (EOR)
5. [Announcement] Requests to JPT Members

#### May 2020

1. [News] Emergency Observation of Disasters Occurring in May 2020
2. [News] Kobe University joined JPT as a DAN
3. [Announcement] New Geospatial Analysis Knowledge materials by Yamaguchi University
4. Events
5. How to send an Emergency Observation Request
6. Using Sentinel Asia Operation System, OPTEMIS

#### June 2020

1. [News] Emergency Observation of Disasters Occurring in June 2020
2. [Interview] New DAN Member: NIED (TBD)
3. [News] Steering Committee members discussed the present and future of Sentinel Asia
4. Events
5. How to send an Emergency Observation Request
6. Using Sentinel Asia Operation System, OPTEMIS

#### July 2020

1. [News] Emergency Observation of Disasters Occurring in July 2020
2. Events
3. How to send an Emergency Observation Request
4. Using Sentinel Asia Operation System, OPTEMIS

#### August 2020

1. [News] Emergency Observation of Disasters Occurring in August 2020
2. [Interview] Mr. KWOH Leong Keong, Director, Centre for Remote Imaging, Sensing and Processing (CRISP), Singapore

3. Events
4. How to send an Emergency Observation Request
5. Using Sentinel Asia Operation System, OPTEMIS

#### September 2020

1. [News] Emergency Observation of Disasters Occurring in September 2020
2. [Announcement] UN World Food Programme joined JPT as a DAN
3. Events
4. How to send an Emergency Observation Request
5. Using Sentinel Asia Operation System, OPTEMIS

#### October 2020

1. [News] Emergency Observation of Disasters Occurring in October 2020
2. [Message] for the International Disasters Charter's 20th anniversary
3. Events
4. How to send an Emergency Observation Request
5. Using Sentinel Asia Operation System, OPTEMIS

#### November 2020

1. [News] Emergency Observation of Disasters Occurring in November 2020
2. Events
3. How to send an Emergency Observation Request
4. Using Sentinel Asia Operation System, OPTEMIS

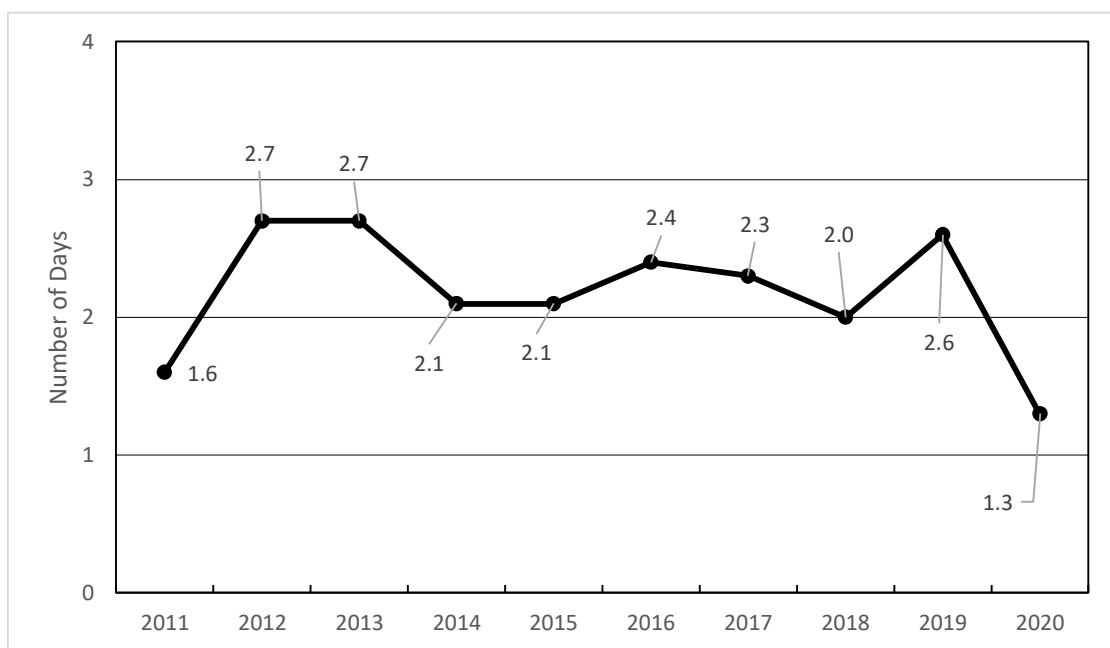
#### December 2020

1. [News] Emergency Observation of Disasters Occurring in December 2020
2. [Interview] Sentinel Asia's New Member, United Nations World Food Programme (WFP)
3. Events
4. How to send an Emergency Observation Request
5. Using Sentinel Asia Operation System, OPTEMIS

## 6. Assessment of Sentinel Asia Operations

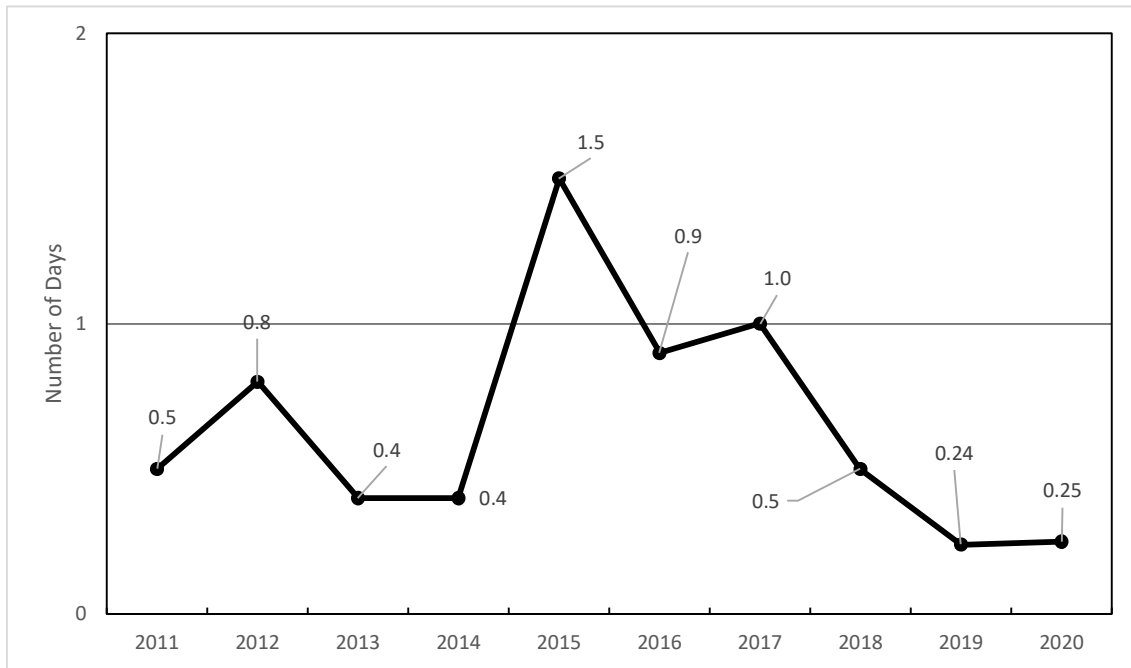
### 6.1. Analysis of Operational Performance

Figure 21 summarizes the number of days from the occurrence of a disaster to the request for each disaster and their respective years. Overall, this shows that it took a number of days from the first occurrence of the disaster to a request for the period between 2011 and 2020.



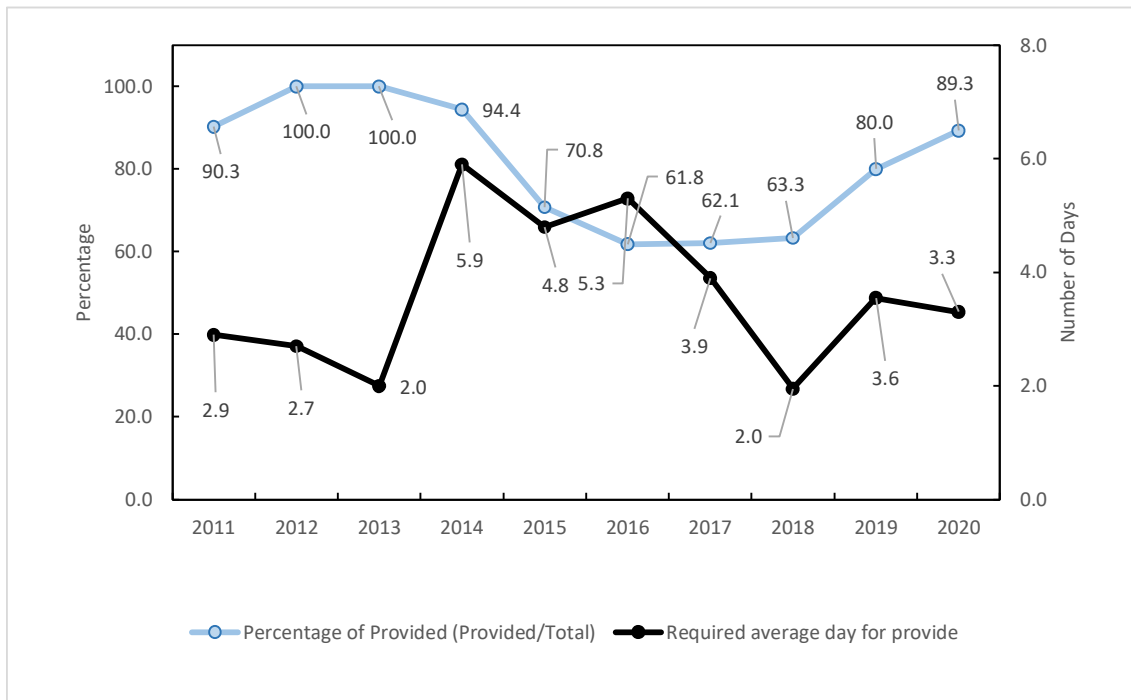
**Figure 21: Number of Days Required from Disaster Occurrence to Request**

Figure 22 shows the number of days that were required from the date the request is received to activation. Overall, it took 0.25 days from request to activation in 2020. This is an improvement over last year.



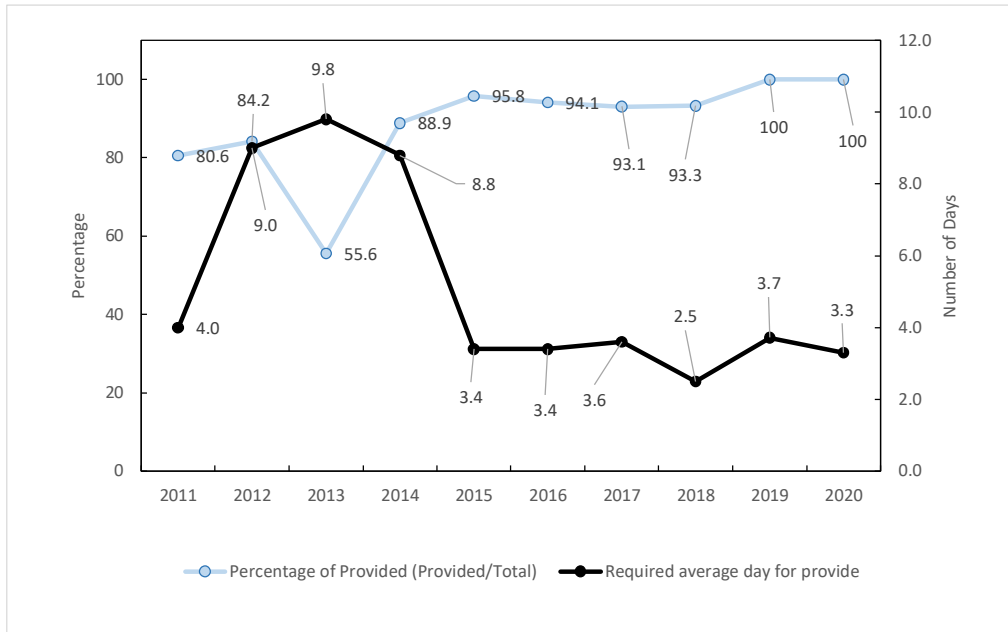
**Figure 22: Number of Days Required from Request to Activation**

Figure 23 and Figure 24 indicate the average number of days required to provide each data for each year, and the percentage of completed data provisions. Figure 23's Archive Satellite Data indicates that the percentage of provisions improved from 2016, totaling 89.3% in 2020. However, the average number of days required rose to 3.3 days from last year's 2.0.



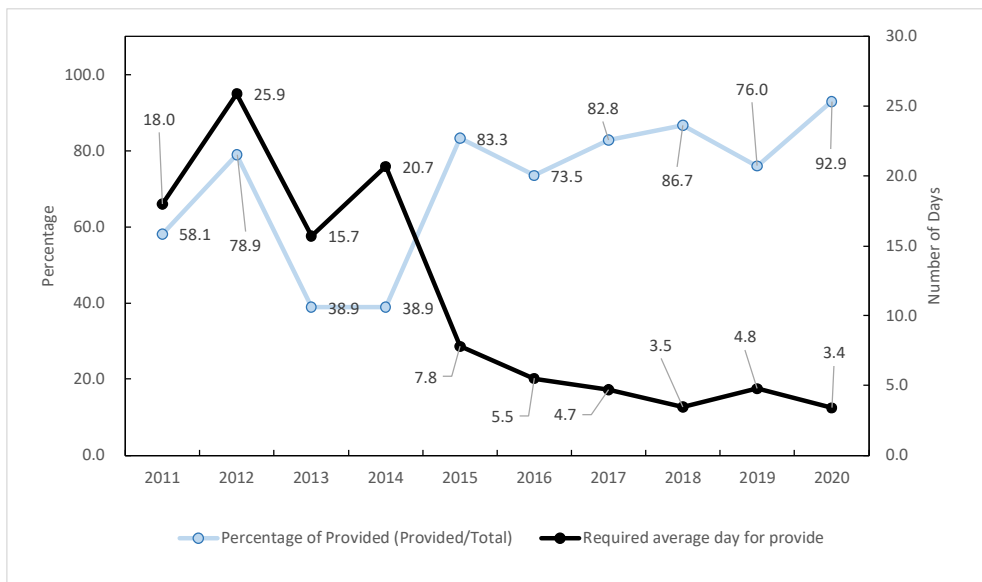
**Figure 23: Average Number of Days Required to Provide Archive Satellite Data and Response Rate for Each Year**

Figure 24's Satellite Data after Disaster shows that the percentage of provisions increased sharply from 2014 onward, while the number of days required for data provision has declined in recent years. The average number of days required for provision was around 3.3 days over the past 5 years, from 2016 to 2020.



**Figure 24: Average Number of Days Required to Provide Satellite Data After Disaster and Activation Rate for Each Year**

Figure 25's products were 92.9% in 2020. The average number of days required for provision was also 4.4 days over the past 5 years, from 2016 to 2020.



**Figure 25: Average Number of Days Required to Provide Products and Activation Rate for Each Year**



## 7. Conclusions

Since the start of 2007, we have accepted 389 EORs and activated 342. Furthermore, the Research Center for Urban Safety and Security (RCUSS) at Kobe University and the United Nations World Food Programme (WFP) joined SA as new members in 2020. Sentinel Asia activities were particularly affected by the COVID-19 pandemic this year, but by taking advantage of remote sensing technology, Sentinel Asia were able to contribute their support by providing effective data even in times of disaster. The following points are conclusive statements based on activities in 2020.

- In 2020, 28 EORs were submitted and 28 EORs were activated. Around 57% of the EORs were related to floods and earthquakes.
- The “Number of Days Required from Disaster Occurrence to Request” has greatly improved from 2.6 days in 2019 to 1.3 days in 2020. This indicates that the significance of EOR in supporting disaster response has become more meaningful.
- Eight (8) out of twenty-eight (28) Sentinel Asia activations were escalated to the IDCs in 2020. This is the highest number in SA’s history. Project managers of these escalated IDC were nominated from JPT members (e.g., AIT, IWMI, PHIVOLCS, and Yamaguchi University).
- The RCUSS and WFP joined SA as new JPT members in 2020. WFP supported providing data for two EORs: "Flood in Cambodia" and "Typhoon in the Philippines".
- New earth observation satellites from 2 DPNs, TeLEOS-1 of CRISP and KhalifaSat of MBRSC, started providing satellite images in 2020.
- Sentinel Asia made contributions for JPT members during disaster situations amidst COVID-19 pandemic by taking advantage of the remote sensing technology.



## List of JPT Members

(94 organizations from 28 countries/regions and 17 international organizations)

No.	Country / Region	No.	Organization	Data Provider Node (DPN)	Data Analysis Node (DAN)
1	Armenia	1	Ministry of Emergency Situation (MES)		
2	Australia	2	CSIRO Office of Space Science and Applications (COSSA)		
		3	Geoscience Australia (GA)		
		4	Bureau of Meteorology (BOM)		
3	Bangladesh	5	Bangladesh Space Research and remote Sensing Organization (SPARRSO)		
4	Bhutan	6	Department of Disaster Management, Ministry of Home and Cultural Affairs		
		7	National Land Commission		
		8	Sherubtse College, Royal University of Bhutan		
		9	Department of Geology and Mines (DGM)		
		10	Ministry of Works and Human Settlement (MoWHS)		
5	Brunei	11	Survey Department (SD), Ministry of Development		✓
6	Cambodia	12	Ministry of Land Management, Urban Planning and Construction		
		13	National Committee for Disaster Management (NCDM)		
7	China	14	National Disaster Reduction Center of China (NDRCC), Ministry of Civil Affair		
		15	College of Disaster and Emergency Management, Beijing Normal University (BNU)		
		16	Institute of Geology, China Earthquake Administration (CEA)		✓
		17	Sichuan University		✓
		18	The Chinese University of Hong Kong (CUHK)		✓
		19	Institute of Mountain Hazards and Environment (IMHE), Chinese Academy of Sciences (CAS)		✓
8	Fiji	20	National Disaster Management Office, FIJI (NDMO)		
9	India	21	Indian Space Research Organization (ISRO)	✓	✓
		22	University of Kashmir		
		23	Gauhati University		
		24	Symbiosis Institute of Geoinformatics (SIG) , Symbiosis International University (SIU)		✓
10	Indonesia	25	National Disaster Management Agency (BNPB)		
		26	Indonesian National Institute of Aeronautics and Space (LAPAN)		✓
		27	Institute of Technology Bandung (ITB)		
		28	Universitas Jenderal Achmad Yani (UNJANI)		
		29	Center for Remote Sensing and Ocean Sciences (CReSOS) Udayana University		✓
		30	Center of Technology for Natural Resources Inventory (PTISDA - BPPT)		✓
		31	Ministry of Marine Affairs and Fisheries		✓

11	Japan	32	Keio University		
		33	Japan Aerospace Exploration Agency (JAXA)	✓	✓
		34	Infrastructure Development Institute (IDI) Japan (IFNet)		
		35	Hokkaido University		
		36	Yamaguchi University		✓
		37	Chubu University		✓
		38	Chiba University		✓
		39	Hiroshima Institute of Technology		✓
		40	Tokyo Institute of Technology (TIT)		✓
		41	International Research Institute of Disaster Science, Tohoku University		✓
		42	University of Tokyo		✓
		43	National Research Institute for Earth Science and Disaster Resilience (NIED)		✓
		44	Japan International Cooperation Agency (JICA)		
		45	RIKEN		✓
		46	Kobe University		✓
12	Kazakhstan	47	National Center of Space Researches and Technologies (NCSRT)		✓
13	Korea	48	Korea Aerospace Research Institute (KARI)	✓	✓
		49	National Disaster Management Research Institute (NDMI)		✓
14	Kyrgyz	50	Central Asian Institute of Applied Geosciences (CAIAG)		✓
15	Lao P.D.R.	51	Ministry of Labor and Social Welfare		
		52	Natural Resources and Environment Institute (NREI), Ministry of Natural Resources and Environment (MONRE)		
16	Malaysia	53	National Security Division, Prime Minister's Department		
		54	Malaysian National Space Agency (ANGKASA)		✓
17	Mongolia	55	Information And Research Institute Of Meteorology, Hydrology And Environment (IRIMHE)		
18	Myanmar	56	Department of Meteorology and Hydrology (DMH)		
		57	Relief and Resettlement Department (RRD)		
		58	Myanmar Earthquake Committee (MEC) , Myanmar Engineering Society (MES)		
19	Nepal	59	Survey Department (SD)		
		60	Department of Water Induced Disaster Management (DWIDM), Ministry of Irrigation		
		61	Land Management Training Centre		
		62	Department of Hydrology and Meteorology (DHM), Ministry of Population & Environment		

20	Pakistan	63	Pakistan Space & Upper Atmosphere Research Commission (SUPARCO)		✓
21	Papua New Guinea	64	National Disaster Centre (NDC)		
22	Philippines	65	Office of Civil Defense (OCD), National Disaster Risk Reduction and Management Council (NDRRMC)		
		66	National Mapping and Resource Information Authority (NAMRIA)		✓
		67	Bureau of Soils and Water Management (BSWM), Department of Agriculture		
		68	Mines and Geoscience Bureau (MGB), Department of Environment and Natural Resources		
		69	Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)		✓
		70	Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD)		
		71	Philippine Institute of Volcanology and Seismology (PHIVOLCS)		✓
		72	Manila Observatory (MO)		✓
23	Singapore	73	NOAH Center of the University of the Philippines Resilience Institute		✓
		74	Centre for Remote Imaging, Sensing and Processing (CRISP)	✓	✓
24	Sri Lanka	75	Earth Observatory of Singapore (EOS)		✓
		76	Survey Department of Sri Lanka		✓
25	Taiwan	77	Ministry of Disaster Management		✓
		78	National Applied Research Laboratories (NARL)	✓	✓
26	Thailand	79	Center for Space and Remote Sensing Research, National Central University (CSRSR, NCU)		✓
		80	Geo-Informatics and Space Technology Development Agency (GISTDA)	✓	✓
		81	Department of Disaster Prevention and Mitigation (DDPM)		
		82	Department of Water Resources (DWR)		
		83	Royal Forest Department (RFD)		
		84	National Park, Wildlife and Plant Conservation Department		
		85	Royal Irrigation Department (RID)		
		86	Land Development Department (LDD)		
27	Thailand	87	Andaman Environment and Natural Disaster Research Center, Prince of Songkla University (ANED, PSU)		✓
		88			

