



# SENTINEL ASIA ANNUAL REPORT 2019

# Sentinel Asia

# Annual Report 2019

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- JPT member report "Sentinel Asia Activity in 2019"

### 1. Introduction

#### 1.1. Purpose and Scope of the Document

This document describes the activities of Sentinel Asia (SA) in 2019 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 of Sentinel Asia

Chapter 3 Emergency Observation Operation in 2019: results of emergency observation activities in 2019

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

Chapter 5 Communication and Conference: 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							
DAN	Data Analysis Node							
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							
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							
MoWHS	Ministry of Works and Human Settlement (Bhutan)							
NARLabs	National Applied Research Laboratories							
NDMO	National Disaster Management Office (Fiji)							
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			
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 disasters have been on the rise worldwide, including the Asia-Pacific region (Figure 1). The Asia-Pacific region suffers from different types of natural disasters, 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 disasters 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 disasters and an elevated loss of lives and properties from these events, SA, a collaborative, regional project, was conceptualized in 2005, and begun to operate in 2007. It is engaged in activities to share and provide disaster-related information, including earth observation satellite images via the internet, 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 disasters 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, FORMOSAT, IRS, KOMPSAT, THEOS, VNREDSAT, X-SAT and DUBAISAT) in the event of major disasters
- Acceptance of observation requests of 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. To promote the activities of SA, the JPT was organized, which 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 "OPTEMIS", which started to operate in 2019 (Figure 3). Between 2006 and 2019, about 361 EORs have been made or accepted, providing data and products to its members to support disaster management. The four WGs work toward the establishment and improvement of early warning/forecasting systems, as well as monitoring and planning for disaster management in their respective fields.



Figure 3: Flow of Sentinel Asia emergency observation

#### 2.1.4. Current Phase (Step 3) and Ongoing Actions of Sentinel Asia

Out of the 3 Steps employed by Sentinel Asia, the successful completion of Steps 1 and 2 has so far been declared. Step 3 began in 2013, defining its priority areas based on experiences in the earlier Steps and user requests leading to necessary actions as shown in Figure 4.

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 (2007-2019)

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 164 requests (49.2%), followed by earthquakes at 43 (12.9%), landslides at 25 (7.5%), typhoons at 25 (7.5%), forest fires and fires at 17 (5.1%), volcanic eruptions at 17 (5.1%), and cyclones at 14 (4.2%).

Generally, activation is made for around 80% to 90% of requests for most disasters. There is 95.1% activation for flood, but the activation rate is only 41.2% for forest fires.



Figure 5: Breakdown of Emergency Observations by Disaster (2007 - 2019) \*Requests (N=361)





Table 1: Number of Requests, Activations, and Rejections for Emergen	су
Observations by Disaster (2007 - 2019)	

	Number of Request	Number of Activation	umber of Activation Number of Rejection	
Flood	175	164	11	93.7%
Earthquake	49	44	5	89.8%
Landslide	27	22	5	81.5%
Typhoon / Storm	30	28	2	93.3%
Forest Fire	18	8	10	44.4%
Volcano	18	15	3	83.3%
Cyclone	15	14	1	93.3%
Oil Spill	5	3	2	60.0%
Others	24	16	8	66.7%
Total	361	314	47	

#### 3. Emergency Observation Operations in 2019

#### 3.1. Emergency Observation Requests

Figure 7 shows the number of requests, activations and rejections involving emergency observations from 2007 to 2019. 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

All 2019 activations are listed in Table 2. In total, 28 requests were received in 2019. The following three requests were rejected after confirmation with the requester:

- Activation No. 346, Country [India], Disaster type [Flood]
- Activation No. 349, Country [Vietnam], Disaster type [Flood]
- Activation No. 350, Country [Nepal], Disaster type [Flood]

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 11 requests (39.3%), followed by earthquakes at 6 (21.4%), and typhoons at 5 (17.9%).