27	United Arab Emirates	88	Mohammed Bin Rashid Space Centre (MBRSC)	✓	✓
28	Vietnam	89	Vietnamese Academy of Science and Technology (VAST)	✓	✓
		90	Ministry of Agriculture and Rural Development (MARD)		
		91	Ministry of Natural Resources and Environment (MONRE)		✓
		92	Cartography Department, Ministry of Defense (MOD)		
		93	Ministry of Science and Technology (MOST)		
		94	Vietnam Institute of Geosciences and Mineral Resources (VIGMR)		
29	International Organization	95	Asian Institute of Technology (AIT)		✓
		96	The ASEAN Secretariat		
		97	United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)		
		98	United Nations Office for Outer Space Affairs (UNOOSA)		
		99	International Center for Integrated Mountain Development (ICIMOD)		✓
		100	CSIRO Office of Space Science and Applications (COSSA)		
		101	International Centre for Water Hazard and Risk Management (ICHARM)		
		102	Asian Disaster Reduction Center (ADRC)		✓
		103	Secretariat of the Pacific Community (SPC/SOPAC)		✓
		104	The World Bank (WB)		
		105	International Water Management Institute (IWMI)		✓
		106	Asian Development Bank (ADB)		✓
		107	ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre)		
		108	World Wide Fund for Nature (WWF) - Pakistan		
		109	Asian Disaster Preparedness Center (ADPC)		✓
		110	Myanmar Information Management Unit (MIMU)		✓
		111	UN World Food Programme (WFP)		✓
				8	53

as of Dec 2020







## JPT member report “Sentinel Asia Activity in 2020”

1	ADPC	Activities related to Sentinel Asia
2	ADRC	Participation for international conferences
3	AHA Center	AHA Centre Disaster Situation Update on the AHA Centre Response in Indonesia, Viet Nam, and The Philippines in 2020
4	Chiba University	Damage assessment of the 2020 Japan Floods
5	CRISP	Providing satellite images of the TeLEOS-1 for EORs in 2020
6	DMH	The United Nations Economic and Social Commission for Asia and the Pacific
7	EOS	EOR Responses and Publications from EOS as a Data Analysis Node
8	GIC/AIT	Activities carried out as Principal Data Analysis Node (P-DAN) for Sentinel Asia
9	GISTDA	GISTDA Contribution in supporting Disaster Management
10	ICIMOD	<ul style="list-style-type: none"> <li>- Mapping floods in Bangladesh caused by Cyclone Amphan to support humanitarian response</li> <li>- Streamflow prediction for flood warning and satellite-based inundation mapping for the HKH region</li> </ul>
11	ISRO	Support to Sentinel Asia
12	JAXA	Support from the Sentinel Asia community in response to the “Heavy rain of July, Reiwa 2”
13	JICA	Emergency Observation Request (Flood in Jakarta, Indonesia)
14	LAPAN	Emergency Observation Request
15	MBRSC	Date support of KHALIFSAT for EOR (2020)
16	MO	2020 Sentinel Asia Activities of Manila Observatory
17	MONRE	Summary of 2020 results through SA system activation
18	NARL	<ul style="list-style-type: none"> <li>- Satellite Imagery Support to Sentinel Asia</li> <li>- Sentinel Asia JPT-3 Cloud Services</li> </ul>
19	RIKEN	Preliminary Flood Mapping Following Torrential Rain in Kumamoto, Japan
20	Tohoku University	Combining News Media and AI to Rapidly Identify Flooded Buildings
21	Udayana University	3rd Human resource development and space data utilization for Disaster

22	University of Tokyo	R&D on applications of large-scale building mapping and night-time light observation for socioeconomic monitoring
23	VIGMR	Multi projects for the Sentinel Asia
24	Yamaguchi University	Contribution VAPs for EOR activities

<b>Organization</b>	<b>Asian Disaster Preparedness Center (ADPC)</b>
<b>Title</b>	<b>Activities related to Sentinel Asia</b>
<b>Type of Activity</b>	<b>OPTEMIS training</b>
<b>Date</b>	<b>27/11/2020</b>

The Asian Disaster Preparedness Center (ADPC) is an autonomous international organization that works to build the resilience of people and institutions to disasters and the impacts of climate change in Asia and the Pacific. Established in 1986, it provides comprehensive technical services across social and physical sciences to countries in the region to support sustainable solutions for risk reduction and climate resilience. Since joining in 2014, ADPC has also been an active member of Sentinel Asia.

ADPC has supported the disaster management activities of the Sentinel Asia community, and notably co-organized and hosted the last Joint Project Team Meeting in 2019. During the 2020, ADPC have not activated any EOR.

While for 2021, the following are the activities related to Sentinel Asia:

- WEB-based training on OPTEMIS, together with GITSDA and DDPM (in February 2021)
- Supported DMH of Nepal on the EOR of Flood (in July 2021)
- Sentinel Asia Secretariat interviewed Mr. Hans Guttman, the executive director of ADPC (in July 2021)

<b>Organization</b>	<b>Asian Disaster Reduction Center (ADRC)</b>
<b>Title</b>	<b>Participation for international conferences</b>
<b>Type of Activity</b>	<b>International Conference</b>
<b>Date</b>	<b>-</b>

1. International Disaster Charter (IDC) Board Meeting (November 11, 2020 (Online))

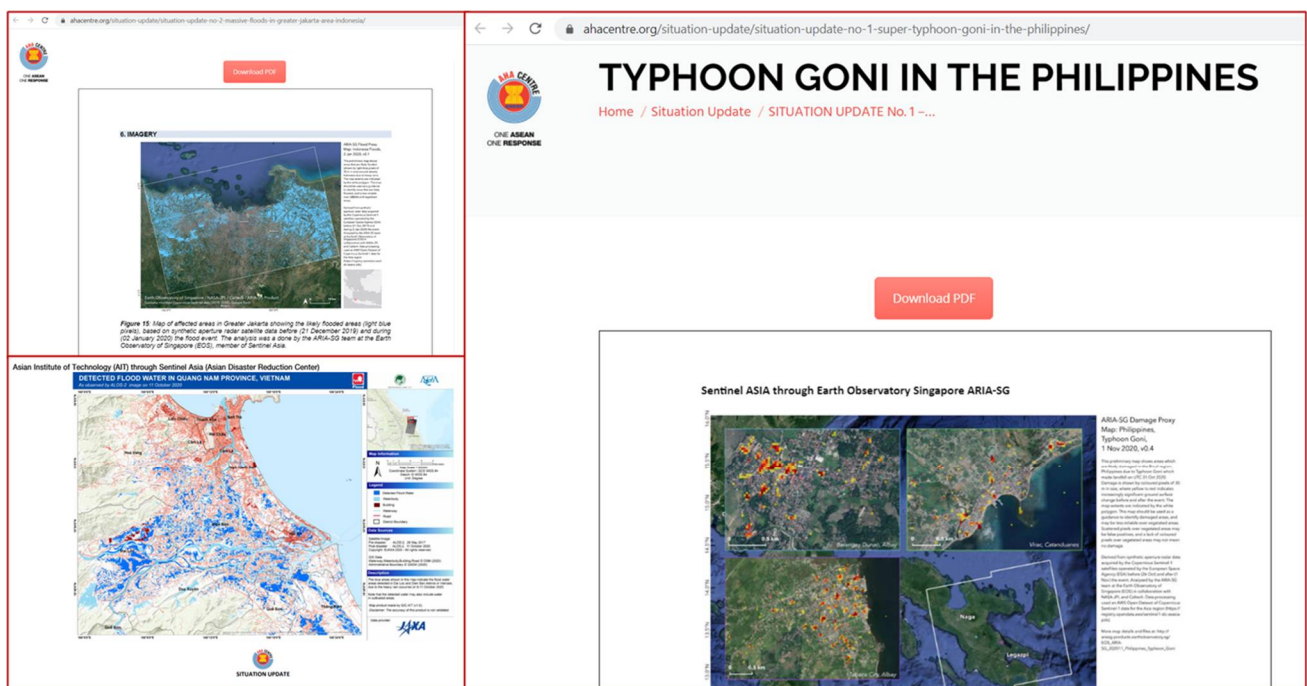
ADRC participated in the International Disaster Charter (IDC) Board Meeting on 11 November 2020, which was held in an online format. Space agencies from the IDC member countries participated and gave updates on the latest DRR activity in this virtual meeting. ADRC functions as a Regional Support Office (RSO) in the IDC framework. When ADRC receives an emergency observation request for Sentinel Asia, ADRC escalates that request to IDC if asked to do so by the agency making the request. Sentinel Asia targets Asian countries, but the IDC provides worldwide support in case of a more catastrophic disaster. ADRC has escalated 49 cases to IDC since 2011. At this conference, ADRC proposed that a more robust network be developed. ADRC would like to be a strong bridge between the space agencies and disaster management organizations.

2. Symposium: Human Resource Development and Space Data Utilization for Disasters (January 9 2020 (Bali, Indonesia))

The Asian Disaster Reduction Center (ADRC) participated in a symposium entitled Human Resource Development and Space Data Utilization for Disasters, which was organized by Yamaguchi University and Udayana University on 9 January 2020 in Bali, Indonesia. The symposium was attended by about 30 participants representing local disaster management organizations, Tokyo University, the National Research Institute for Earth Science and Disaster Resilience, and the organizing institutions, Yamaguchi University and Udayana University. ADRC presented information on Sentinel Asia and the activation of emergency observations. ADRC also explained how emergency observations are requested during disasters and how to become a member of the Sentinel Asia program.

<b>Organization</b>	<b>The ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre)</b>
<b>Title</b>	<b>AHA Centre Disaster Situation Update on the AHA Centre Response in Indonesia, Viet Nam, and The Philippines in 2020</b>
<b>Type of Activity</b>	<b>Providing satellite data for disaster emergency situation</b> (e.g., Conference, Workshop, Meeting, Training, EOR, Providing satellite data or VAP)
<b>Date</b>	<b>5/01– 16/11 2020</b>

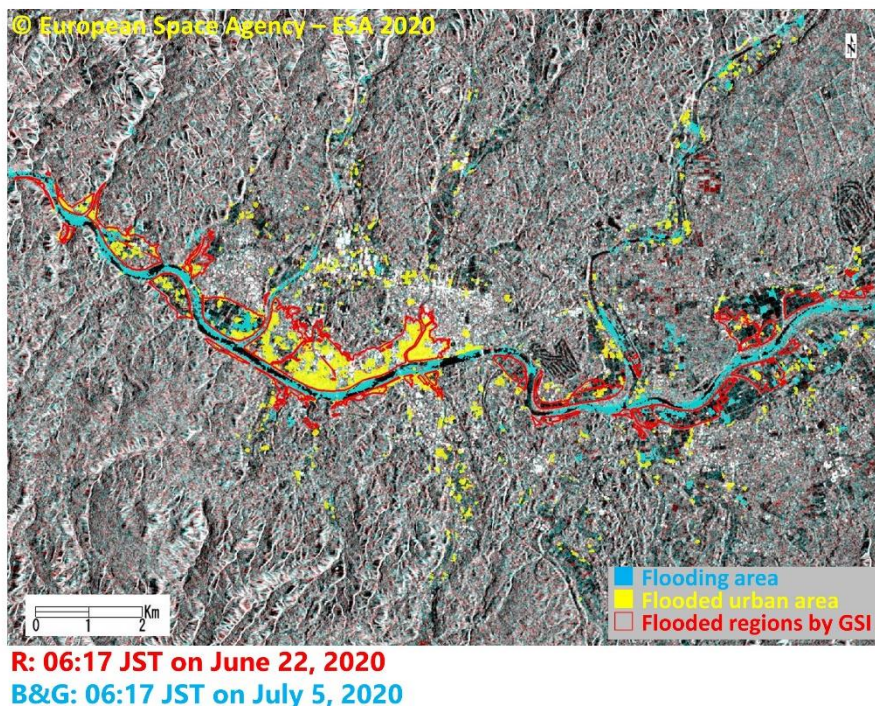
The ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre) is an inter-governmental organization which aims to facilitate cooperation and coordination among the ASEAN Member States and with the United Nations and international organizations for disaster management and emergency response in the ASEAN region. One of the main responsibilities for the AHA Centre is to conduct disaster monitoring and analysis in the ASEAN Region. When a significant disaster occurs in one or more of the ASEAN Member States, the AHA Centre carries out emergency response operations. During these emergency response operations, the AHA Centre issues situation updates regarding the disaster. In the period of 2020, through the Disaster Monitoring and Analysis (DMA) unit, The AHA Centre published situation updates for the (1) massive floods in Greater Jakarta Area (Indonesia), (2) Flooding in Central Viet Nam (Viet Nam), and (3) Super Typhoon Goni in The Philippines. In these three disaster situation updates, mapping and analyses of the flooded areas from the ARIA-SG team at Earth Observatory Singapore (EOS) and Asian Institute of Technology (AIT) through Sentinel ASIA were included. The AHA Centre also utilized the other products of Sentinel ASIA for internal correspondence.



Sentinel ASIA product on the AHA Centre Disaster Situation Report in 2020

<b>Organization</b>	<b>Chiba University, Japan</b>
<b>Title</b>	<b>Damage assessment of the 2020 Japan Floods</b>
<b>Type of Activity</b>	<b>EOR</b>
<b>Date</b>	<b>07/07/2020</b>

Record-breaking heavy rainfall hit the Kyushu and central regions of Japan from July 3 to 31, 2020. The International Charter Space and Major Disasters (Charter) and Sentinel Asia was activated for this event on July 7, 2020, in response to a request from the Japanese Government. Many optical and synthetic-aperture radar (SAR) satellite images were provided through the website. Our group attended the EOR from the same day. We generated the color composites of multi-polarizations of SAOCOM-1A images in the whole Kyushu regions, Japan. From those color composite, possible inundations were observed in Kurume, Hita and Hitoyoshi Cites. Several washed-away bridges in Kuma and Kusu Rivers were detected by visual interpretation from the color composites of the pre- and post-event Sentinel-1 images. The inundations in Hitoyoshi City were extracted by a semi-automated method from two temporal SAR intensity images. Due to a bank collapse and several overflows, wide urban area was flooded by the water from Kuma River. Although the post-event SAR image was taken after the peak of flow, flooded urban area were still detected from the SAR image.



### Sentinel-1 (S1) imagery

Flood in Japan, 2020  
 Kumagawa river flood in Hitoyoshi City,  
 Kumamoto Prefecture, Japan  
 Color composite of pre- and post-event Sentinel-1 intensity image, spacing in 10m/pixel resolution. Flooding area were extracted by the decrease of the backscatter intensity. Flooded urban area were extracted by the increase of the backscatter intensity. Sentinel-1 image was owned by ESA, downloaded from OpenHub.



Extraction of the inundations and flooded urban area from the pre- and post-event Sentinel-1 images.

<b>Organization</b>	<b>Centre for Remote Imaging, Sensing and Processing (CRISP) National University of Singapore</b>
<b>Title</b>	<b>Providing satellite images of the TeLEOS-1 for EORs in 2020</b>
<b>Type of Activity</b>	<b>Support for EOR</b>
<b>Date</b>	<b>July/2020</b>

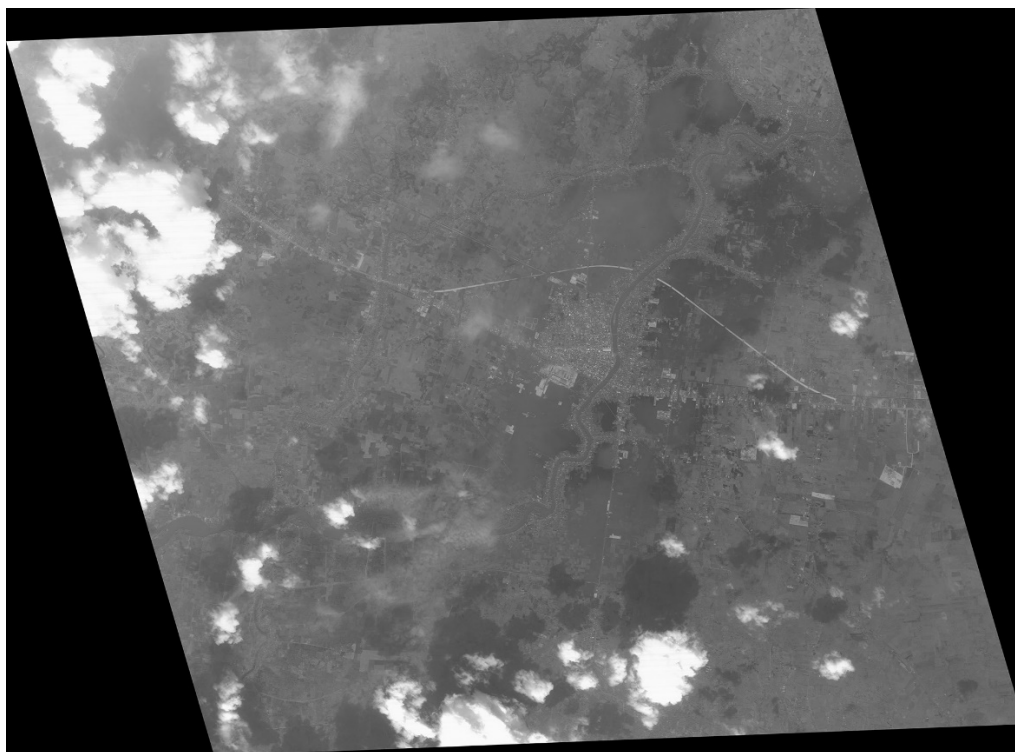
The Centre for Remote Imaging, Sensing and Processing (CRISP) is a research centre of the National University of Singapore established with funding from the Agency for Science, Technology & Research (A\*STAR) of Singapore. CRISP's mission is to develop an advanced capability in remote sensing to meet the scientific, operational and business requirements of Singapore and the region. TeLEOS-1 is Singapore's first commercial Near Equatorial Orbit (NEqO) Earth Observation satellite. It is built by ST Electronics (Satellite Systems). TeLEOS-1 was launched in December 2015 on an Indian PSLV-CA vehicle. Centre for Remote Imaging, Sensing and Processing (CRISP) provided satellite images of the TeLEOS-1 upon a request from JPT members, Sentinel Asia.

- Flood in Indonesia on 13 July, 2020
- Tropical Storm Noul in Vietnam on 18 September, 2020
- Flood in Cambodia on 17 October, 2020



Satellite Image of TeLEOS-1 (Tropical Storm Noul in Vietnam on 18 September, 2020)



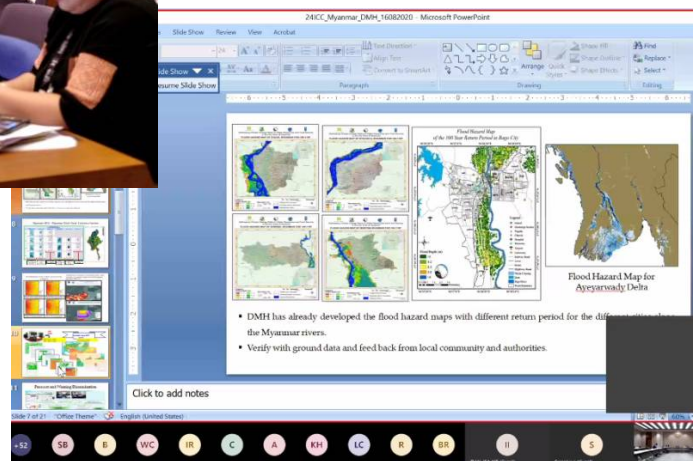


Satellite Image of TeLEOS-1 (Flood in Cambodia on 17 October, 2020)



<b>Organization</b>	Department of Meteorology and Hydrology, Ministry of Transport and Communications
<b>Title</b>	The United Nations Economic and Social Commission for Asia and the Pacific <i>The twenty-fourth session of Intergovernmental Consultative Committee (ICC) on the Regional Space Applications Programme for Sustainable Development (RESAP)</i>
<b>Type of Activity</b>	Video Conference via MS Teams
<b>Date</b>	18-19August 2020

The twenty-fourth session of the Intergovernmental Consultative Committee (ICC) on the Regional Space Applications Programme for Sustainable Development in Asia and the Pacific (RESAP) was held online on 18-19 August 2020. The Committee reconfirmed its commitment to support the Asia-Pacific Plan of Action for Space Applications (2018-2030), referred hereafter as the Plan of Action, and was informed of the progress of implementation by the RESAP member countries, which included good practices in supporting response and recovery of COVID-19. Several partner organizations participated in the meeting as observers and introduced their work that contributes to the Plan of Action. The Committee discussed and identified the priority needs and contributions for the implementation of Phase I (2018-2022) and provided details of how space applications has been able to support action against COVID-19. In this conference, Myanmar made the presentation on "Use of Space Applications for Disaster Risk Reduction and Resilience in Myanmar".



<b>Organization</b>	<b>Earth Observatory Singapore (EOS), Nanyang Technological University</b>
<b>Title</b>	<b>EOR Responses and Publications from EOS as a Data Analysis Node</b>
<b>Type of Activity</b>	<b>EOR and Publication</b>
<b>Date</b>	<b>2020</b>

As a Data Analysis Node (DAN) in the Sentinel Asia network, the Earth Observatory of Singapore (EOS) has responded to a total of 11 Emergency Observation Requests (EORs) in 2020. These responses include floods, typhoons, and earthquakes (Figure 1).

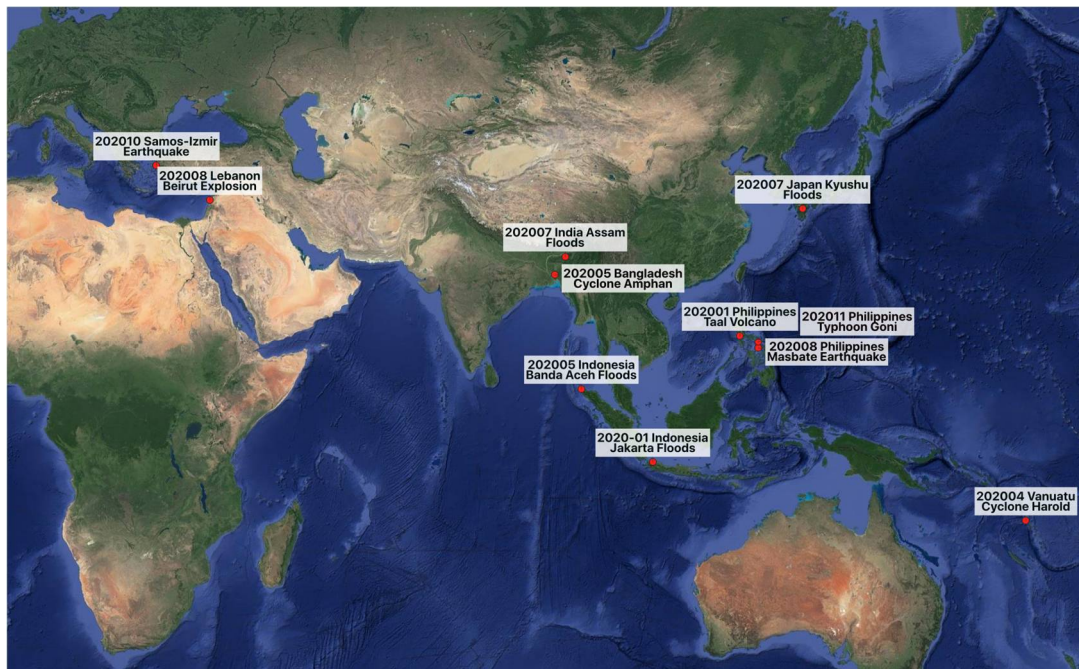


Figure 1: Map of the 11 EORs the Earth Observatory of Singapore has responded to in 2020. A total of 4 interferogram products, 8 Flood Proxy Maps and 9 Damage Proxy Maps were disseminated across these events.