Activation Number	Country	Disaster Type	Activation Date	Requester
334 Japan		Volcanic Eruption	2019/1/17	JAXA/JMA
335 Indonesia		Flood	2018/3/18	LAPAN
336	Nepal	Storm	2019/4/4	Department of Hydrology and Meteorology
337	Korea	Forest Fire	2019/4/5	NDMI
338	Philippines	Earthquake	2019/4/27	PHIVOLCS
339	Philippines	Earthquake	2019/4/27	PHIVOLCS
340	India	Cyclone	2019/5/2	ISRO
341	Turkey	Landslide	2019/5/29	AFAD
342	Bhutan	GLOF	2019/6/22	МОНСА
343	China	Earthquake	2019/6/22	CEA
344	Vietnam	Flash Flood	2016/6/26	MONRE DMPTC
345	Indonesia	Earthquake	2019/7/15	LAPAN BNPB
346	India	Flood		SIU
347	Myanmar	Flood	2019/8/14	AHA Center RRD
348	Japan	Flood	2019/8/28	YMGU, NIED
349	Vietnam	Flood		MONRE
350	Nepal	Flood		DHM, MOHA
351	Vietnam	Flood	2019/9/5	MONRE, DMPTC
352	Laos	Flood	2019/9/6	AHA Center, NDMO
353	Thailand	Flood	2019/9/21	AHA Center, DDPM
354	India	Flood	2019/9/30	ISRO, DMS
355	Japan	Typhoon	2019/10/11	JAXA, CAO
356	Philippines	Earthquake	2019/11/1	PHIVOLCS
357	Vietnam	Typhoon	2019/11/7	MONRE, DMPTC
358	Philippines	Typhoon	2019/12/9	МО
359	Kyrgyzstan	Landslide	2019/12/10	CAIAG
360	Philippines	Earthquake	2019/12/16	МО
361	Fiji	Typhoon	2019/12/31	SPC, NDMO(Fiji)

#### Table 2: List of 2019 Activations

\*ID 346, 349 and 350 were rejected.



Figure 8: Breakdown of Emergency Observations by Disaster \*Requests in 2019 \*Requests (N=28)



Figure 9: Breakdown of Emergency Observations by Disaster \*Activations in

2019

# \*Activations (N=25)

#### 3.2. Results of Emergency Observations

During 2019, the monthly average of activations was 2.1. Figure 10 shows the monthly distribution of activations throughout 2019. The highest number of activations occurred in April, September, and December, corresponding to 48.0% of the total number. The remaining months of 2019 saw a number of activations that varied from 0 to 3.



Figure 10: Number of monthly activations in 2019

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 and Indonesia. The highest number of activations was the Philippines, at 5 activation. A request from the AFAD of Turkey was accepted for the first time.



Figure 11: Number of activations by country in 2019

Figure 12 shows the number of implementations by DPN. In total, 65 implementations were made in 2019, and satellite data was provided to the requesters.



Figure 12: Number of responses by DPN in 2019

DPN have 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 2019

Figure 14 shows the number of implementations by DAN in 2019. In total, 69 were implemented, and VAP were provided to requesters. Figure 15 shows the number of provided VAP in 2019.



Figure 14: Number of responses by DAN in 2019



Figure 15: Numver of VAP by DAN in 2019

#### 3.3. Good Practices

#### 3.3.1. GLOF in Bhutan (June 2019)

[EOR Requestor] National Center for Hydrology and Meteorology, Bhutan [SA website URL] <u>https://sentinel-asia.org/EO/2019/article20190620BT.html</u>

The Thorthormi-Lake is one of the potentially dangerous lakes which has the possibility to cause a Glacial Lake Outburst Flood (GLOF) in Bhutan. The Thorthormi-Lake in the head waters of Phochu was partially bridged on 20th June during the nighttime. The National Center for Hydrology and Meteorology submitted an EOR because of the detection of an advance warning of a hazardous situation. Sentinel Asia received an EOR related to this disaster from the National Center for Hydrology and Meteorology on the 21st of June 2019, and activated it the next day. The ADRC confirmed the EOR sheet and transferred a DPN/DAN. First satellite images from the DPN were provided on the 26th of June. Finally, 10 satellite images were provided by JAXA, ISRO and GISTDA, and the AIT, operating as a DAN, provided support on the 27th of June as shown in figure 16AA.