In 2020, we strived to create better Damage Proxy Maps (DPMs) and Flood Proxy Maps (FPMs) using improved algorithms that detect damage and flood more reliably based on time-series made up of multiple pre-event scenes, as opposed to a single pre-event scene<sup>1,2</sup>. We also focused on creating DPMs, where possible, due to its uniqueness and positive feedback from users in the past. A catalogue of products produced from our responses can also be found at: <http://ariasg-products.earthobservatory.sg/>.

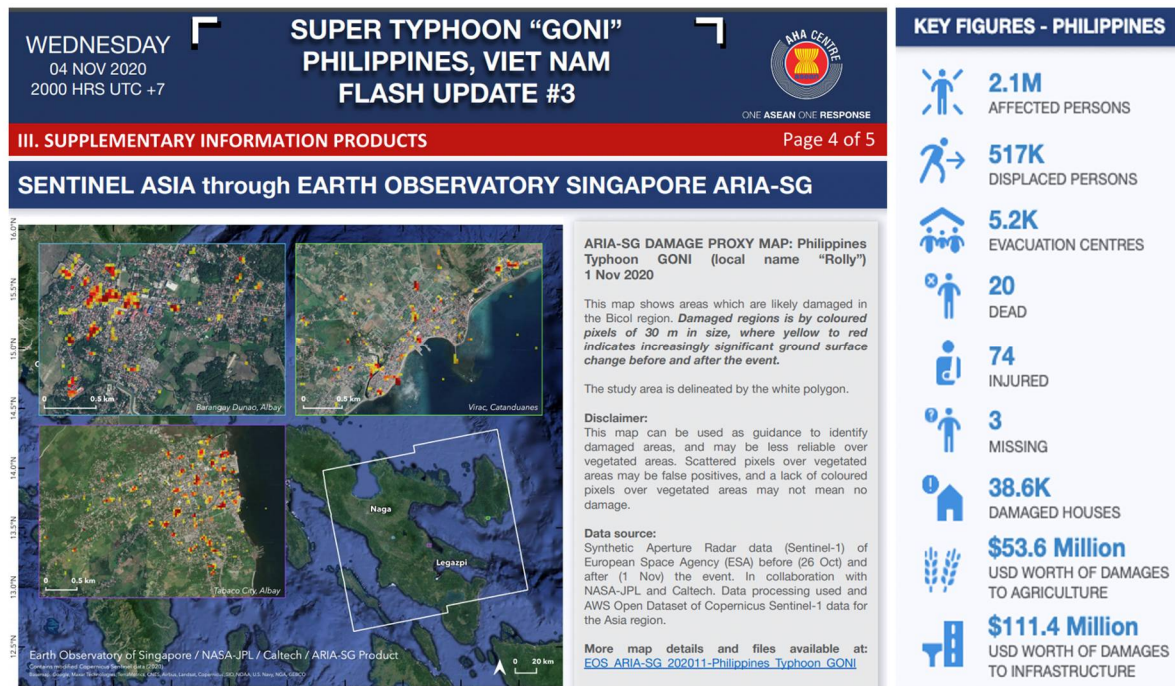


Figure 2: AHA Flash Updates with the Damage Proxy Map created by the EOS team, showing areas (yellow to red, red being more severe) where building damage has likely occurred in the aftermath of Typhoon Goni.

One notable event where we mapped damage is the Category 5 Typhoon Goni that hit the Philippines on 31<sup>st</sup> Oct 2020. Many homes were damaged due to strong winds. Upon activation of the EOR on 2<sup>nd</sup> Nov 2020, we shared a damage map shortly after, on 3<sup>rd</sup> Nov 2020. The map indicates possible building damage that likely occurred in the aftermath of Typhoon Goni (Figure 2). This map was relayed through the Sentinel Asia network and used by the ASEAN Coordinating Centre for Humanitarian Assistance (AHA) for its Flash Updates<sup>3</sup>. After the typhoon passed, AHA transported much needed emergency supplies from their warehouse in Quezon City to affected areas and evacuation centres<sup>4</sup>.

Coming 2021, EOS will be expanding our team with a new EOS Remote Sensing (EOS-RS) Lab. The new team will continue to further our work in the Sentinel Asia network, striving towards our mission to provide quality and rapid remote sensing mapping products useful for disaster response. Updates will be posted on our twitter page ([https://twitter.com/eos\\_rs/](https://twitter.com/eos_rs/)) for interested individuals.

<sup>1</sup> Lin, Y. N., Yun, S. H., Bhardwaj, A., & Hill, E. M. (2019). Urban flood detection with Sentinel-1 multi-temporal synthetic aperture radar (SAR) observations in a Bayesian framework: a case study for Hurricane Matthew. Remote Sensing, 11(15), 1778. <https://doi.org/10.3390/rs11151778>

<sup>2</sup> Jung, J., Yun, S. H., Kim, D. J., & Lavalley, M. (2017). Damage-mapping algorithm based on coherence model using multitemporal polarimetric-interferometric SAR data. IEEE Transactions on Geoscience and Remote Sensing, 56(3), 1520-1532.

<sup>3</sup> Flash update: No. 03 – Super Typhoon Goni, Philippines and Viet Nam – 04 Nov 2020. (2020, November 04). Retrieved October 21, 2021, from <https://ahacentre.org/flash-update/flash-update-no-03-super-typhoon-goni-philippines-and-viet-nam-04-nov-2020/>

<sup>4</sup> ASEAN extends solidarity for typhoon-affected people in the Philippines. (2020, November 14). Retrieved October 21, 2021, from <https://ahacentre.org/press-release/aha-centre-response-to-super-typhoon-goni/>

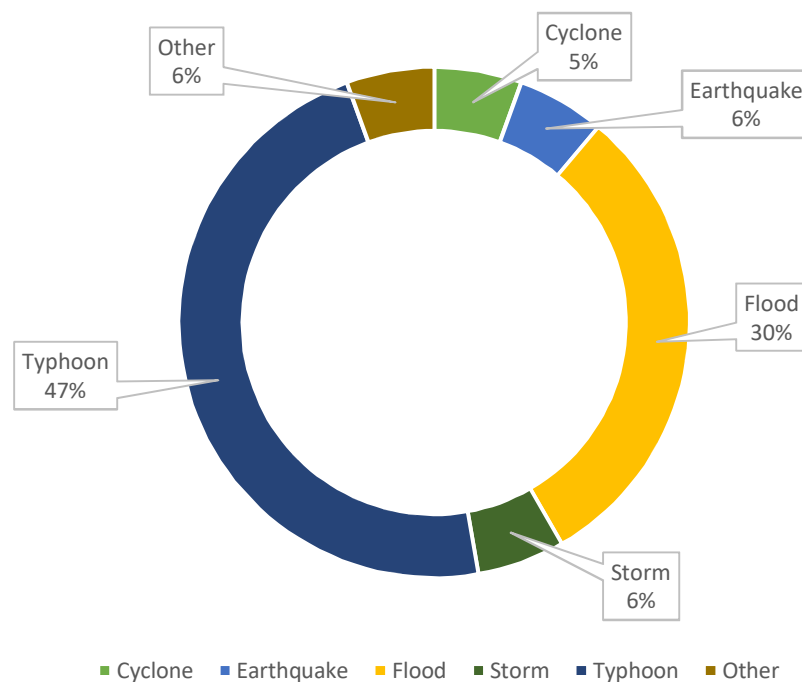


<b>Organization</b>	<b>Geoinformatics Center, Asian Institute of Technology</b>
<b>Title</b>	<b>Activities carried out as Principal Data Analysis Node (P-DAN) for Sentinel Asia</b>
<b>Type of Activity</b>	<b>Value-Added Product Generation for Disaster Activations</b>
<b>Date</b>	<b>14/07/2020 - 31/03/2021</b>

As the Principal Data Analyses Node (P-DAN) of Sentinel Asia, Geoinformatics Center of the Asian Institute of Technology (GIC/AIT) produces Value Added Products (VAP) right after disaster occurrences to support disaster response activities of the Sentinel Asia Community.

Since July 14th, 2020, GIC-AIT has worked on 17 emergency observations requests until March 31st, 2021, and nine countries submitted requests in the Asia Pacific region. Most of the requests were sent by Vietnam (5 activations; 29.4%), followed by the Philippines (4 activations; 23.5%) and Indonesia (2 activations; 11.7%). The rest of the requests (35.3%) were submitted by Cambodia, India, Japan, Lebanon, Sri Lanka, and Turkey, each with one activation request.

Regarding Project Management (PM) activities, The GIC/AIT had undertaken PM activities for two events, including Flooding in Indonesia (July 16th, 2020) and Flooding in the Philippines (November 15th, 2020).



Disaster wise VAP creation by GIC-AIT (2020/07-2021/03)

<b>Organization</b>	<b>Geo-Informatics and Space Technology Development Agency</b>
<b>Title</b>	<b>GISTDA Contribution in supporting Disaster Management</b>
<b>Type of Activity</b>	<b>Provide Satellite Data and Software</b> (e.g., Conference, Workshop, Meeting, Training, EOR, Providing satellite data or VAP)
<b>Date</b>	<b>2020</b>

GISTDA supported the disaster management activities by

1. Providing hundreds of satellites images 195 images as following.
2. Provide OPTEMIS system for making EOR

Summary of cooperation SA-GISTDA to contribute Thaichote Satellite								
No	ACQ date	Country	Disaster Type	MS	PAN	PS	Mosaic	No. of Images
1	20/02/2020	Indonesia	Flood	1	5	0	0	6
2	23/02/2020	Indonesia	Flood	2	4	0	0	6
3	29/02/2020	Indonesia	Flood	4	7	0	0	11
4	01/03/2020	Indonesia	Flood	4	8	0	0	12
5	04/08/2020	Lebanon	Explosion (Building Damage)	4	8	3	0	15
6	18/08/2020	Philippines	Earthquake	2	7	0	0	9
7	22/09/2020	Vietnam	Flood-Landslide	2	5	0	0	7
8	23/09/2020	Vietnam	Flood-Landslide	2	5	0	0	7
9	24/09/2020	Vietnam	Flood-Landslide	4	5	0	0	9
10	10/10/2020	Vietnam	Flood-Landslide	1	4	0	0	5
11	03/11/2020	Philippines	Flood-Landslide-Storm	3	4	0	0	7
12	4/11/2020	Philippines	Flood-Landslide-Storm	1	2	0	0	3
13	07/11/2020	Philippines	Flood-Landslide-Storm	2	6	0	0	8
14	07/11/2020	Turkey	Earthquake-Tsunami	1	4	0	0	5
15	09/11/2020	Cambodia	Flood	5	15	0	0	20
16	10/11/2020	Cambodia	Flood	5	16	0	0	21
17	11/11/2020	Philippines	Flood-Landslide-Storm	2	4	0	0	6
18	11/11/2020	Turkey	Earthquake-Tsunami	2	6	0	0	8
19	12/11/2020	Philippines	Flood-Landslide-Storm	2	6	0	0	8
20	12/11/2020	Turkey	Earthquake-Tsunami	2	6	0	0	8
21	17/11/2020	Philippines	Flood-Landslide-Storm	2	4	0	0	6
22	18/11/2020	Philippines	Flood-Landslide-Storm	2	6	0	0	8
Total								195

<b>Organization</b>	<b>International Centre for Integrated Mountain Development (ICIMOD)</b>
<b>Title</b>	<b>Mapping floods in Bangladesh caused by Cyclone Amphan to support humanitarian response</b>
<b>Type of Activity</b>	<b>Providing satellite data (Flood inundation map)</b> <a href="https://www.icimod.org/article/mapping-floods-in-bangladesh-caused-by-cyclone-amphan-to-support-humanitarian-response/">https://www.icimod.org/article/mapping-floods-in-bangladesh-caused-by-cyclone-amphan-to-support-humanitarian-response/</a>
<b>Date</b>	<b>27/04/2020</b>

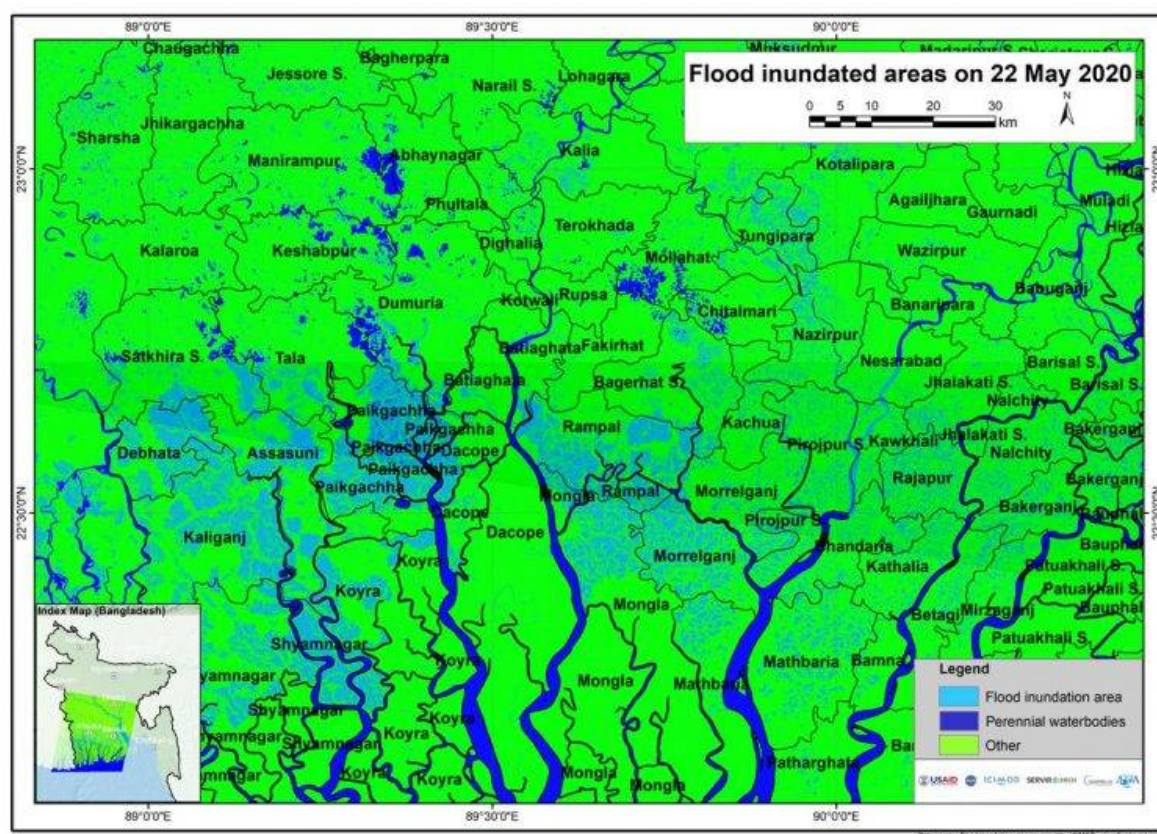


Figure: Flood inundation map on 22 May 2020 for the Cyclone Amphan affected area.



<b>Organization</b>	<b>International Centre for Integrated Mountain Development (ICIMOD)</b>
<b>Title</b>	<b>Streamflow prediction for flood warning and satellite-based inundation mapping for the HKH region</b>
<b>Type of Activity</b>	<b>Providing satellite data (Flood inundation map)</b> <a href="https://www.icimod.org/article/streamflow-prediction-for-flood-warning-and-satellite-based-inundation-mapping-for-the-hkh-region/">https://www.icimod.org/article/streamflow-prediction-for-flood-warning-and-satellite-based-inundation-mapping-for-the-hkh-region/</a>
<b>Date</b>	<b>02/08/2020</b>

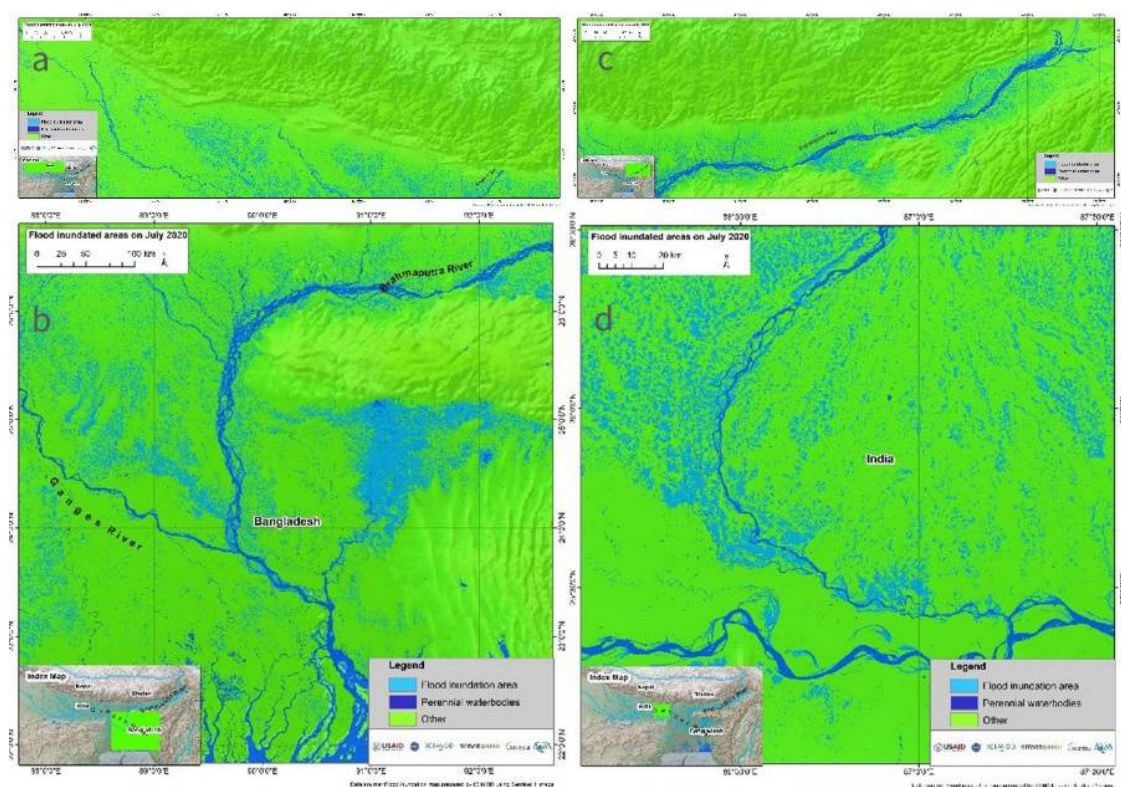
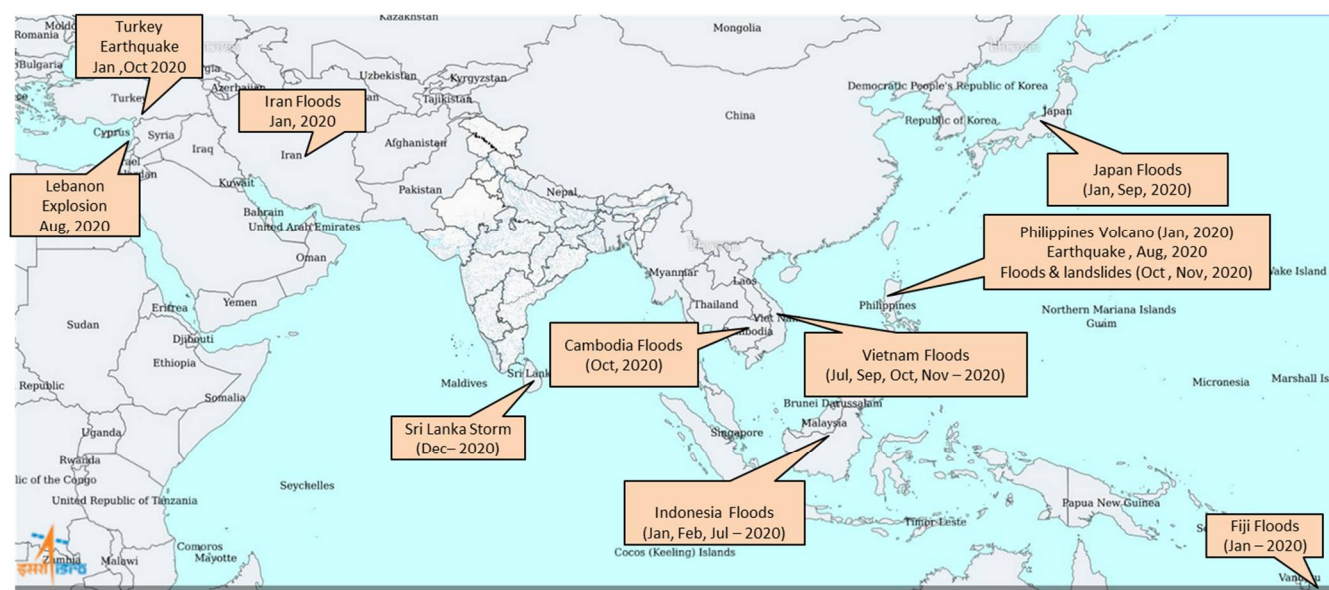


Figure: Inundated areas in different regions: a. Nepal Terai; b. Bangladesh; c. Assam, India; d. Bihar, India.

<b>Organization</b>	<b>INDIAN SPACE RESEARCH ORGANISATION (ISRO)</b>
<b>Title</b>	<b>Support to Sentinel Asia</b>
<b>Type of Activity</b>	<b>Providing Satellite data as Data Provider Node (DPN)</b> (e.g., Conference, Workshop, Meeting, Training, EOR, Providing satellite data or VAP)
<b>Date</b>	<b>31/12/2020</b>

During 2020, ISRO has contributed in the Sentinel Asia activities as Data Provider Node and was a regular in all the meetings held during the tenure. ISRO as a DPN has successfully responded to various Emergency Observation Requests (EOR's) pertaining to 10 countries (shown in Fig 1) with the help of 50 Indian Remote Sensing Series (IRS) satellite datasets comprising of Resourcesat – 2/2A and Cartosat series. All these satellite data products were provided in near real-time addressing various disasters in member countries.

### ISRO Support to Sentinel Asia EOR's during 2020



During 2020, NRSC/ ISRO has responded to 21 disaster events in 10 countries with the help of 50 IRS satellite datasets.

**Fig 1: EOR's responded during 2020 (Satellite datasets are shown in brackets)**





### Support to Lebanon, Industrial Explosion

During 2020, ISRO has activated sentinel Asia towards support to Cyclone “AMPHAN”, “NIVAR” and “BUREVI” . In addition, SA was also activated for Assam and Bihar floods-2020 and as part of it has received data from ALOS PALSAR-2 and THEOS-1 satellite datasets.

### 10<sup>th</sup> Sentinel Asia Steering Committee Meeting:

The 10<sup>th</sup> Steering Committee meeting is hosted by NRSC/ISRO during 21 – 22, January 2020 in Hyderabad in close collaboration with Japan Aerospace Exploration Agency (JAXA) and ISRO. About 17 international Participants from 7 countries namely Sri Lanka, Japan, Singapore, Thailand, Vietnam, Philippines, and India have participated in the meeting. Important discussions and decisions were taken during this SC meeting. Various capacity building programmes are envisaged during the meeting.



Delegates of 10<sup>th</sup> Steering Committee Meeting

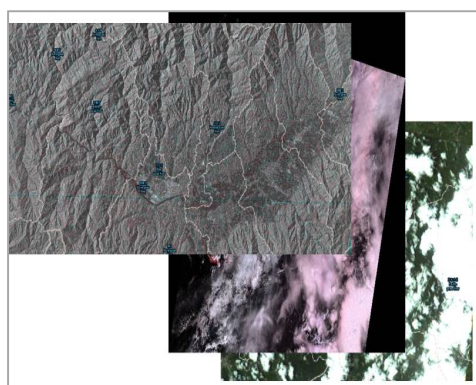
<b>Organization</b>	<b>Japan Aerospace Exploration Agency (JAXA)</b>
<b>Title</b>	<b>Support from the Sentinel Asia community in response to the “Heavy rain of July, Reiwa 2”</b>
<b>Type of Activity</b>	<b>EOR</b> (e.g., Conference, Workshop, Meeting, Training, EOR, Providing satellite data or VAP)
<b>Date</b>	<b>July 2020</b>

While JAXA as DPN member supports almost always EORs from the Sentinel Asia community, JAXA itself benefits greatly from the Sentinel Asia community as well. From 3 to 4 July, torrential heavy rains hit the southern island of Japan, “Kyushu region”. The Kuma river in Kumamoto prefecture was flooded devastatingly. The situation was aggravated, and the almost entire Kyushu region got affected.

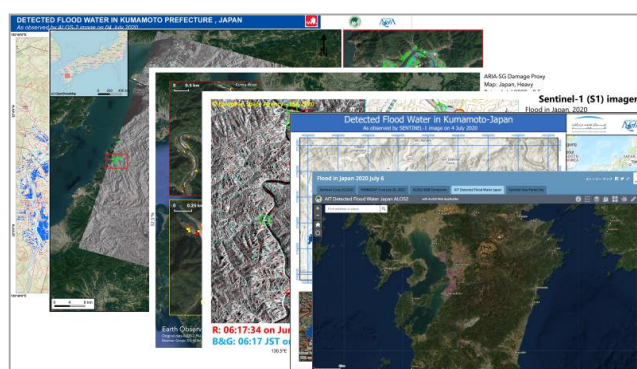
On 6 July 2020, upon request from disaster management authorities, “Ministry of Land, Information, Transport and Tourism (MLIT) and upon subsequent consultation from JAXA, **ADRC** made an emergency observation request (EOR) to Sentinel Asia. Following the request, DPN members – **ISRO**, **JAXA**, **NSPO/NARLabs** - conducted emergency observation with their respective satellites. The satellite data were provided to DAN members via Sentinel Asia’s system, **OPTEMIS**, developed by **GISTDA**. Then, DAN members, such as, **the Asian Institute of Technology**, **Chiba University**, **Earth Observatory of Singapore**, **MBRSC**, **RIKEN**, and **Yamaguchi University** generated estimated damage maps out of the provided satellite data. The estimated damage maps were provided to disaster management authorities.

Also, through **ADRC**, the EOR has been escalated to the International Disaster Charter, as “**Sentinel Asia Escalation**”. In this context as well, an expert from **Yamaguchi University** supported the call by playing the role of Project Manager to coordinate space agencies regarding emergency observation plan and generate estimated damage maps.

We have been greatly encouraged by the thought and the fact that Sentinel Asia colleagues are with us. On behalf of the Japanese people, we would like to take this opportunity to extend our sincere gratitude to all Sentinel Asia members who have supported us.



support from DPN members



support from DAN members



<b>Organization</b>	<b>Japan International Cooperation Agency (JICA)</b>
<b>Title</b>	<b>Emergency Observation Request (Flood in Jakarta, Indonesia)</b>
<b>Type of Activity</b>	<b>EOR Activity</b>
<b>Date</b>	<b>February 2020</b>

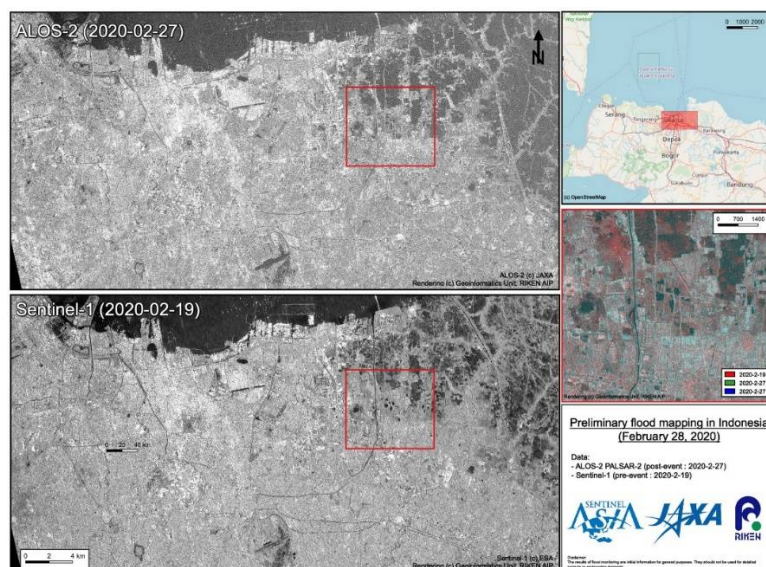
JICA was established as an independent institution in charge of the administration of Japan's Official Development Assistance (ODA). It is one of the largest bilateral international cooperation agencies and promoting human security and quality growth in developing countries. JICA also assists developing countries in building a society that is more disaster-resilient than before. JICA joined for Sentinel Asia Joint Team Member in 2019 and started to utilize a space technology for Disaster Risk Reduction in Sentinel Asia framework.

On 24<sup>th</sup> February 2020, a rainstorm hit in Jakarta, Indonesia and it caused the massive flooding in the urban area, such as Jakarta, Karawang and Bekasi Regencies of West Java, and South Tangerang Regency of Banten. The rainstorm lasted until 27<sup>th</sup> February 2020 (UNOCHA 2020). According to the report by UNOCHA, the death toll from the flooding and landslides caused by the heavy rain reached 9 and more than 222,000 residents suffered from the inundation. Focusing on the Jakarta area and West Java, over 80,000 residents took refuge on drier grounds and over 85,000 residents were affected.

EOR was submitted 25<sup>th</sup> February 2020 by JICA as its first observation request to Sentinel Asia, collaborated with a JICA Indonesia office and the Ministry of Public Works and Housing (PUPR) in Indonesia. 27 satellite images were provided by ISRO, JAXA and GISTDA and the analyzed products were shared by ATI and RIKEN. Thanks to the support from JPT member, a lot of valuable information were provided and they were utilized to inform the situation in the affected area.

(UNOCHA: <https://reliefweb.int/report/indonesia/asia-and-pacific-weekly-regional-humanitarian-snapshot-25-february-02-march-2020>)

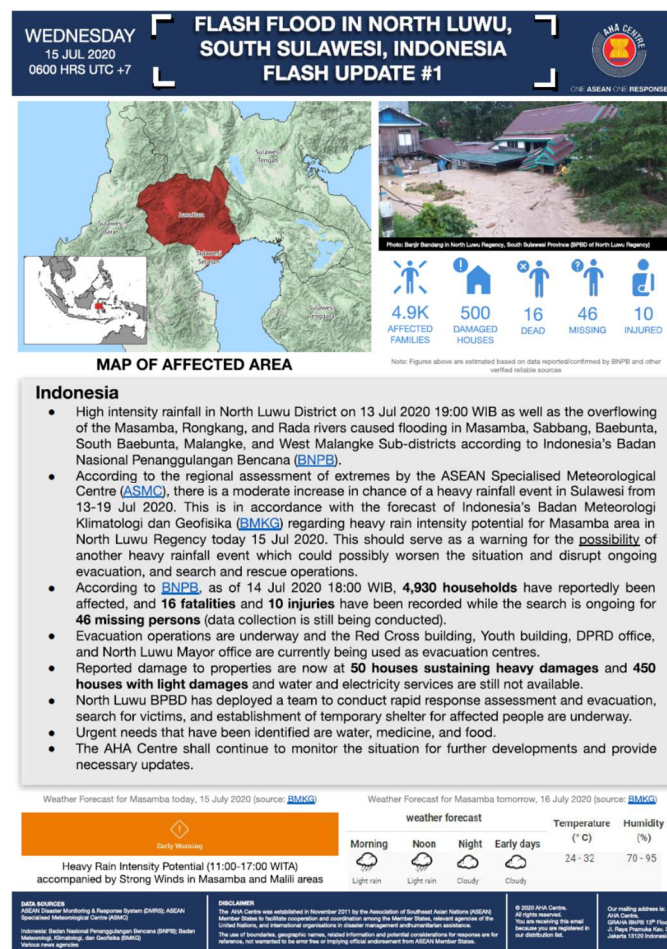
(UNOCHA: <https://reliefweb.int/report/indonesia/indonesia-floods-and-landslides-update-bnpb-bmkg-media-echo-daily-flash-27-february>)



One Value-Added Map provided by RIKEN

<b>Organization</b>	<b>National Institute of Aeronautics and Space of Indonesia (LAPAN)</b>
<b>Title</b>	<b>Emergency Observation Request</b>
<b>Type of Activity</b>	EOR request (Flood in Indonesia)
<b>Date</b>	<b>7 / 2020</b>

Indonesia is disaster prone country. We have been affected by a lot of disasters ever year. In July 2020, heavy rain hit in south Sulawesi of Indonesia. It was tragic damage in this region. Therefore, we submitted EOR with BNPB. Thanks to SA support, we got many useful data. We shared the satellite images and VAP to BNPB as national disaster management organization, as well as local disaster management organization in Sulawesi (BPBD) for emergency response activity in affected area. We develop a disaster map by using provided satellite images. Also, we shared to other agencies for sharing information.



### Situation Report (AHA Center)

<b>Organization</b>	<b>Mohammed Bin Rashid Space Centre (MBRSC)</b>
<b>Title</b>	<b>Date support of KHALIFSAT for EOR (2020)</b>
<b>Type of Activity</b>	<b>Sharing satellite images for EOR</b>
<b>Date</b>	<b>2020</b>

The Mohammed Bin Rashid Space Centre (MBRSC), is a Dubai government organization working on the UAE National Space Programme, which includes various earth observation satellite projects, the Emirates Mars Mission, the Emirates Lunar Mission, and the UAE Astronaut Programme. MBRSC launched a new earth observation satellite, named “KHALIFSAT”, in October 2018. KHALIFSAT is one of the world’s most technologically advanced remote sensing observation satellite – and the first 100% designed and manufactured in the UAE. MBRSC supported to provide satellite images and VAP as following EORs in 2020.

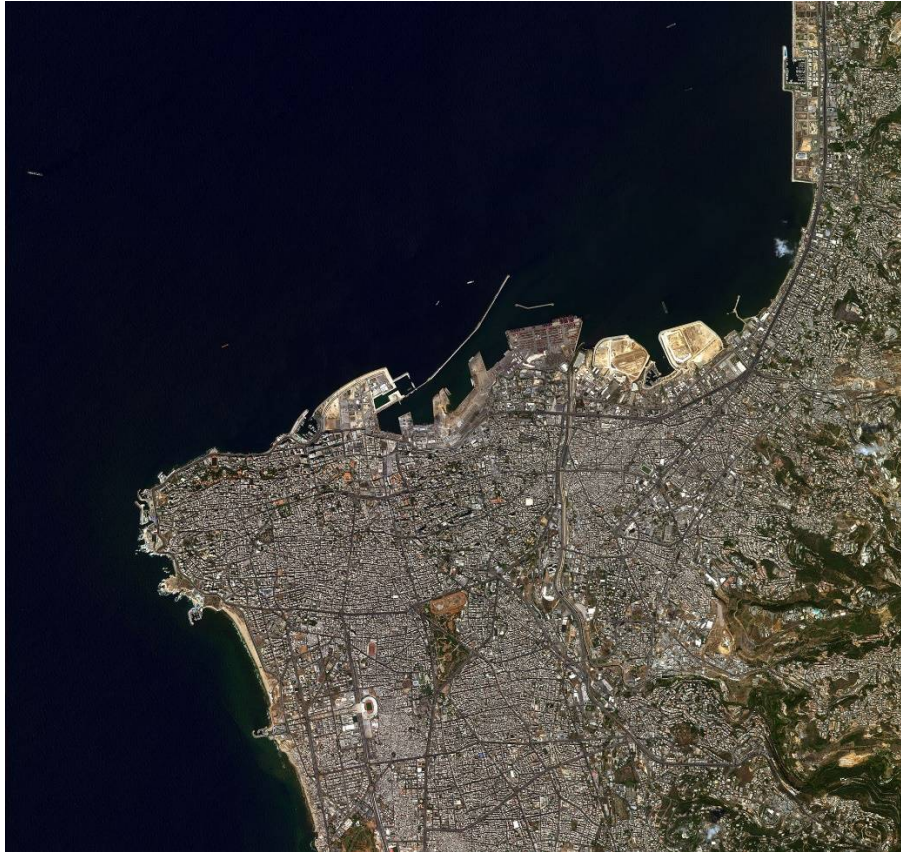
MBRSC shared satellite images of KHALIFSAT as follow

- ✓ Industrial Accident (Lebanon), August 2020
- ✓ Earthquake (Turkey), November 2020

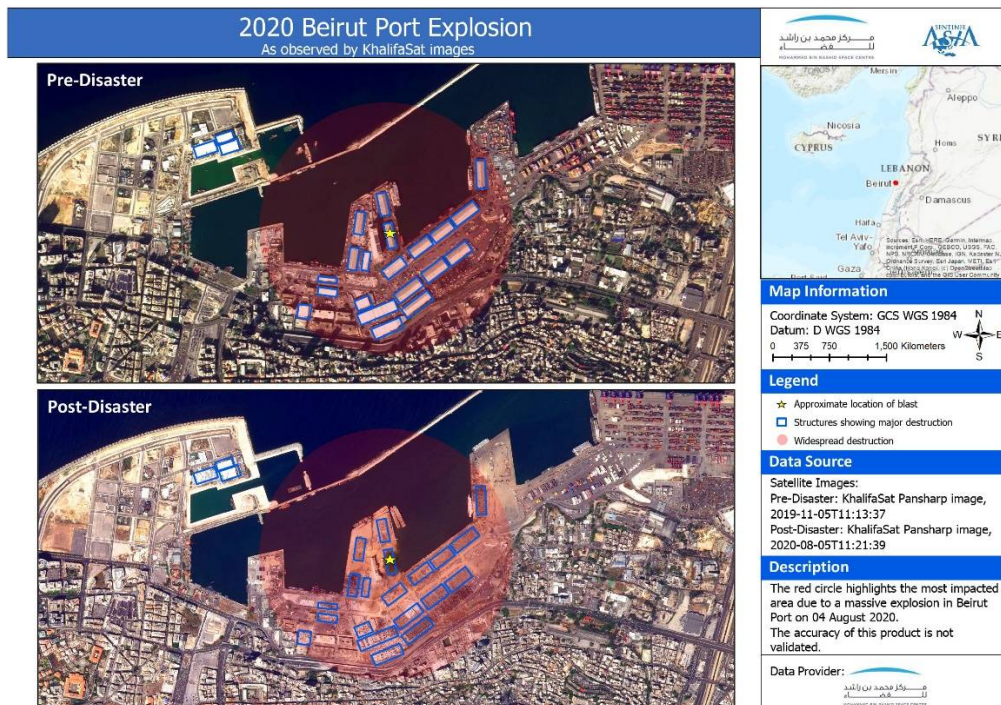
MBRSC shared VAPs as follow

- ✓ Flood (Japan), July 2020
- ✓ Flood (India), July 2020
- ✓ Flood (Indonesia), July 2020
- ✓ Flood (Vietnam), July 2020
- ✓ Industrial Accident (Lebanon), August 2020
- ✓ Earthquake (Philippines), August 2020
- ✓ Flood (Vietnam), September 2020
- ✓ Flood (Vietnam), October 2020
- ✓ Flood (Cambodia), October 2020
- ✓ Flood (Philippines), November 2020
- ✓ Earthquake (Turkey), November 2020
- ✓ Typhoon (Philippines), November 2020
- ✓ Typhoon (Vietnam), November 2020





Satellite Image of KHALIFSAT [Industrial Accident in Lebanon]



VAP [Industrial Accident in Lebanon]

<b>Organization</b>	<b>Manila Observatory</b>
<b>Title</b>	<b>2020 Sentinel Asia Activities of Manila Observatory</b>
<b>Type of Activity</b>	<b>Submission of EOR and providing value added products</b> (e.g., Conference, Workshop, Meeting, Training, EOR, Providing satellite data or VAP)
<b>Date</b>	<b>19/10/2021</b>

Please write about your activity related to Sentinel Asia in 2020:

We experienced the Taal Volcano Eruption in January 12, 2020 as well as two major typhoons named Goni and Vamco in November 1 and November 12, 2020, respectively. For the typhoons of November 2020, an EOR (#386) was submitted. Value-added products for emergency observation/ mapping (EO/ M) were derived and disseminated, as indicated below.

Value added products production:

Hazard	Product Title	Date of Release	Mode of distribution	Website
Taal Volcano Eruption (January 12, 2020)	Impacts of Taal Volcano Phreatic Eruption (12 January 2020) on the Environment and Population: Satellite-based Observations compared with Historical Records	March 13, 2020	Manila Observatory's website and geoportal	<a href="http://www.observatory.ph/2020/04/20/impacts-of-taal-volcano-phreatic-eruption-12-january-2020-on-the-environment-and-population-satellite-based-observations-compared-with-historical-records/">http://www.observatory.ph/2020/04/20/impacts-of-taal-volcano-phreatic-eruption-12-january-2020-on-the-environment-and-population-satellite-based-observations-compared-with-historical-records/</a> <a href="http://mapsanddata.observatory.ph/11766/impacts-of-taal-volcano-phreatic-eruption/">http://mapsanddata.observatory.ph/11766/impacts-of-taal-volcano-phreatic-eruption/</a>
Typhoon Rolly (November 1, 2020)	Mapping the Impacts of Typhoon Goni in Albay / Mapping the Impacts of Typhoon Goni in Camarines Sur / Mapping the Impacts of Typhoon Goni in Catanduanes	November 9, 2020	Emailed to partners, uploaded in Sentinel Asia website	<a href="https://sentinel-asia.org/EO/2020/article20201101PH.html">https://sentinel-asia.org/EO/2020/article20201101PH.html</a>
Typhoon Vamco (November 12, 2020)	Mapping the Impacts of Typhoon Vamco in Cagayan and Isabela/ Mapping the Impacts of	November 20, 2020	Emailed to partners, uploaded in Sentinel Asia website, Manila Observatory	<a href="https://sentinel-asia.org/EO/2020/article20201111PH.html">https://sentinel-asia.org/EO/2020/article20201111PH.html</a> <a href="http://mapsanddata.observatory.ph/11661/typhoon-vamco/">http://mapsanddata.observatory.ph/11661/typhoon-vamco/</a> <a href="http://www.observatory.ph/">http://www.observatory.ph/</a>



Hazard	Product Title	Date of Release	Mode of distribution	Website
	Typhoon Vamco in Metro Manila Mappin the Impacts of Typhoon Vamco in Pampanga		website, and Geoportal	

Please put here if you have any photo/image/picture  
(title of image, picture, etc)