The National Center for Hydrology and Meteorology shared the "provided data (satellite images and VAPs)" at an emergency meeting held on the 21<sup>st</sup> of June 2019, chaired by the Cabinet Secretary and attended by the Secretary, Ministry of Home and Cultural Affairs, Dasho Zimpon of His Majesty's Secretariat and officials of the Department of Disaster Management (DDM). The provided data was also shared with different divisions of the Center-Cryosphere Services Division and the Hydrology and Water Resources Services Division for filed surveys on-site, and making internal reports. (news source: <u>https://kuenselonline.com/experts-to-visit-thorthormi-today/</u>)

(news source: <u>https://www.thethirdpole.net/2019/07/10/glof-bhutan/</u>)



Figure 16: VAP (provided by AIT)

3.3.2. Landslide in Kyrgyzstan (December 2019)

[EOR Requestor] Central-Asian Institute for Applied Geosciences (CAIAG) [SA website URL] <u>https://sentinel-asia.org/EO/2019/article20191201KG.html</u>

The Central Asian Institute of Applied Geosciences (CAIAG) is an independent nonprofit organization and was founded in 2002 under a cooperative agreement between the Government of the Kyrgyz Republic and the German GeoForschungs Zentrum, Potsdam, Germany. CAIAG is also the only JPT member that functions as a DAN in Kyrgyzstan. CAIAG participated in the 7th Joint Project Team Meeting (JPTM 2019), which was held from the 12<sup>th</sup> to the 14<sup>th</sup> of November 2019 in Bangkok, Thailand. It was jointly organized by the Asian Disaster Preparedness Center (ADPC) and the Japan Aerospace Exploration Agency (JAXA). At the meeting, CAIAG conducted a presentation entitled "Possible Ways to Improve Sentinel Asia's Potential in Central Asian Countries" and joined a training workshop session that included an explanation about EORs when using OPTEMIS.

After CAIAG participated in JPTM, a large landslide occurred in a waste pile at the Kumtor mining camp in Kyrgyzstan on the 1st of December 2019. Two people died in the landslide. According to a public report, the volume of the landslide was around 12 million cubic meters. Sentinel Asia received an EOR related to the disaster from the CAIAG and the Ministry of Emergency Situation in Kyrgyzstan on the 1st of December 2019.

The last EOR received from Kyrgyzstan was related to a flood which occurred in March 2012. The experience and knowledge acquired by CAIAG through JPTM 2019 contributed toward this EOR for the December 2019 landslide, after a gap of around 9 years.

ADRC confirmed the EOR sheet and transferred a DPN/DAN on the 10th of December. The first satellite images from the DPN were provided on the 12th of December. Finally, 21 satellite images were provided by JAXA, NARLabs, ISRO and GISTDA, and JAXA provided a WEB-GIS system that was unable to confirm the provided satellite images, as shown in Figure 17. CAIAG shared the "provided data (satellite images)" to the Department of Monitoring, Forecasting of Emergencies under the Ministry of Emergency Situations of the Kyrgyz Republic, as well as Indian International Remote Sensing. This data was used for making the "Extraction of depletion and accumulation zones" report and improving the capacity of young researchers to use and process satellite data.



Figure 17: WEB-GIS (provided by JAXA)

3.3.3. Earthquake in the Philippines (December 2019)

[EOR Requestor] Manila Observatory (MO)

[SA website URL] https://sentinel-asia.org/EO/2019/article20191215PH.html

The Philippines is a one of the major disaster-prone countries in Asia. Large scale disasters such as typhoons, cyclone, volcanos, and earthquakes have been occurring every year. The Manila Observatory (MO) is a non-profit research institute housed on the campus of the Ateneo de Manila University in Quezon City, Philippines. The MO is also one of the JPT members that functions as a DAN in the Philippines.

MO also participated in the 7th Joint Project Team Meeting (JPTM 2019), which was held from the 12<sup>th</sup> to the 14<sup>th</sup> of November 2019 in Bangkok, Thailand. At the meeting, MO conducted a presentation entitled "Sentinel Asia DAN Updates, PHILIPPINES", and joined a training workshop session that included an explanation about EORs when using OPTEMIS.

After the MO participated in JPTM, a magnitude 6.9 earthquake hit the southern Philippine island of Mindanao on the 15<sup>th</sup> of December. Reliefweb reported that in Davao del Sur, Mindanao, more than 378,000 people were affected, over 210 people were injured, and there were 13 fatalities. Sentinel Asia received an EOR related to the disaster from the MO on the 16th of December 2019. The experience and knowledge acquired by the MO through JPTM 2019 contributed toward the swift submission of an EOR.

ADRC confirmed the EOR sheet and transferred a DPN/DAN on the same day. The first satellite images from the DPN were provided on the 17th of December. Finally, 12 satellite images were provided by JAXA, NARLabs and ISRO, and the EOS, operating as a DAN, provided support through a VAP on the 20th of December, as shown in figure 18. There are 9 JPT members in the Philippines, and 5 of the members operate as DANs. However, there is no DPN in the country, so the MO filed a request for the EOR and collected the satellite images in order to share them with other DANs in the Philippines.



Figure 18: VAP (provided by EOS)

ARIA-SG Damage Proxy Map: Philippines Earthquake, 25 Dec 2019, v1.0

2019, v1.0 This preliminary map shows areas which are likely damaged (shown by colured pixels of 30 m in size) in southern Philippines due to the MM 6.8 earthquake on 15 Dec 2019. Vellow to ref indicates increasingly significant ground surface change before and after the event. The map before and after the event. The map before and after the event. The map southers are indicated by the white polygon. This map should be used as guidance to identify damaged areas, and may be less reliable over vegetated areas. Scattered pixels over vegetated areas may be false positives, and a lack of coloured pixels over vegetated areas may not mean no damage.

mean no damage. Derived from synthetic aperture radar data acquired by the Coperricus Sentinel-1 satellites operrated by the European Space Agency (ESA) before (13 Dec) and after (25 Dec) the event. Analysed by the ARIA-SG team at the Earth Observatory of Singapore (EOS) in Collaboration with NASA-JPL and Caltech. Data processing used an AWS Open Dataset of Copernicus Sentinel-1 data for the Asia region (https://registry.opendata.ws/ sentinel1-alc-seasia-pds).



3.3.4. Typhoon in Fiji (December 2019)

[EOR Requestor] Secretariat of the Pacific Community (SPC/SOPAC) [SA website URL] <u>https://sentinel-asia.org/EO/2019/article20191228FJ.html</u>

Fiji is an island country located in the South Pacific, and consists of more than 300 islands. The Pacific Community (SPC) is an international development organization owned and governed by its 26 country and territory members, including Fiji. The National Disaster Management Office (NDMO) in Fiji is also a major disaster management organization in the country.

The NDMO also participated in the 7th Joint Project Team Meeting (JPTM 2019), which was held from the 12<sup>th</sup> to the 14<sup>th</sup> of November 2019 in Bangkok, Thailand. At the meeting, the NDMO reported on a past EOR activity in Fiji, and joined a training workshop session that included an explanation about EORs when using OPTEMIS.

After the NDMO participated in JPTM 2019, Tropical Cyclone "Sarai" passed through the Fijian islands from the 28<sup>th</sup> of December 2019, and continued to progress through the country on the 30<sup>th</sup> of December. There were two fatalities, and more than 2,500 people were evacuated to evacuation centers. The cyclone also brought strong winds and heavy rain to south-east Fiji. Sentinel Asia received an EOR related to the disaster from the SPC and NDMO on the 30th of December 2019.

The last EOR received from Fiji was related to cyclone which occurred in February 2016. The experience and knowledge acquired by the NDMO through JPTM 2019 contributed toward this EOR for Tropical Cyclone Sarai, after a gap of around 5 years.

ADRC confirmed the EOR and transferred a DPN/DAN on the 31st of December. The first satellite images from the DPN were provided on the 2nd of January 2020. Finally, 6 satellite images were provided by ISRO and NARLabs. The SPC shared the "provided data (satellite images)" to the National Emergency Operations Centre and used it for a field assessment. The data was also included in the map and internal documents. (news source: http://floodlist.com/australia/fiji-tropical-cyclone-sarai-december-2019)



Figure 19: Satellite image (provided by NARLabs)

#### 4. External Relations

#### 4.1. Accession of New Members

In 2019, the following three organizations joined SA. An introduction from the Japan International Cooperation Agency (JICA) is shown as follows.