Figure 1. Taal Volcano eruption report in Manila Observatory's website

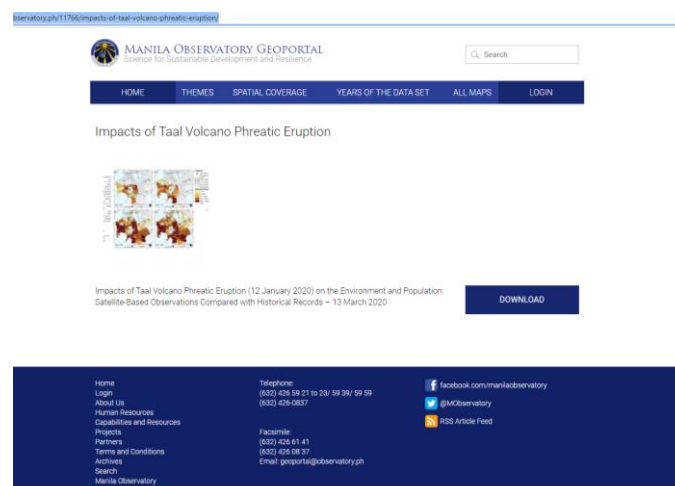


Figure 2. Taal Volcano Eruption Report in Manila Observatory's Geoportal

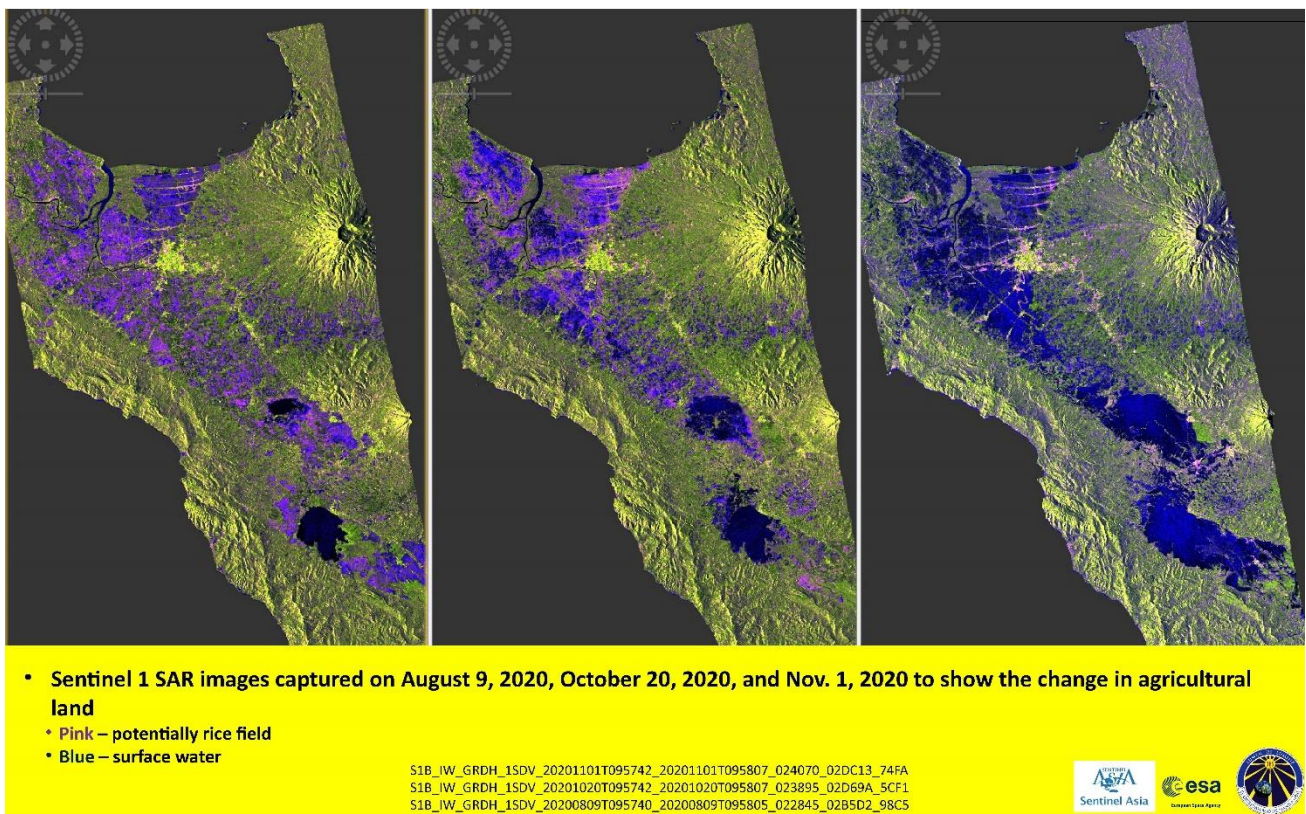
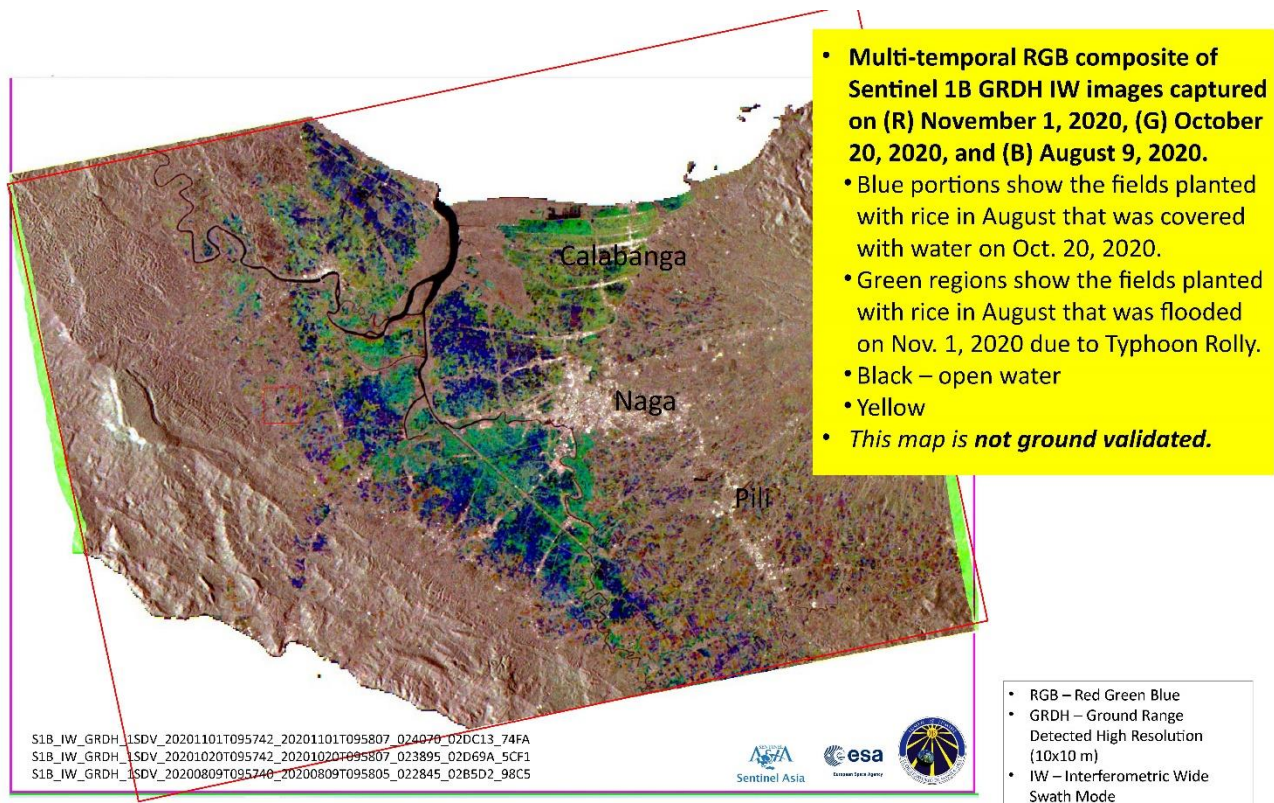
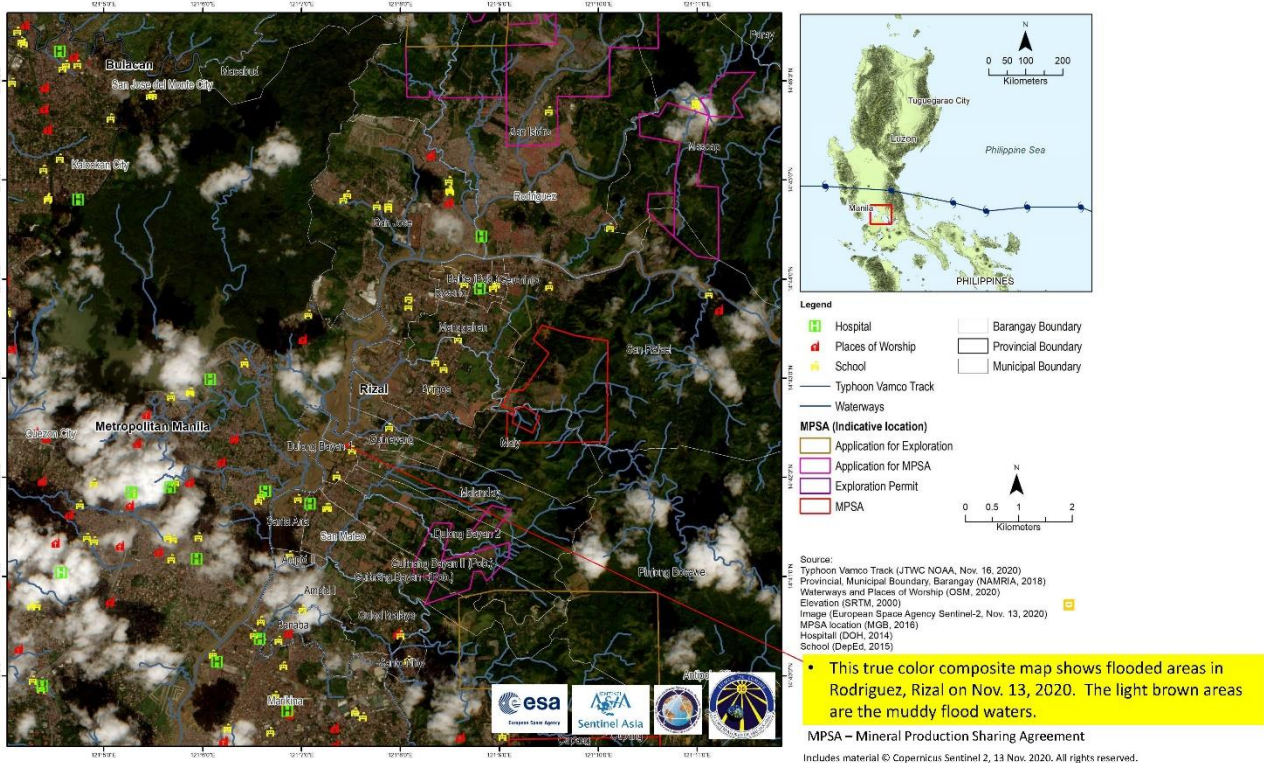


Figure 3. TC Goni Emergency Observation/ Mapping



RODRIGUEZ, RIZAL Typhoon Vamco RGB Composite of Sentinel-2 Image (Nov. 13, 2020)



RODRIGUEZ, RIZAL Typhoon Vamco RGB Composite of Landsat 8 Image (Nov. 6, 2020)

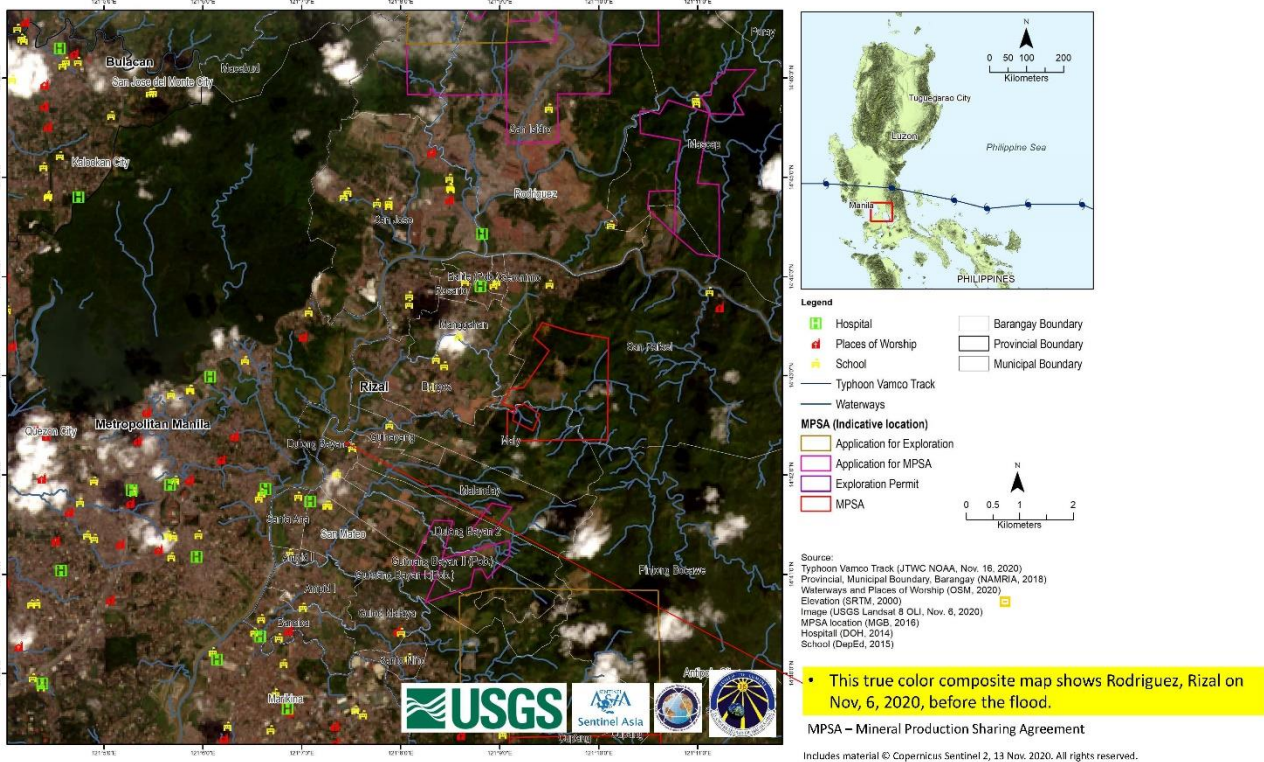


Figure 4. TC Vamco Emergency Observation/ Mapping

# Mapping the Impacts of Typhoon Vamco in Metro Manila

Geomatics for Environment and Development  
MANILA OBSERVATORY  
December 2, 2020

## Summary

- Low-lying municipalities (with elevation of less than 10 meters above sea level) as well as municipalities along the upstream portion of Marikina River were flooded due to accumulated 24-hour rainfall exceeding 150 mm during the onslaught of Typhoon Ulysses.
- Multi-temporal Synthetic Aperture Radar images detected flooding along Marikina River and around Laguna Lake three days after the flood event.



## Typhoon Vamco Track over the Philippines



## Typhoon Vamco



With a diameter of 800 km, Typhoon Vamco covered the entire mainland of Luzon in the Philippines. It made landfall on Nov. 11, 2020 in Quezon, crossed Bulacan and Pampanga, and exited Zambales on Nov. 12, 2020.

Typhoon Vamco "Ulysses" (INDUKKIVC Situation Report No. 6)

- Maximum sustained winds: 150 km/h
- Gustiness: 200 km/h
- First landfall: 10:30 of Nov. 11, 2020 in Patnungan, Quezon
- Second landfall : 11:20 in Burdeos, Quezon
- Third landfall: 1:40 am of Nov. 12, 2020 in General Nakar, Quezon

## Typhoon Vamco Rainfall over the Philippines

### JAXA GLOBAL RAINFALL WATCH 世界の雨分布速報

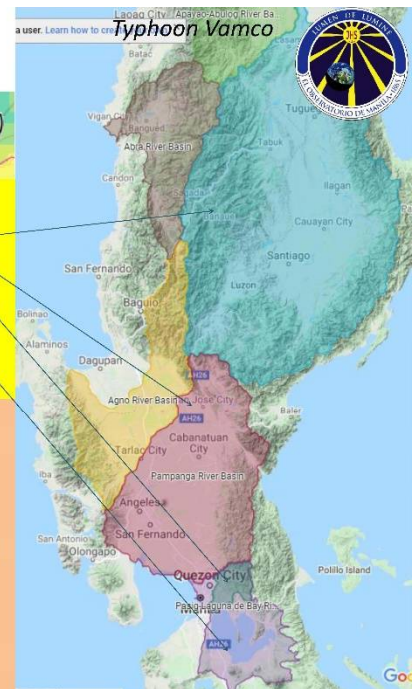
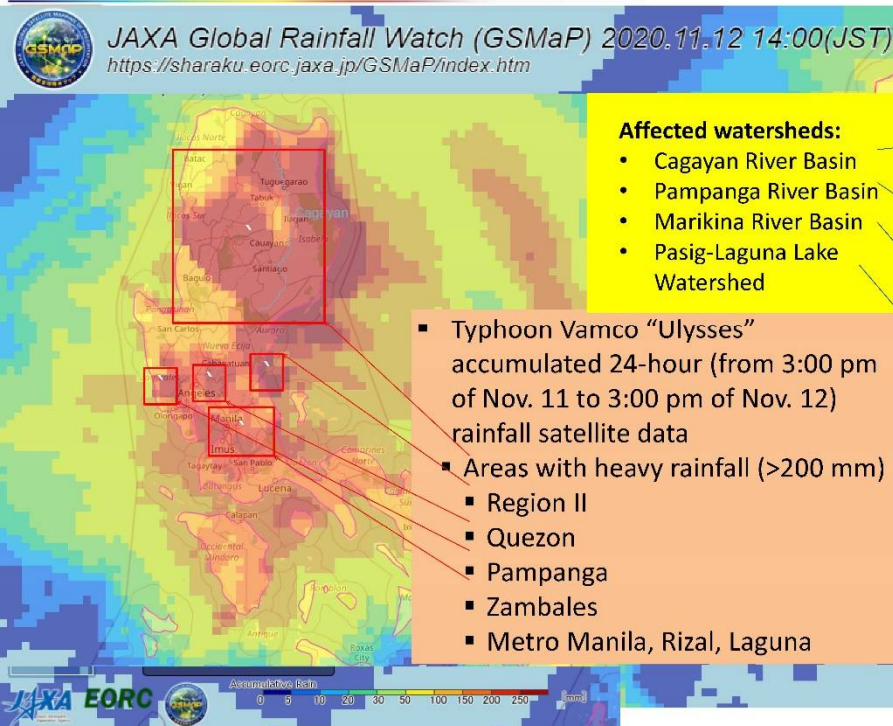
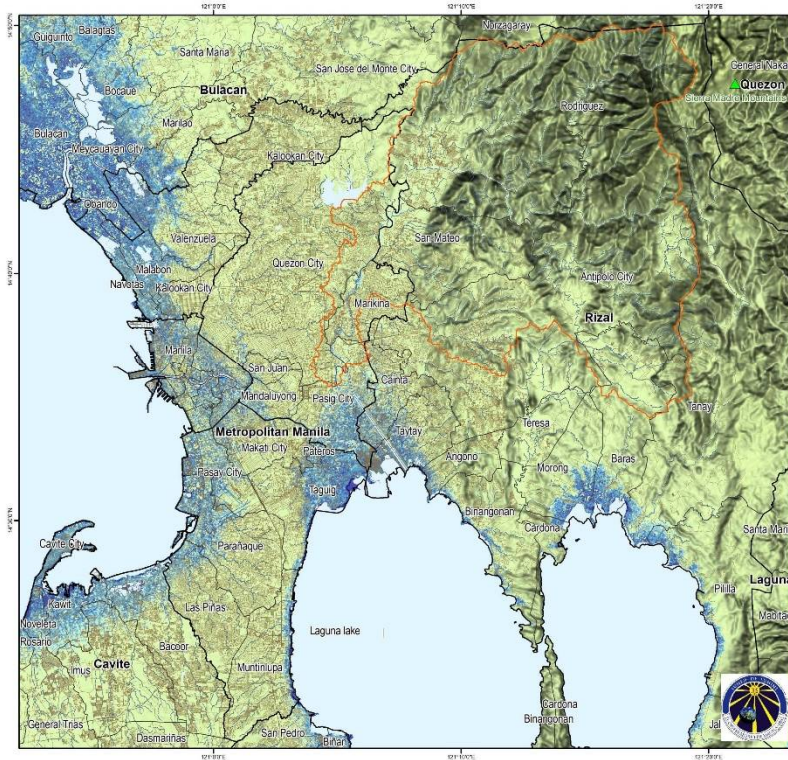


Image Source: Google Maps  
18 Major River Basins & 3 Principal River Basins in the Philippines



## Low-lying Areas in Metro Manila



## Typhoon Vamco

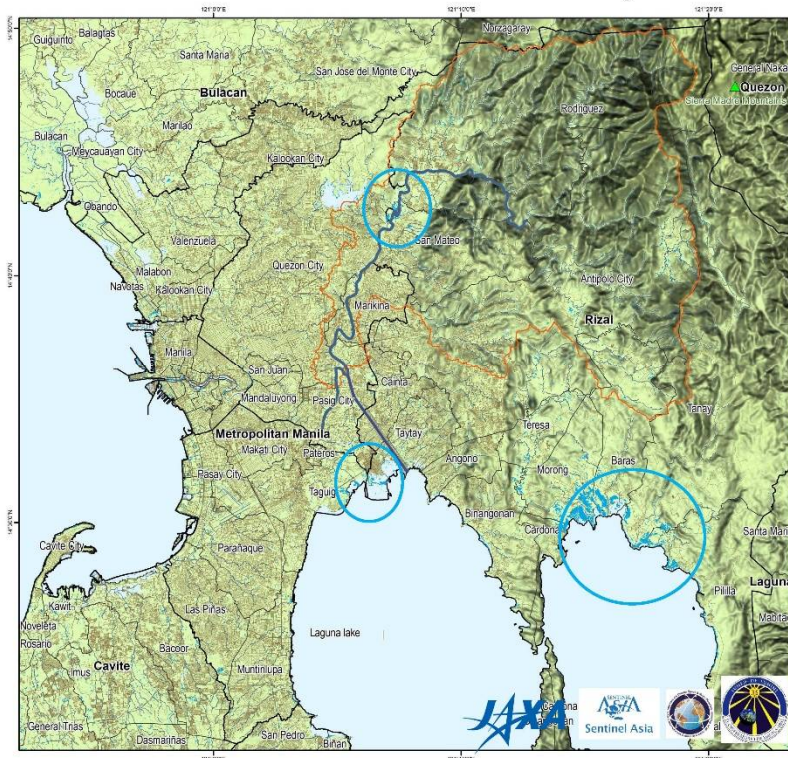


Source:  
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, and Waterbodies (OSM, 2020)  
Elevation (SRTM 30 meters, 2000)

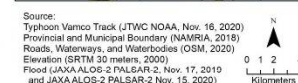
### LOW-LYING MUNICIPALITIES

- | METRO MANILA    | RIZAL       | LAGUNA       |
|-----------------|-------------|--------------|
| Manila City     | Taytay City | Lumban       |
| Taguig City     | Calinta     | Mabitac      |
| Pasig City      | Morong      | Santa Cruz   |
| Valenzuela City | Pililla     | Victoria     |
| Paranaque City  | Jala-Jala   | Cabuyao City |
| Pasay City      | Baras       | Calamba City |
| Navotas City    | Binangonan  | Pila         |
| Makati City     | Tanay       | Bay          |
| Las Pinas City  | Cardona     | Pangil       |
| Muntinlupa City | Angono      | Calauan      |
|                 |             | Siniloan     |

## Detected Flood in Metro Manila and Rizal (ALOS Nov. 15, 2020)



## Typhoon Vamco



Source:  
Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, and Waterbodies (OSM, 2020)  
Elevation (SRTM 30 meters, 2000)  
Flood (JAXA ALOS-2 PALSAR-2, Nov. 17, 2019 and JAXA ALOS-2 PALSAR-2 Nov. 15, 2020)

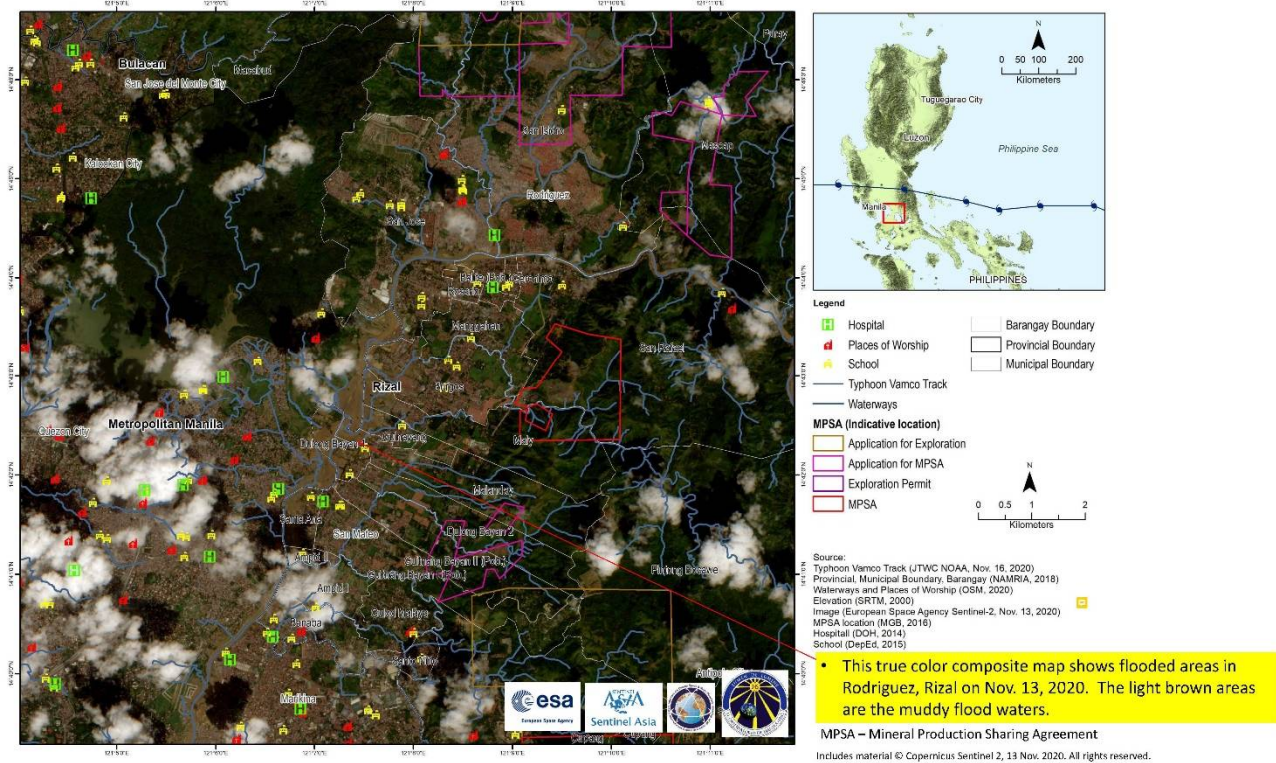
- Highlighted in **blue** are the observed flooded areas in Metro Manila and Rizal three days after the flooding event due to Typhoon Vamco.
- Flood extent was detected by thresholding the difference of pixel values of ALOS-2 PALSAR-2 image taken on Nov. 15, 2020 and Nov. 17, 2019.
- Please note that flood extent could be underestimated in urban areas due to complex backscattering over built surface.
- Note also that **no ground validation** was done for this map.