- RIKEN

#### - Japan International Cooperation Agency (JICA)

#### 4.1.1. Message from the Japan International Cooperation Agency (JICA)

JICA was established as an independent administrative institution in charge of the administration of Japan's ODA. It is one of the largest bilateral aid agencies supporting socioeconomic development in developing countries. JICA also assists developing countries in building a society that is more disaster-resilient than before.

Developing countries are especially vulnerable to natural disasters. For this reason, once a large-scale disaster strikes a developing country, the outcomes of development and opportunities for sustainable growth for the country will be lost, making it difficult for the country to untangle itself from the downward spiral of disaster and poverty. It is important to understand the damage situation soon after a disaster occurs, and to take necessary actions for recovery and reconstruction. Following the earthquake in central Sulawesi, Indonesia last year, for example, JICA provided support for the Indonesian Government to formulate a recovery plan. Thanks to Sentinel Asia and its member organizations, JICA was able to utilize the satellite images and analysis results to understand the actual damage incurred. In this way, we have found SA capabilities to be incredibly effective and efficient.

JICA's post-disaster assistance focuses on the rehabilitation of infrastructure as well as the recovery of societies and livelihoods based on the concept of Build Back Better. JICA also pursues seamless cooperation that covers different phases, from response to recovery and reconstruction. As such, we hope to utilize the information provided from Sentinel Asia in our operations.

JICA is honored to be accepted as a member organization of Sentinel Asia, and we look forward to cooperating with its other members.

# 4.2. Collaboration and Cooperation

### 4.2.1 International Disaster Charter

The rollout to IDC began in February 2010 as required. Five disasters were escalated through SA in 2019.

Activation Number	Country	Disaster Type	Activation Date	Requester	Project Manager
335	Indonesia	Flood	18-Mar-19	Lapan	Philippine Institute of Volcanology and Seismology (PHIVOLCS) - DOST
348	Japan	Flood	28-Aug-19	YMGU, NIED	Yamaguchi University (YMGU)
355	Japan	Typhoon	11-Oct-19	JAXA, CaO	Yamaguchi University (YMGU)
356	Phillipnes	Earthqueke	1-Nov-19	PHIVOLCS	PHIVOLCS
361	Fuji	Typhoon	31-Dec-19	SPC, NDMO (Fiji)	Asian Institute of Technology (AIT)

Table 3 List of Charter Escalation in 2019

### 5. Conferences and Press Releases

#### 5.1. Conferences

5.1.1. Steering Committee Meeting of Sentinel Asia, 29-30 January 2019
Organizer: Geo-Informatics and Space Technology Development Agency (GISTDA) and
Japan Aerospace Exploration Agency (JAXA)
Date: 29-30 January 2019
Venue: Space Krenovation Park, Sriracha, Thailand

The Sentinel Asia Steering Committee Meeting was held in Thailand, from the 29<sup>th</sup> to the 30<sup>th</sup> of January 2019. The meeting was organized by GISTDA and JAXA. JAXA serves as the secretariat of Sentinel Asia's Joint Project Team. The purpose of this Steering Committee Meeting of Sentinel Asia was to review the current status of the Strategic Plan documents and activities by leading agencies, to discuss how to promote realization of Step 3 – which covers all disaster cycles – and to discuss strategies on private sector involvement in Sentinel Asia activities.

Opening remarks were made by Mr. Koji Suzuki, the co-chairperson of Sentinel Asia. These were followed by a briefing by JAXA on the Steering Committee Mandate, and the status on and lessons learned from emergency observations conducted thus far. All of these helped demonstrate the advantages of satellite imagery for DRR purposes. There were also many participants from space agencies and research organizations (e.g. AIT, GISTDA, NARLab, University of Tokyo, Yamaguchi University, ISRO, IWMI, NIED, etc.). These organizations reported on their various activities that focus on basic approaches for discussing strategic plans, which will be discussed throughout the year in preparation for the APRSAF, scheduled for the fall of 2020.