Three days after the flooding event, flood water was detected along Marikina River, Manggahan Floodway, and around Laguna Lake.

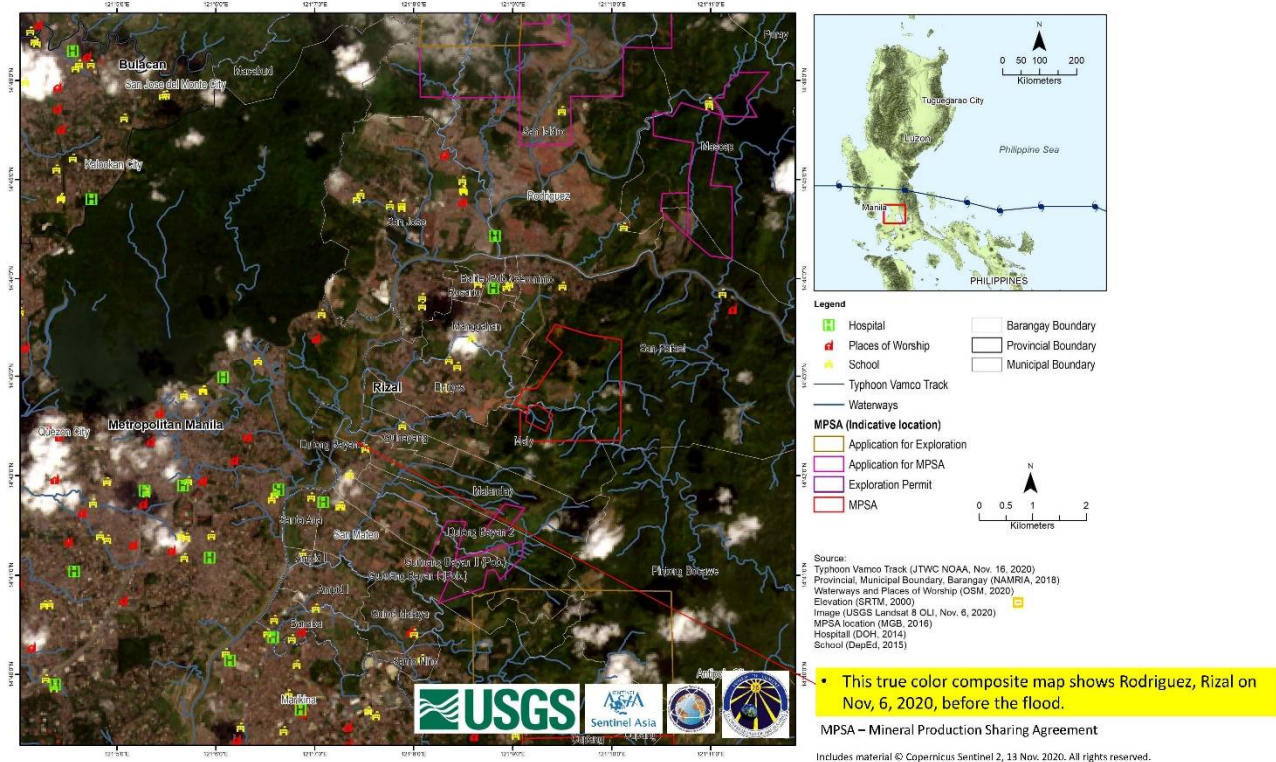
Includes material © JAXA ALOS-2 PALSAR-2 Nov. 15, 2020 and Nov. 17, 2019. All rights reserved.



RODRIGUEZ, RIZAL Typhoon Vamco RGB Composite of Sentinel-2 Image (Nov. 13, 2020)



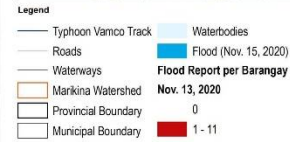
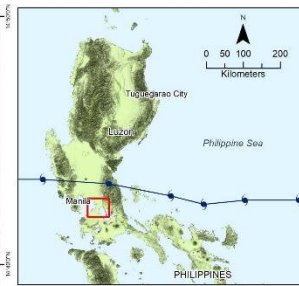
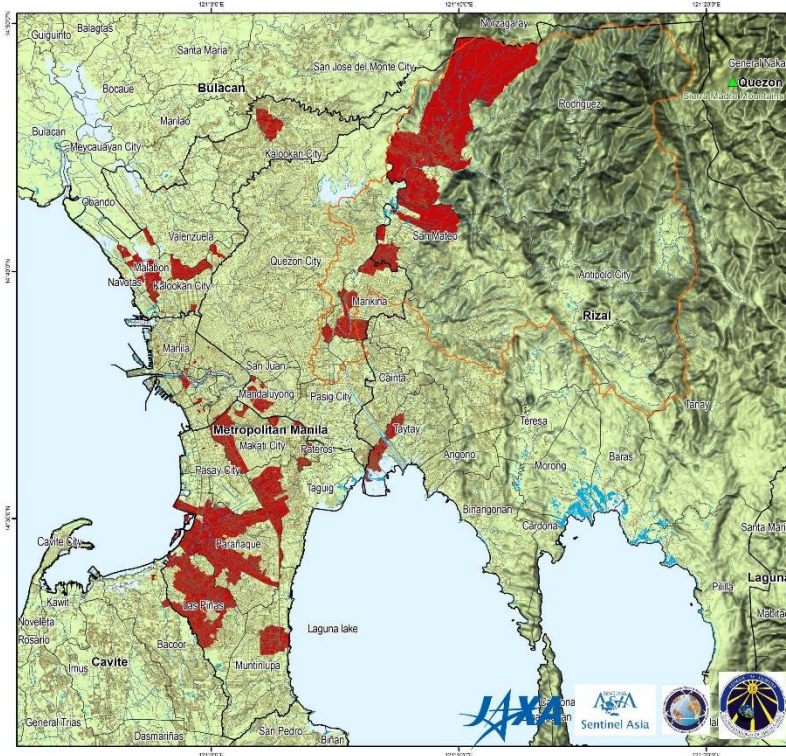
RODRIGUEZ, RIZAL Typhoon Vamco RGB Composite of Landsat 8 Image (Nov. 6, 2020)





## Reported Flood in Metro Manila and Rizal

Typhoon Vamco

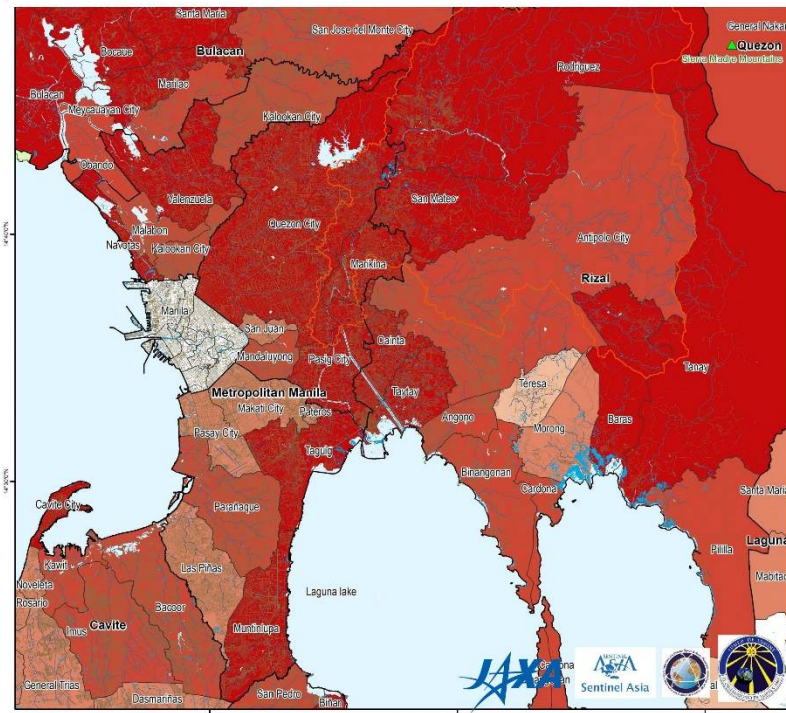


Source: Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, and Waterbodies (OSM, 2020)  
Elevation (SRTM 30 meters, 2000)  
Flood (JAXA ALOS-2 PALSAR-2, Nov. 17, 2019 and JAXA ALOS-2 PALSAR-2 Nov. 15, 2020)  
Flood Reports (NDRRMC Situation Report 3, Nov. 13, 2020)

Includes material © JAXA ALOS-2 PALSAR-2 Nov. 15, 2020 and Nov. 17, 2019. All rights reserved.

## Affected Population in Metro Manila and Rizal as of Nov. 8, 2020

Typhoon Vamco



Source: Typhoon Vamco Track (JTWC NOAA, Nov. 16, 2020)  
Provincial and Municipal Boundary (NAMRIA, 2018)  
Roads, Waterways, and Waterbodies (OSM, 2020)  
Elevation (SRTM 30 meters, 2000)  
Flood (JAXA ALOS-2 PALSAR-2, Nov. 17, 2019 and JAXA ALOS-2 PALSAR-2 Nov. 15, 2020)  
Affected Population (NDRRMC Situation Report 7, Nov. 17, 2020)

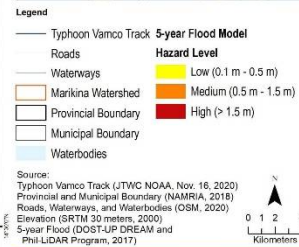
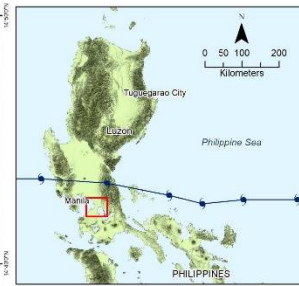
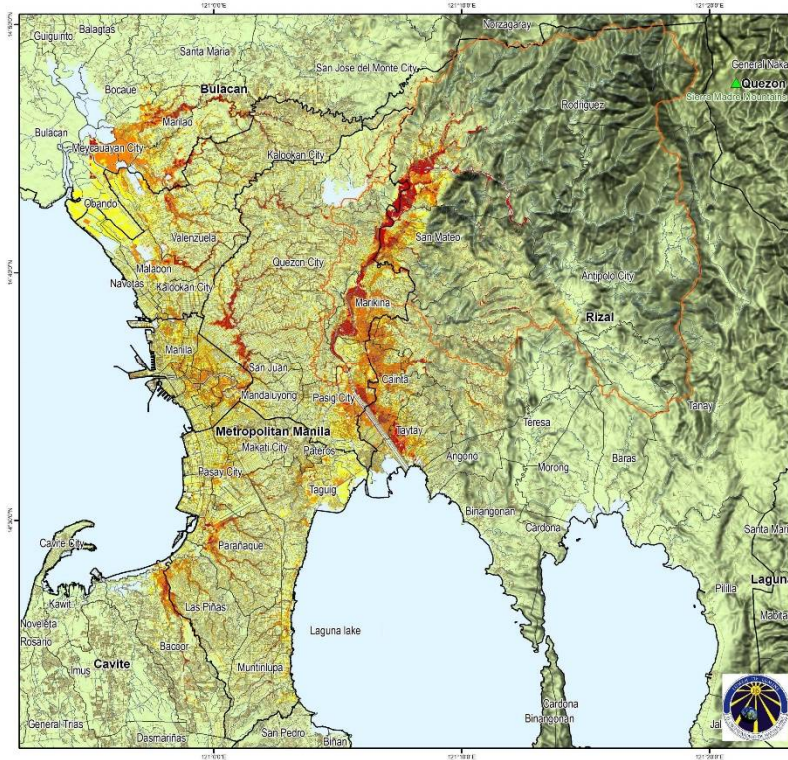
- NDRRMC reported that Typhoon Ulysses affected a total of **51,7655 persons in Metro Manila** and **69,984 persons in Rizal**.
- 20,457 persons were affected in Marikina City.
- 36,357 persons were affected in Rodriguez, Rizal

Includes material © JAXA ALOS-2 PALSAR-2 Nov. 15, 2020 and Nov. 17, 2019. All rights reserved.



## 5-year Flood in Metro Manila and Rizal

Typhoon Vamco



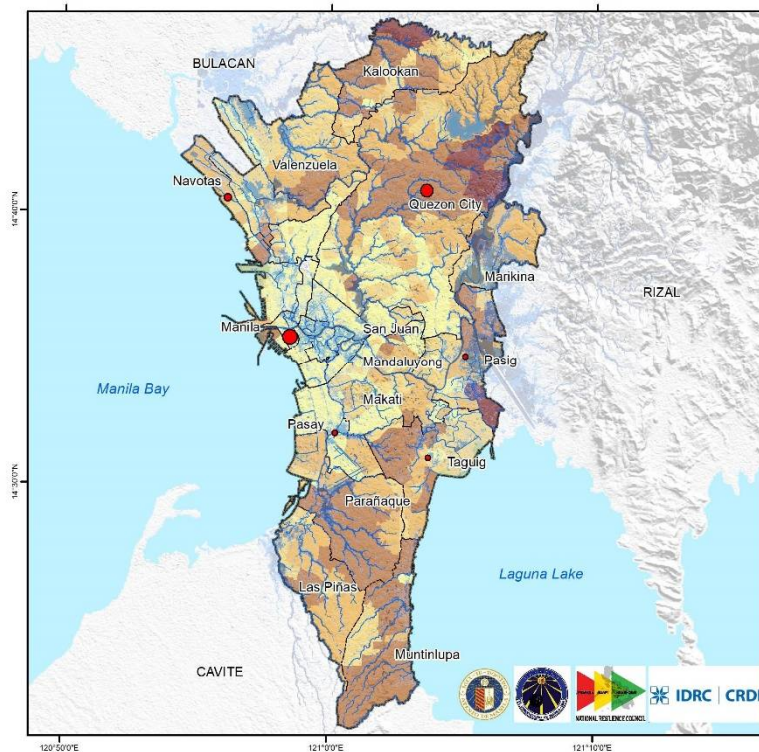
**Municipalities with high hazard level (ranked based on area of high flood hazard level per municipality):**

Quezon City*	Cainta	Las Pinas City*
Rodriguez	Taytay City	Malabon City*
San Mateo	Valenzuela City*	Makati City*
Marikina City*	Caloocan City*	Taguig City*
Antipolo City	Paranaque City*	San Juan City*
Pasig City*	Muntinlupa City*	Manila City*

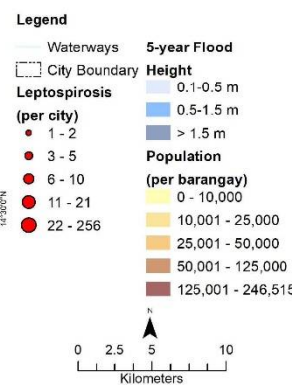
\* Cities in Metro Manila

## Population exposed to 5-year flood in Metro Manila

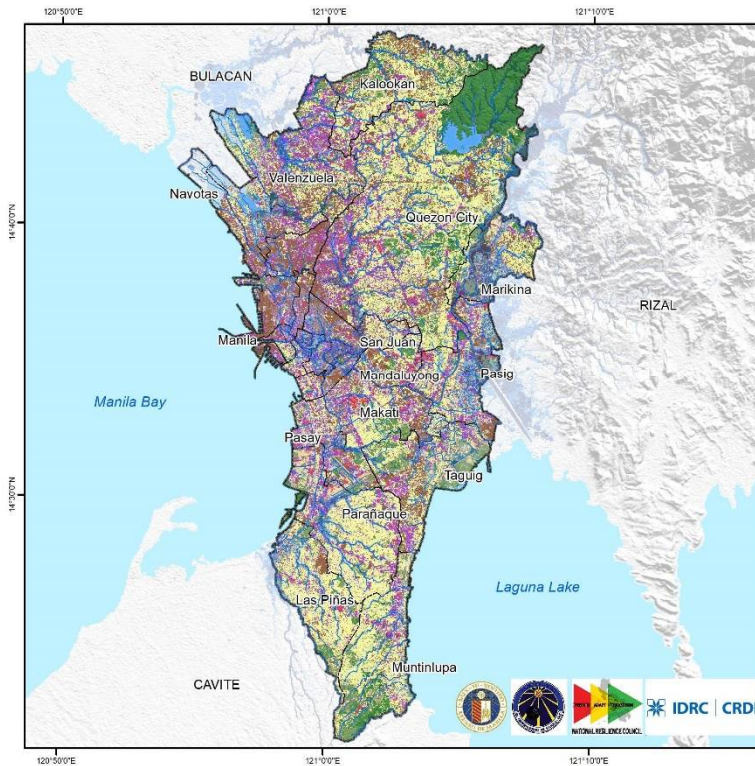
Typhoon Vamco



**Metro Manila: 5-year Flood, Population (2015), and Leptospirosis Cases (2018)**



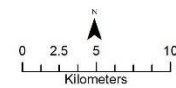
**Data Sources:**  
 HDX, NAMRIA, PSA, 2018 (city boundary);  
 OSM, 2019 (waterways); DOH, 2018 (Leptospirosis cases);  
 PHIL-LIDAR, 2017 (flood); PSA, 2015 (population).



## Metro Manila: 5-year Flood and Land Use and Cover (2018)

### Legend

Waterways	Land Use/Cover
City Boundary	Commercial
5-year Flood	Bare
Height (m)	Residential
0.1-0.5 m	Informal Settlements
0.5-1.5 m	Industrial
> 1.5 m	Grass
	Tree
	Water



Data Sources:  
 HDX, NAMRIA, PSA, 2018 (city boundary);  
 OSM, 2019 (waterways); PHIL-LIDAR, 2017  
 (flood); IFSAR, 2013 and Sentinel-2, 2018 and  
 Worldview-3, 2017 (land use and cover).

<b>Organization</b>	<b>Department of national remote sensing – VietNam Ministry of natural resources and environment</b>
<b>Title</b>	<b>Summary of 2020 results through SA system activation</b>
<b>Type of Activity</b>	<b>EOR</b> (e.g., Conference, Workshop, Meeting, Training, EOR, Providing satellite data or VAP)
<b>Date</b>	<b>17/09/2020: EOR</b> <b>07/10/2020: EOR</b> <b>27/10/2020: EOR</b> <b>13/11/2020: EOR</b>

Through four activation sessions we have received timely support for satellite observation data as well as other value-added products. With the processing of satellite data and other supporting documents, we have provided 43 floods map for agencies to use data to respond to natural disasters in Vietnam. Details of the duties are listed below.

#### **17/09/2020:**

Receive forecast information from Vietnam's hydro-meteorological forecasting agency on the impact of tropical Storm Noul which will cause heavy rain and flooding in central provinces. According to the disaster response scenario, for typhoon level 10 and level 13, more than 107,000 households with more than 548,000 people in the central danger zone may be evacuated. This is usually done 12 hours before a storm hits. We immediately activated the system to request the support of Sentinel Asia, Through timely support from data providers and application organizations, we have received the following satellite image materials and value-added products:

- + 02 ALOS-2 pre-disaster scenes and 03 ALOS-2 after-disaster scenes, 02 ALOS-2 PALSAR-2, RGB color composite image from JAXA
- + 02 TeLEOS-1 after-disaster scenes from CRISP
- + 02 THEOS1 after-disaster scenes from GISTDA
- + 01 RESOURCESAT-2 after-disaster scenes from ISRO
- + 01 FORMOSAT-5 after-disaster scenes from NARL
- + 02 detected flood water map of AOI and Detected Flood Water in Vietnam in SHP file format from AIT
- + 02 detected flood water map of AOI from MBRSC

#### **07/10/2020:**

Due to the influence of the tropical converging strip passing through the Central Vietnam combined with the cold air, from 6 October to 11 October in the Central provinces, there is a possibility of heavy

rain. The total popular rainfall is 300-500mm / period, particularly the provinces from Ha Tinh to Quang Ngai have very heavy rain with popular rainfall 500-700mm /period; the North Central Highlands provinces have moderate rainfall, heavy rain, some places with very heavy rain with popular rainfall of 200-350mm /period. we have activated the system and received the following valuable support:

- + 08 ALOS-2 pre-disaster scenes and 08 ALOS-2 after-disaster scenes, 02 ALOS-2 PALSAR-2, RGB color composite image from JAXA
- + 01 RESOURCESAT-2 after-disaster scenes from ISRO
- + 04 THEOS1 after-disaster scenes from GISTDA
- + 02 FORMOSAT-5 after-disaster scenes from NARL
- + 02 detected flood water map in QuangNam an Danang province of Vietnam and Detected Flood Water in Vietnam in SHP file format from AIT
- + 01 detected flood water map of AOI in Vietnam As observed by SENTINEL-1 image and 01 detected lanslides map from MBRSC

**27/10/2020:**

Molave storm in the west direction, with the speed of 25 km per hour, into the South China Sea. At 1:00 on October 27, the storm center was about 350 km northeast of Song Tu Tay Island to the northeast, the strongest is to be at 12 (115 to 135 km / h), increasing two levels. On October 28, the storm center about 240 km from the coast of the provinces from Quang Nam to Phu Yen to the East, the strongest wind is level 13 (115 to 150 km / h), level 15. We have received the following satellite image materials and value-added products:

- + 01 RESOURCESAT-2 after-disaster scenes from ISRO

**13/11/2020:**

Due to the influence of storm No. 7 and combined with cold air, in the North and North Central region, there are heavy to very heavy rains and scattered thunderstorms with a common rainfall of 150-350mm/time, in some places over 400mm/period. There is a high risk of flash floods and landslides, flooding in low-lying mountainous provinces in the North and North Central regions. we have activated the system and received the following valuable support:

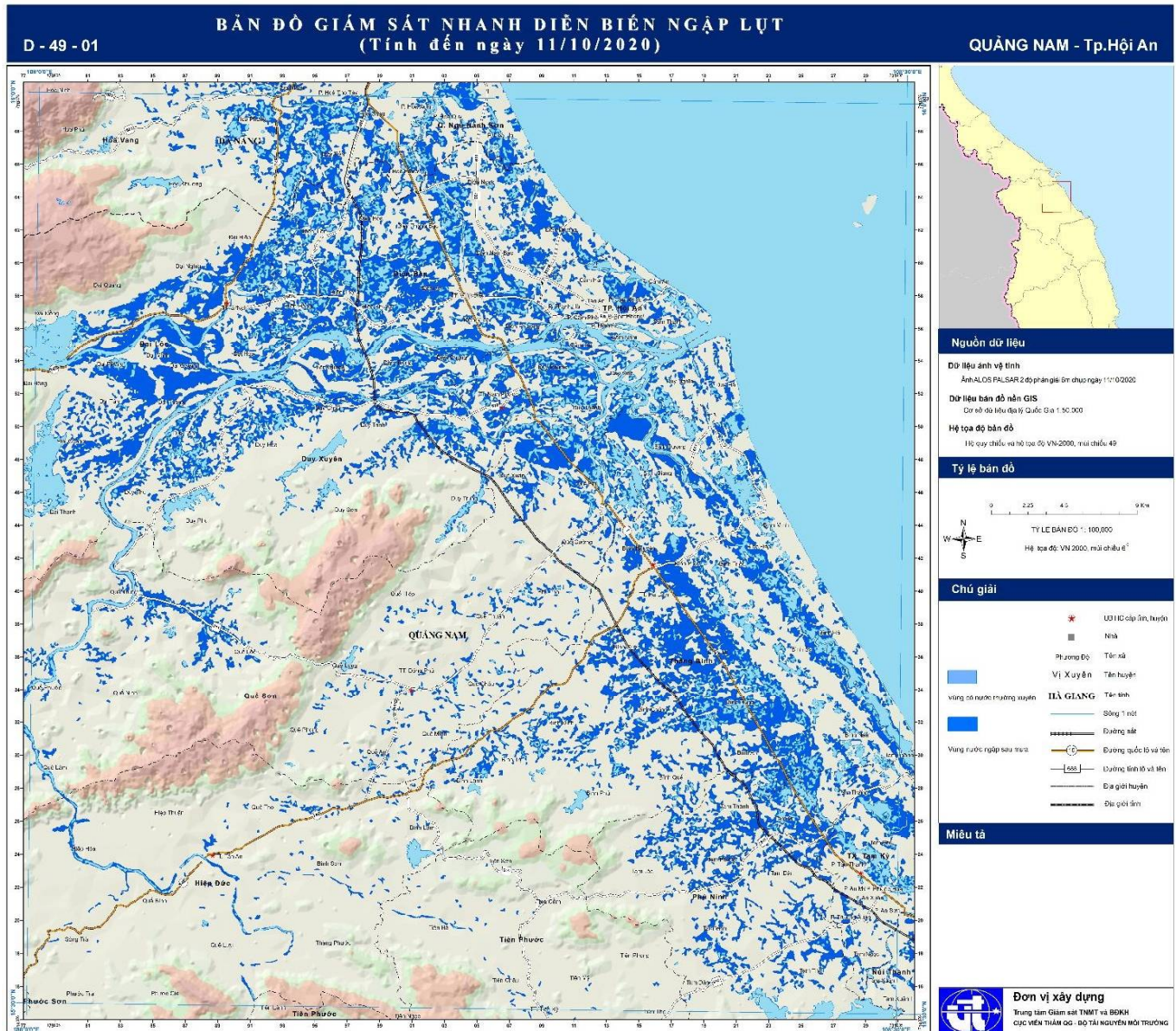
- + 04 ALOS-2 pre-disaster scenes and 08 ALOS-2 after-disaster scenes, 04 ALOS-2 PALSAR-2 from JAXA
- + 01 RESOURCESAT-2 after-disaster scenes from ISRO
- + 01 FORMOSAT-5 after-disaster scenes (PAL, MS & PMS) from NARL
- + 01 detected flood water map in Thua Thien - Hue province, Vietnam and Detected Flood Water in



Vietnam in SHP file format from AIT

+ 03 map of Vietnam flood, Vietnam landslides and Vietnam Storm As observed by SENTINEL-1 image and data analysis in SHP file format from MBRSC

Figure 1. The analysis results of flooded areas in Quang Nam are shown on the quick monitoring map of flooding in Hoi An city, Quang Nam province, Vietnam (October 11, 2020).



<b>Organization</b>	<b>National Space Organization, National Applied Research Laboratories (NSPO-NARLabs)</b>
<b>Title</b>	<b>Satellite Imagery Support to Sentinel Asia</b>
<b>Type of Activity</b>	<b>Responses to EOR (Providing Satellite data as Data Provider Node)</b>
<b>Date</b>	<b>Year of 2020</b>

During 2020, NSPO has contributed to the Sentinel Asia activities as Data Provider Node. NSPO as a DPN has successfully responded to various Emergency Observation Requests (EOR's) pertaining to 9 countries and 14 events with FORMOSAT-5 satellite datasets comprising of pre- and post-disaster events. All these satellite image products were provided right after we acquired cloudless images. According to the statistics, FORMOSAT-5 satellite image products do support storm and flood relief. At the same time, it has also given disaster response assistance to Indonesia, Japan and Vietnam many times. It's worth noting that NSPO also provided Value-Added Products to assist stakeholders in the rescue, which enabled decision makers to understand the extent and scope of the disaster in intuitive manner.

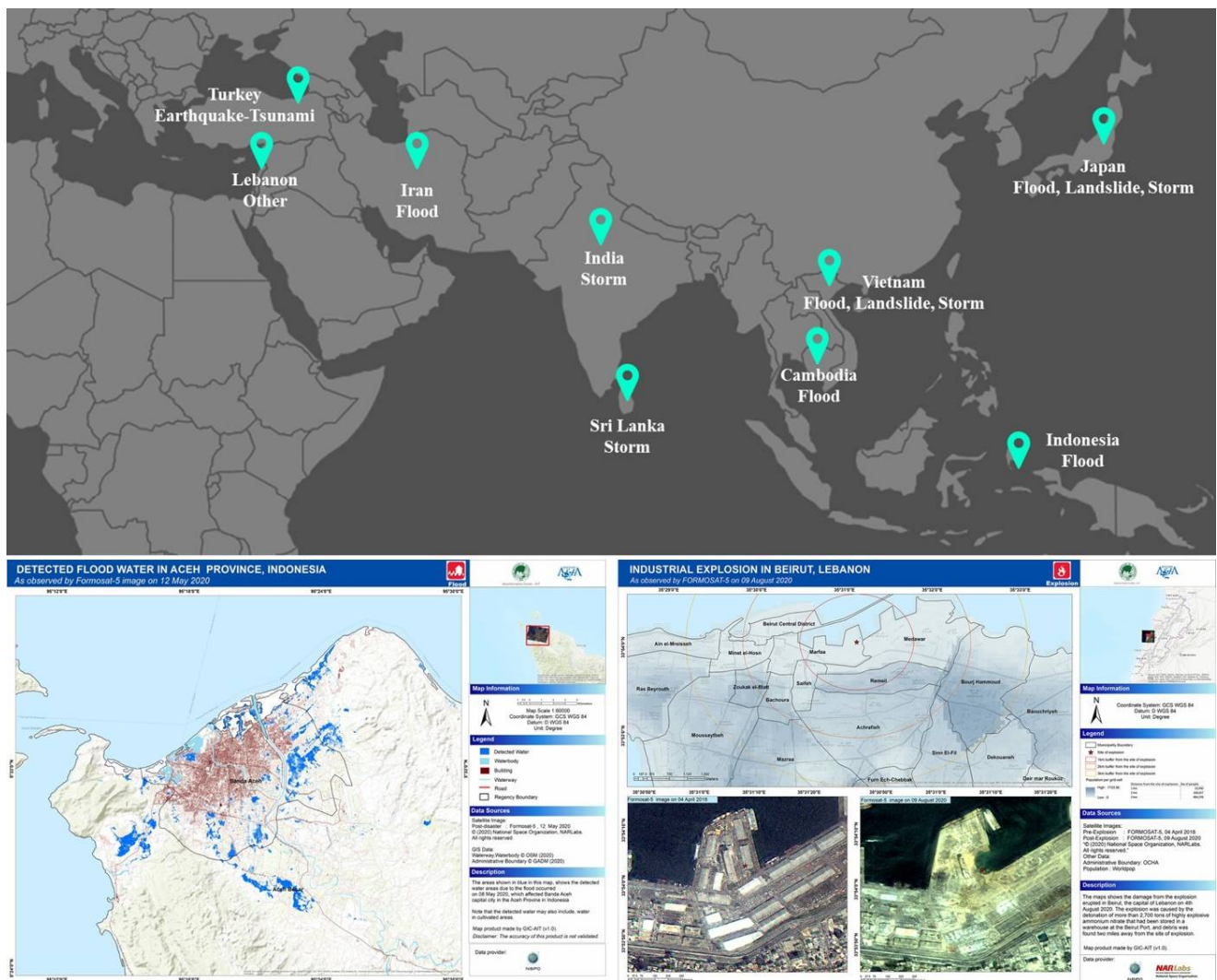


Fig 1 NSPO Support to Sentinel Asia Emergency Observation Requests during 2020



<b>Organization</b>	<b>Academia Sinica Grid Computing Center (ASGC) and NSPO-NARLabs</b>
<b>Title</b>	<b>Sentinel Asia JPT-3 Cloud Services</b>
<b>Type of Activity</b>	<b>Cloud Server Service</b>
<b>Date</b>	<b>Year of 2020</b>

Support Sentinel Asia Emergency Observation (EO) online workflow and the federation of WebGIS, EO pipeline, data access of DAN and DPN, as well as distributed cloud platform from Feb. 2020, in collaboration with Sentinel Asia Tech Team. Reliability of the JPT-3 cloud services is higher than 99.9% on average from Feb. 2020. Around 187GB data is downloaded by about 400 accesses from Sentinel Asia members and applications on a monthly average from Feb. 2020 to Dec. 2020. The total download data scale has been more than 2.01 Terabyte (TB). Also, NSPO together with Sentinel Asia Tech Team to review the status of SA services and technical issues monthly. In the future, NSPO will work with the SA technical team to advance the values of satellite resources on disaster management and their applications by designing and prototyping spatio-temporal infrastructures such as Open Data Cube and token-based authentication and authorization infrastructure.

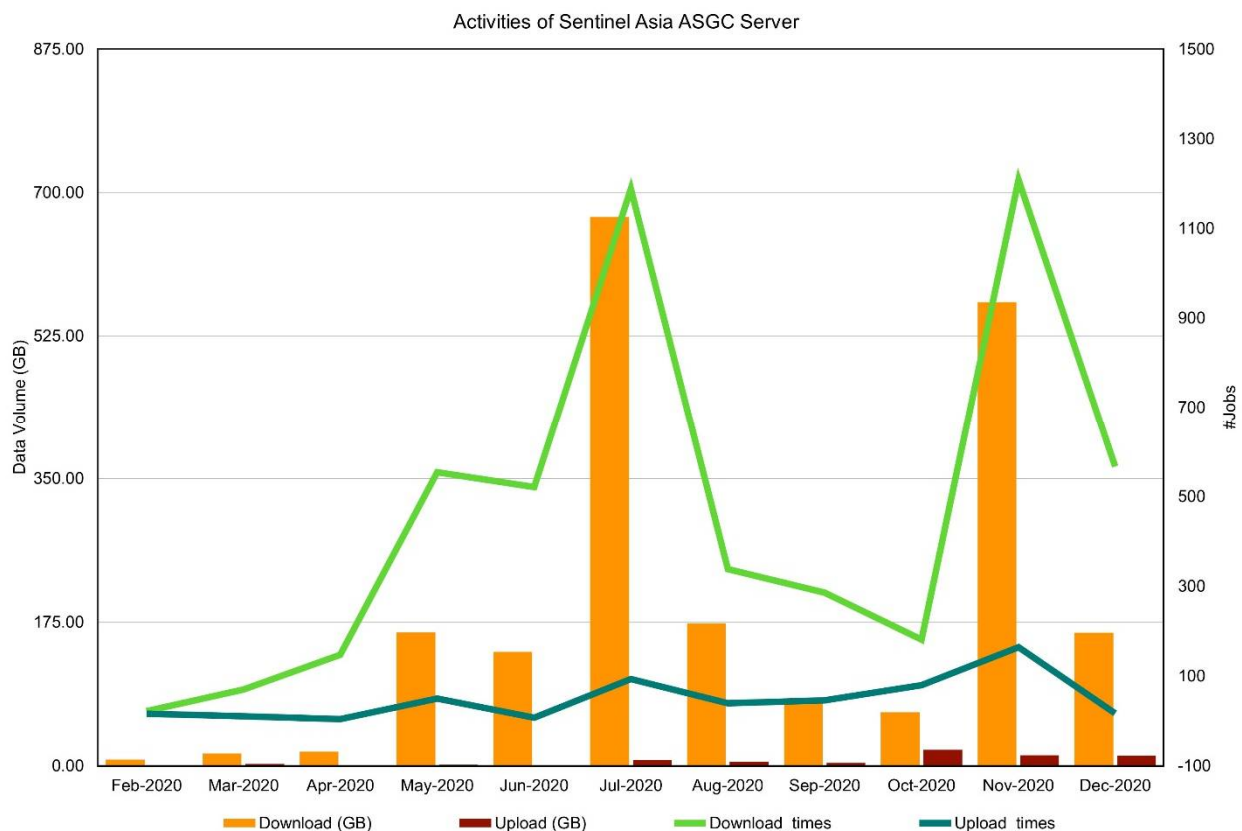
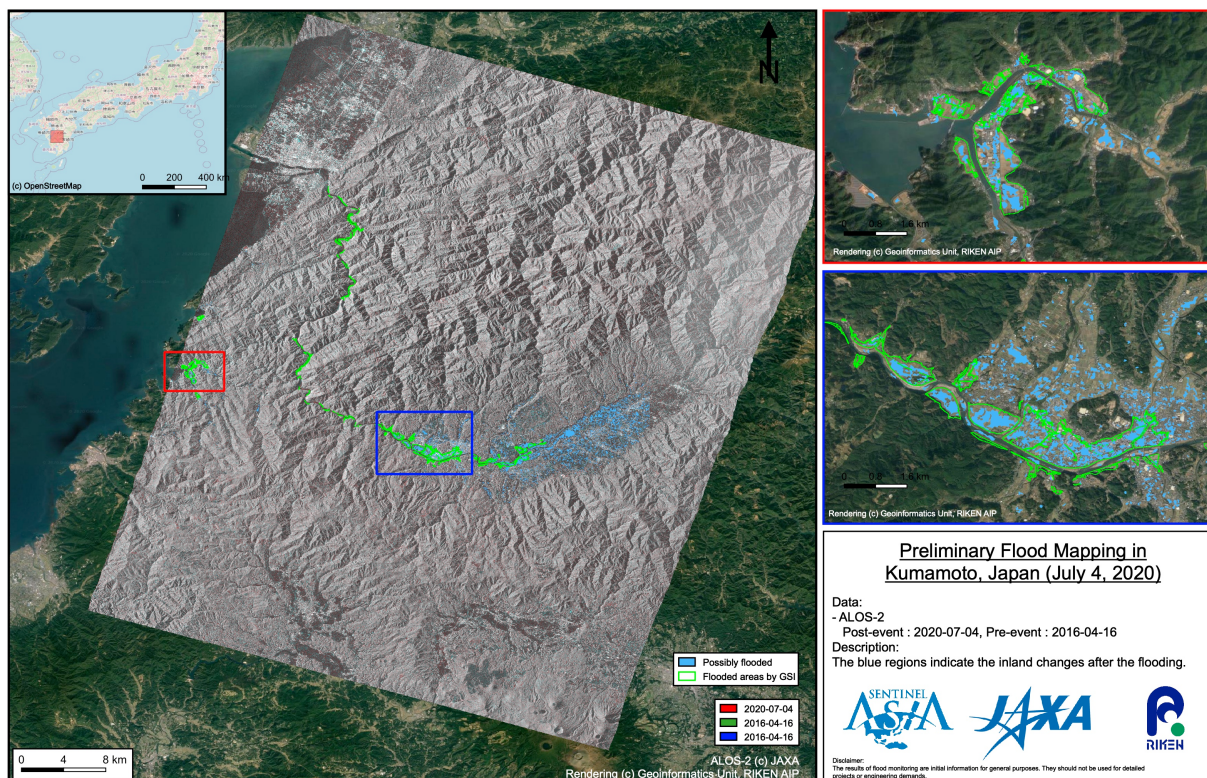


Fig 2 Summary of Sentinel Asia JPT-3 Cloud Services during 2020

<b>Organization</b>	<b>Geoinformatics Unit, RIKEN Center for Advanced Intelligence Project (AIP)</b>
<b>Title</b>	<b>Preliminary Flood Mapping Following Torrential Rain in Kumamoto, Japan</b>
<b>Type of Activity</b>	<b>Disaster Emergency Response</b> (e.g., Emergency activation, Torrential Rain, Flood mapping)
<b>Date</b>	<b>06/07/2020</b>

On July 4, 2020, torrential rains hit Kyushu, Japan, triggering floods and landslides. The Geoinformatics Unit, RIKEN Center for Advanced Intelligence Project conducted a preliminary mapping of the affected areas using ALOS-2 data provided by JAXA through Sentinel Asia. To detect the flooded areas, we carried out a change detection analysis using a pre-event SAR data acquired on April 16, 2016, and a post-event SAR data from July 4, 2020. The image below shows the color composite of ALOS-2 images and the detected flooded areas (blue segments) in Kumamoto, Japan. Visual interpretation results from aerial photos provided by the Geospatial Information Authority of Japan are shown in green polygons.



Flood mapping product. The color composite of ALOS-2 images and the detected flooded areas (blue segments) in Kumamoto, Japan. Visual interpretation results from aerial photos provided by the Geospatial Information Authority of Japan (GSI) are shown in green polygons.



<b>Organization</b>	<b>International Research Institute of Disaster Science, Tohoku University</b>
<b>Title</b>	<b>Combining News Media and AI to Rapidly Identify Flooded Buildings</b>
<b>Type of Activity</b>	<b>Research</b>
<b>Date</b>	<b>21/Nov./2021</b>

Artificial intelligence (AI) has sped up the process of detecting flooded buildings immediately after a large-scale flood, allowing emergency personnel to direct their efforts efficiently. Our research group has created a machine learning (ML) model that uses news media photos to identify flooded buildings accurately within 24 hours of the disaster. The model demonstrates how the rapid reporting of news media can speed up and increase the accuracy of damage mapping activities, accelerating disaster relief and response decisions.

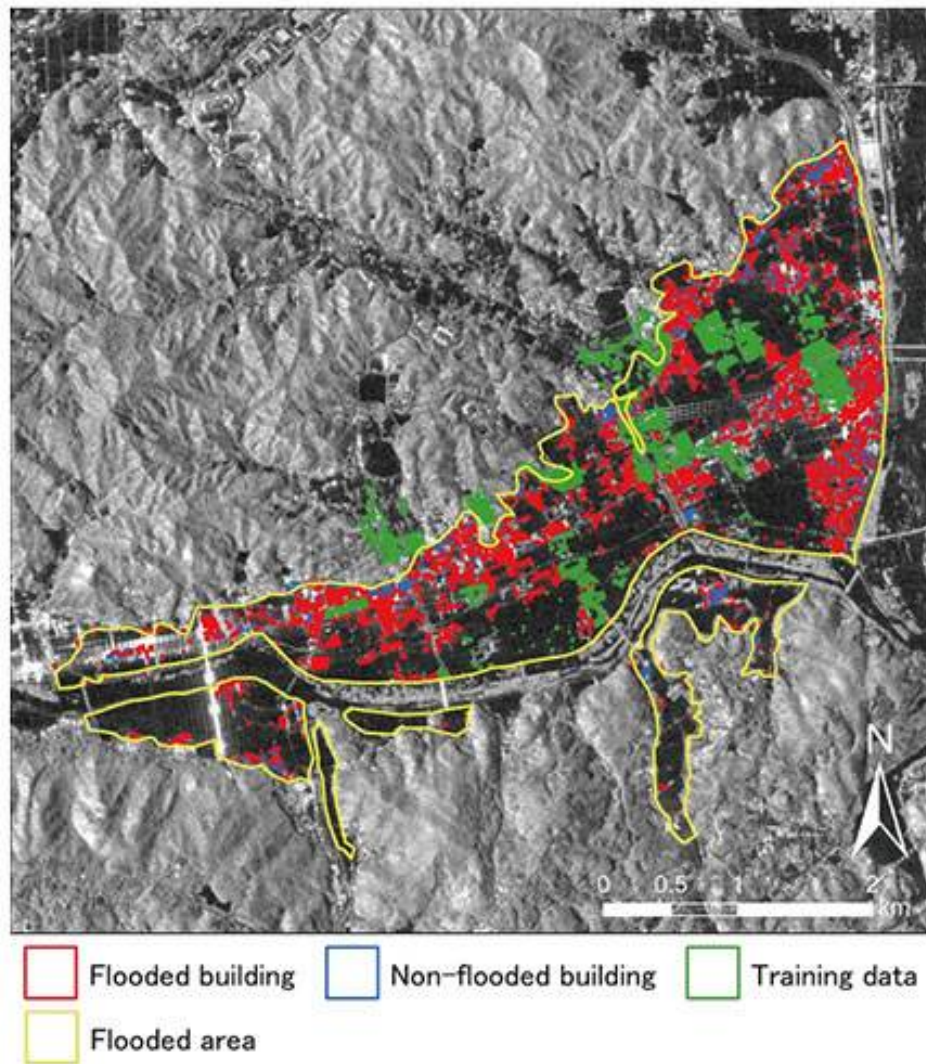
ML and deep learning algorithms are tailored to classify objects through image analysis. For AI and ML to be effective, data is needed to train the model -flood data in the current case. Although flood data can be collected from previous events, it will inadvertently lead to problems on account of every event being different and subject to the local characteristics of the flooded area. Thus, onsite information has higher reliability. News crews and media teams are often the first on the scene of a disaster to broadcast images to viewers at home, and the research team recognized that this information too could be used in AI algorithms. The model is applied to Mabi-town, Kurashiki city in Okayama Prefecture, which was affected by the heavy rains across western Japan in 2018.

First, we identified press photos and geolocated them based on landmarks and other clues appearing in the photo, then used synthetic aperture radar (SAR) PALSAR-2 images provided by JAXA to discretize flooded and non-flooded conditions of unknown areas. Here, SAR images can be employed to classify water bodies since microwaves irradiate differently on wet and dry surfaces. A support vector machine (SVM), one of the machine learning techniques, was used to classify buildings surrounded by floodwaters or within non-flooded areas.

We found that news information taken within 24 h of a disaster can classify flooded and non-flooded buildings with about 80% accuracy. The results were also compared with a standard unsupervised learning method and confirmed that training data generated from news media photographs improves the accuracy obtained from unsupervised classification methods.

This research was published in the journal “Remote Sensing”.

G. Okada, L. Moya, E. Mas, S. Koshimura, The Potential Role of News Media to Construct a Machine Learning Based Damage Mapping Framework, Remote Sensing, 13(7), 1401, 2021. <https://doi.org/10.3390/rs13071401>



The resulted classification shows flooded buildings (red), non-flooded buildings (blue), the learning data from news media (green) and the flooded area (yellow). About 80% of the estimated flooded buildings were actually flooded in the event.

<b>Organization</b>	<b>Udayana University</b>
<b>Title</b>	<b>3rd Human resource development and space data utilization for Disaster</b>
<b>Type of Activity</b>	<b>Workshop</b>
<b>Date</b>	<b>January 9, 2020</b>

Workshop 3rd Human resource development and space data utilization for Disaster hold on 3rd floor of the Postgraduate Building, Udayana University, Denpasar, Bali. Thursday, 9 January 2020. This event aims to present advanced research on disaster management through human resources development and remote sensing utilization. Internationally we are inviting several acknowledged experts to be keynote speakers at this event. By inviting our existing and potential partners, we are looking forward to strengthening and developing existing collaborations and partnerships and exploring a new cooperation form. This event is designed to accommodate intensive discussion based on collaboration interests. Invitees and Participants attended a total of 50 people, including the following agencies.

1. Director of the Postgraduate Program at Udayana University
2. Head of The Institute for Research and Community Service, Udayana University
3. YUCARS, Yamaguchi University
4. CReSOS Udayana University
5. Head of Institute for Marine Research and Observation (IMRO-KKP)
6. The University of Tokyo
7. National Research Institution for Earth Sciences and Disaster and Resilience (NIED)
8. Asian Disaster Reduction Center (ADRC)
9. Bali Provincial Disaster Management Agencies (BPBD)
10. Indonesian Meteorological, Climatological, and Geophysical Agency (BMKG)



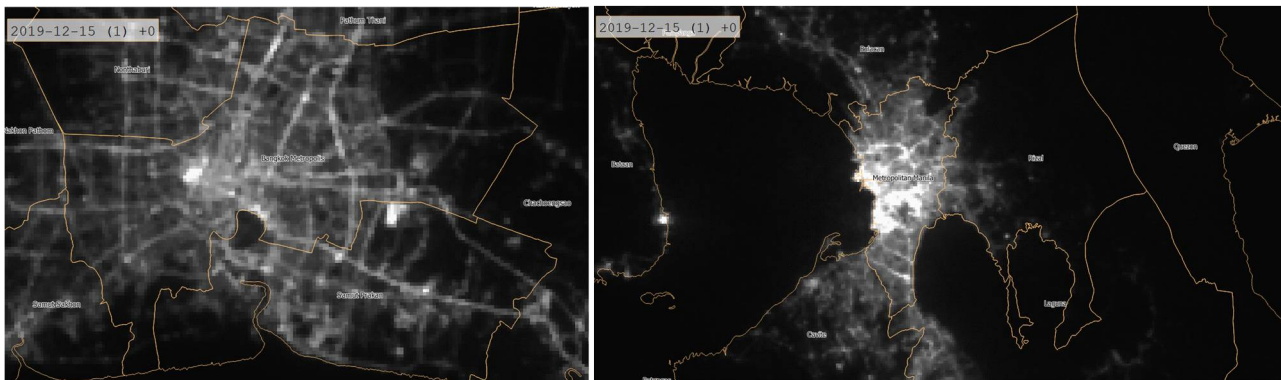


<b>Organization</b>	<b>The University of Tokyo</b>
<b>Title</b>	<b>R&amp;D on applications of large-scale building mapping and night-time light observation for socioeconomic monitoring</b>
<b>Type of Activity</b>	<b>Research and development for data preparedness</b> (e.g., Conference, Workshop, Meeting, Training, EOR, Providing satellite data or VAP)
<b>Date</b>	<b>Through the year in 2020</b>

The University of Tokyo proceeded on research and development of 1) large-scale building mapping from satellite images using deep learning, and 2) socioeconomic monitoring using night-time light observations. The building maps are expected useful for strengthening disaster preparedness of public agencies and, if the data is openly available, also of private sectors and communities. We developed a pilot system of on-demand automated building mapping from high-resolution satellite images of web map services by deep learning techniques. The system demonstrated large-scale building mapping for some cities, such as Sri Lanka, Bangkok, and Maputo. We also demonstrated socioeconomic monitoring from night-time light observation during the COVID-19 crisis, focusing the impact of state of emergency. The activities will be extended to collaborations with JPT members for applications in practice.



Examples of automated building mapping (left: Bangkok; right: Maputo)



Examples of night-time light observation (left: Bangkok; right: Metro Manila)

<b>Organization</b>	<b>Economic Geology and Geomatics Department, Vietnam Institute of Geosciences and Mineral Resources (VIGMR)</b>
<b>Title</b>	<b>Multi projects for the Sentinel Asia</b>
<b>Type of Activity</b>	<b>Research and collaboration</b>
<b>Date</b>	<b>2020</b>

**Introduction:** Economic Geology and Geomatics Department belongs to Institute of Geosciences and Mineral Resources - a basic public research institution under the Vietnam Ministry of Natural Resources and Environment (MONRE), functioning in conducting R&D, consultancy in the fields of geology and mineral resources. In 2019, Economic Geology and Geomatics Department has implemented several activities related to Sentinel Asia as below:

**- Implementing project:**

**a. Establishing a multi-hazard and resilience observatory for Hanoi (MROH)” granted by UKRI in cooperation to BGS.**

With the primary goal of the project: building a multi-hazard observatory, the comprehension data including landslide, soil space, weathering crust, rainfall, river discharge, flood level, v.v ... of Hanoi catchment. The project has carried out technology transfer from the virtual training sessions (BGS) and installation of the instrument

The Sentinel Asia data will be calibrated with the in-situ measurements in the future for disaster management.



Teros 12 soil moisture sensors



OTT Hydrolab HL4



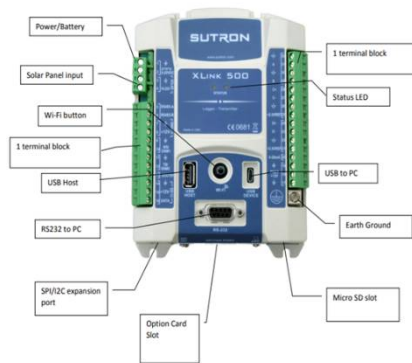
Compact Weather Sensors



Surface Velocity Radar for Measuring Open Channel Flow



Phantom 4 RTK system



Data centre unit XLINK 500



OTT PLS - Pressure Level Sensor

Figure : Sensors and equipment in MROH

### b. Collaboration between VIGMR and VLIR-UOS (VRIJE UNIVERSITEIT BRUSSEL-VUB)

In the framework of Collaboration between VIGMR and VUB, the project “Building capacity for disaster management for the mountainous region of Da Bac district, Hoa Binh Province, Vietnam” was conducted directly by the officials of VIGMR and the project’s partner in Vietnam is Vietnam National University (VNU). In addition, due to the impact of the COVID-19 pandemic, the co-organize VUB and the partner is KU Leuven (Belgium) must cooperate and operate through the online form.

With the ambitions to establish a network of geo-observers for the mountainous region of Hoa Binh Province, Vietnam, fieldworks were conducted for identifying and training geo-observers across different communes of the Da Bac and Mai Chau districts. The geo-observer network of Hoa Binh province was established including 21 members from 7 communes of Da Bac district and 22 members from 8 communes of Mai Chau district.

In May-2020, The project members undertook UAV flight to monitor 2 deep seated landslides in Tien Phong commune. Field survey by UAV will be continued to be performed in next months (October or November, after the rainy season). Additionally, the estimation of economic loss produced by natural hazards will be done through analysing report of damage produce by each district and through household surveying. Coupling these data of damage with the characteristics of the landslide will enable to produce an economic risk map for which the annual average loss for every spatial unit will be calculated.



Field survey in a landslide spot in Da Bac district



Image of a deep landslide in Tien Phong commune taken by UAV flight.

**Training activities:** Organize courses on remote sensing and GIS at GIS lab. Besides, improving soft skills for officials and employees of VIGMR under the project. Organize field trips in areas of the Hanoi catchment, in order to find places to install observer stations and practice using the Phantom 4 RTK drone system.



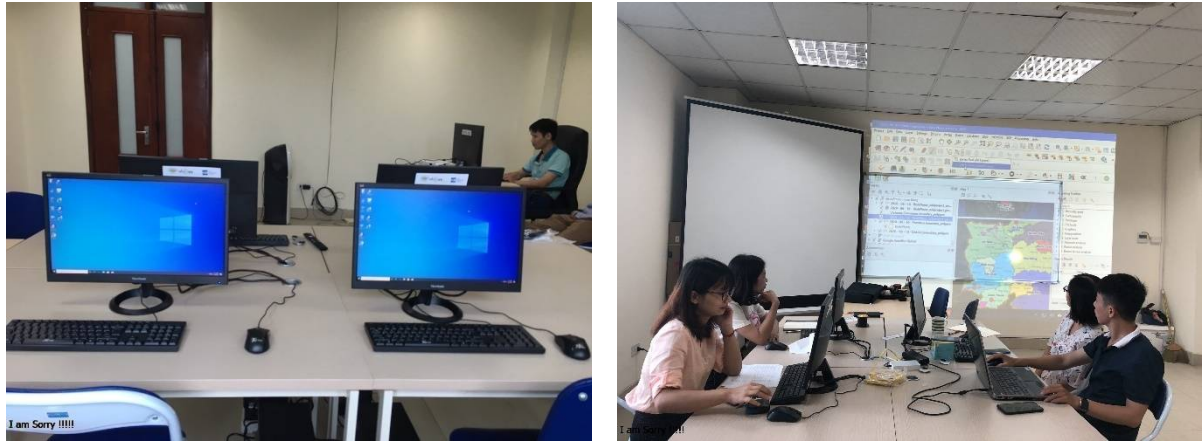


Figure : Facilities of GIS lab and the training activity on GIS

### **c. Establishing GCRF Resilience to Coupled Human-Natural Multi-hazards Network**

'Alliance For Resilient Urban-SE-Asia (ARUSEA)' is the UKRI GCRF Global Network for Resilience to Coupled Human-Natural Multi-hazards with Headquarters in VIGMR. This is one of twenty networks that bring together UK researchers with collaborators from across the developing world to tackle global challenges.

The ARUSEA community is co-developing our flagship program that effectively integrate our approach and generates sustainable prosperity (<https://www.arusea.org/>)

Our mission is to create a global community that empowers vulnerable urban residents to escape the poverty trap by increasing their support system resilience to natural-human hazards.

We manage the disaster risk that hinders the prosperity pathway by addressing the root causes of disaster risk creation. Unveiling the root causes of disaster risk creation is challenging but doable as we are demonstrating in our Hanoi and Metro Manila hyper-expanding cities project..

### **d. Establishing collaboration with local and national stakeholders**

To enhance cooperation and exchange of data, results obtained from multi-hazard studies and projects with the Vietnam Meteorological and Hydrological Administration and the Vietnam Disaster Management Authority. Besides, VIGMR also participated in the workshop "Landslide and Debris flow prevention", Nov 25th - 2020. At the workshop, we presented Sentinel Asia, GEN and MROH projects to stakeholders, universities and institutions. research relationship with emphasis from the UK's GCRF fund, and a representative from the British Council Vietnam.



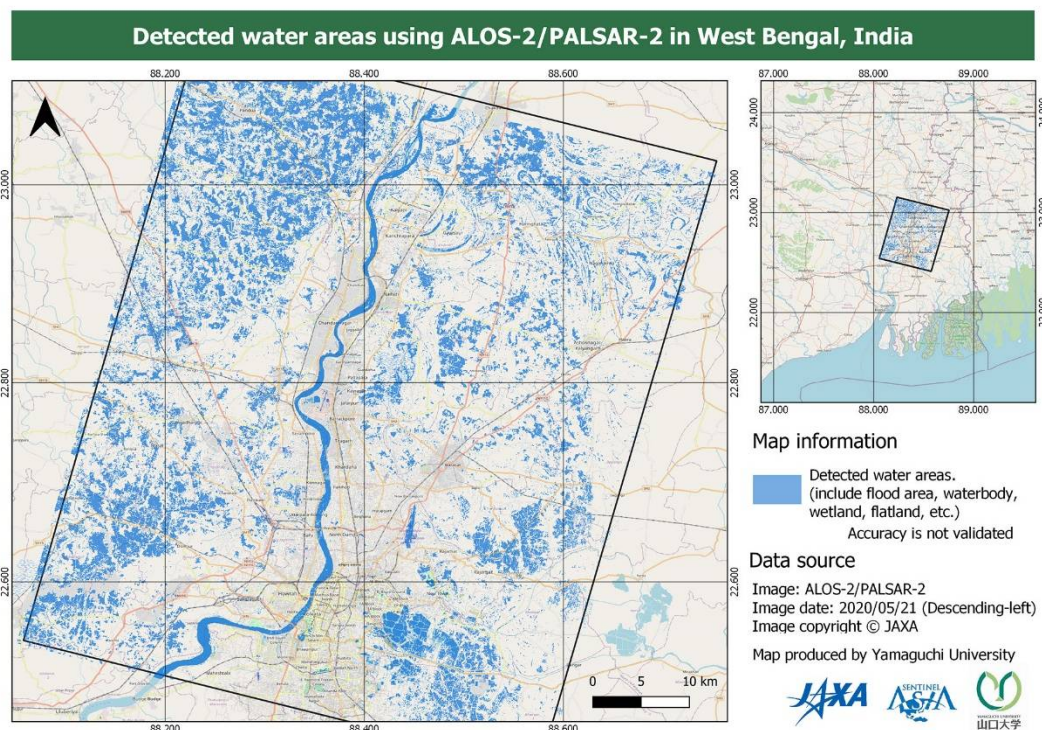


The workshop at Thuy Loi University on Landslide and Debris flow prevention

<b>Organization</b>	<b>Center for Research and Application for Satellite Remote Sensing, Yamaguchi University</b>
<b>Title</b>	<b>Contribution VAPs for EOR activities</b>
<b>Type of Activity</b>	<b>EOR activities</b>
<b>Date</b>	<b>August 2020</b>

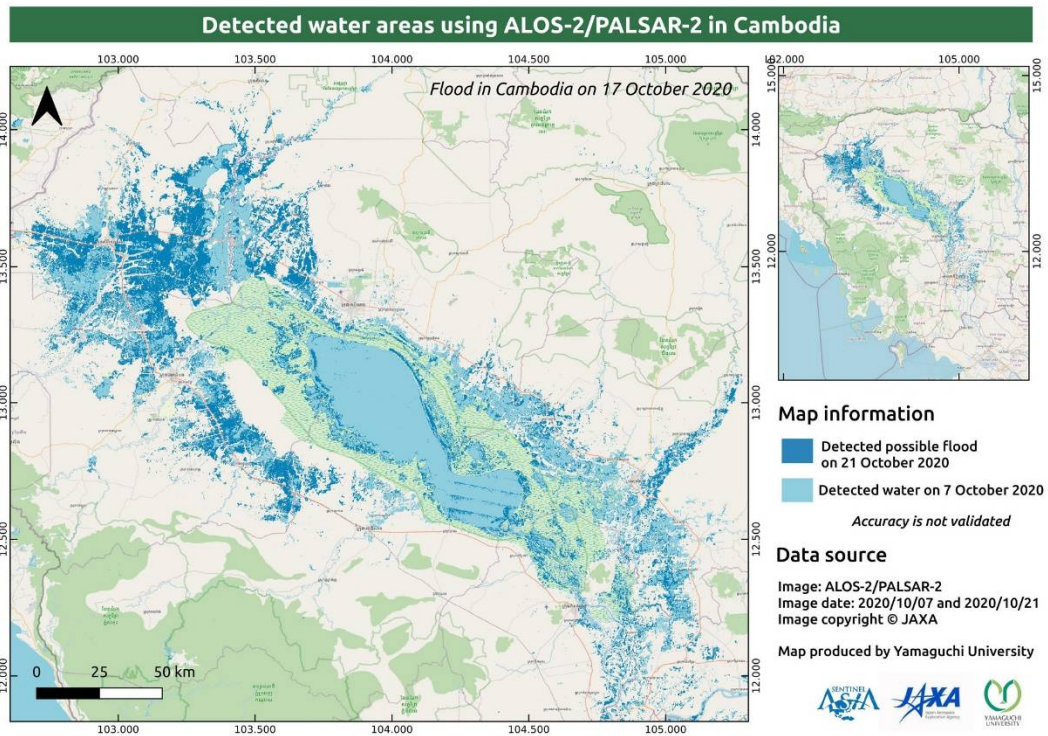
Yamaguchi University, Center for Research and Application of Satellite Remote Sensing, was established in February 2017. There are 4 missions at this center; (1) to promote world-class research in satellite remote sensing, (2) to cultivate human resources capable of promoting a wide range of research in satellite remote sensing and space technology, (3) to contribute to disaster information analysis and improve public safety and security, and (4) to promote local industry and create new industry/business for space utilization technology. Yamaguchi university provided VAPs for following EORs in 2020.

- India: Cyclone, May 2020
- Cambodia: Flood, October 2020
- Philippines: Typhoon GONI, November 2020

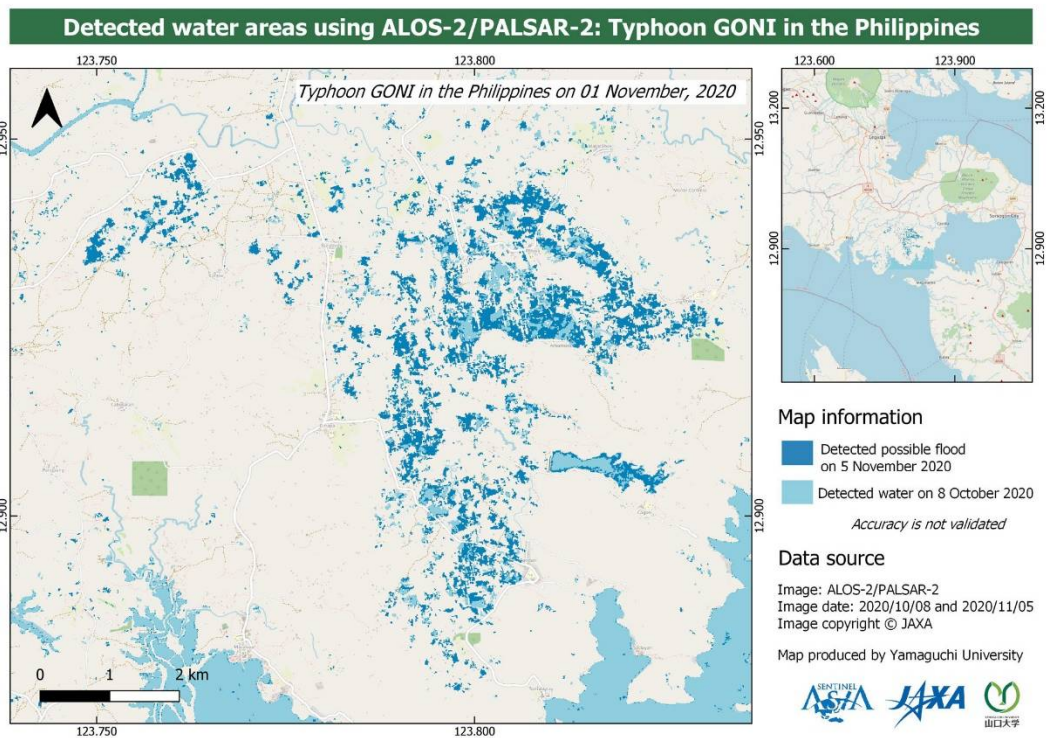


India: Cyclone, May 2020





Cambodia: Flood, October 2020



Philippines: Typhoon GONI, November 2020