**Photo 1: Group Photo** 

#### 5.1.2. Global Platform 2019

Organizer: United Nations Office for Disaster Risk Reduction (UNDRR)

Date: 13-17 May 2019

Venue: Geneva, Switzerland

The Sixth Session of the Global Platform for Disaster Risk Reduction (GP2019) was held at the International Conference Centre Geneva in Geneva, Switzerland, from the 13<sup>th</sup> to the 17<sup>th</sup> of May 2019. The Global Platform has been recognized by the UN General Assembly Resolution, and has been held bi-annually since 2007 to provide a venue for professionals working on DRR from many different stakeholder groups to get together. The groups represented at this year's event included national governments, international organizations, regional organizations, academic institutes, civil societies, and the private sector. This sixth meeting was co-hosted by the government of Switzerland, as well as UNDRR, and was attended by representatives from 182 countries.

Dr. Hiroshi Yamakawa, President of JAXA, participated through a session entitled "Risk-Informed Public and Private Investments", and provided a keynote statement. The statement was related to the connection between the Sendai Framework for Disaster Risk Reduction and space technology, the utilization and development of satellite images for disaster response in Japan and overseas, and activities and recent examples from Sentinel Asia, in which JAXA has a lead role.

JAXA also conducted an internal meeting with the Cabinet Office in Japan and the AFAD (Turkey), in order to strengthen the SA network in Middle East Asia.



**Photo 2: Training** 



**Photo 3: Training** 

5.1.3. 7th Joint Project Team Meeting (JPTM)
Organizer: Asian Disaster Preparedness Center (ADPC) and Japan Aerospace
Exploration Agency (JAXA)
Date: 12-14 November 2019
Venue: Marriott Bangkok, Bangkok, Thailand

The 7th Joint Project Team Meeting for Sentinel Asia STEP-3 (JPTM2019) was held at the Courtyard by Marriott Bangkok, Bangkok, Thailand, from the 12<sup>th</sup> to the 14<sup>th</sup> of November, 2019. It was jointly organized by the Asian Disaster Preparedness Center (ADPC) and the Japan Aerospace Exploration Agency (JAXA). Roughly 70 participants, including representatives of satellite agencies, disaster management organizations, and academic institutions in Japan, attended the meeting. The meeting primarily covered the following topics:

Session 1: Overview

Session 2: New Membership

Session 3: Users' Session

Session 4: Training Workshop

Session 5: Strengthened link between Sentinel Asia and the Sendai Framework

- Session 6: Project Management Session
- Session 7: Wrap-up session



**Photo 4: Group Photo**
5.1.4. Asian Conference on Disaster Reduction 2019
Organizer: Government of Turkey (Disaster and Emergency Management Authority (AFAD), Government of Japan (Cabinet Office), ADRC
Date: 25-27 November 2019
Venue: Sheraton Ankara Hotel & Convention Center, Ankara, Turkey

The Asian Conference on Disaster Reduction, ACDR2019, was organized by the Government of Turkey, the Government of Japan, and the Asian Disaster Reduction Center (ADRC), and was held from the 25<sup>th</sup> to the 27<sup>th</sup> of November 2019 in Ankara, Turkey. ACDR2019 focused its sessions on five thematic areas that are aligned with the Sendai Framework for Disaster Risk Reduction and Sustainable Development Goals. There were 4 sessions in this conference, and Mr. Miyoshi Takanori (JAXA) highlighted the advantages of using satellite emergency observations to improve disaster response. He cited the Aybasti Landslide of May 2019 in Turkey, where AFAD requested a satellite photo image of the impacted area. Along with the web-based GIS information, the disaster responders were able to gain an understanding of the nature and depth of landslide.



Photo 5: Group Photo

5.1.5. 26th Session of the Asia-Pacific Regional Space Agency Forum (APRSAF-26) Organizer: Ministry of Education, Culture, Sports, Science and Technology (MEXT) and Japan Aerospace Exploration Agency (JAXA)

Date: 26-29 November 2019

Venue: Nagoya, Japan

The APRSAF was established in 1993 to enhance space activities in the Asia-Pacific region. Attended by space agencies, governments, and international organizations such as the United Nations, as well as companies, universities and research institutes, this forum is the largest space-related conference in the Asia-Pacific region. APRSAF has four Working Groups: the (1) Space Applications Working Group (SAWG), (2) Space Technology Working Group (STWG), (3) Space Environment Utilization Working Group (SEUWG), and (4) Space Education Working Group (SEWG). APRSAF participants share information about their activities and future plans for their countries and regions in each working group. APRSAF also supports international projects designed to find solutions to common issues, such as disaster management and environmental protection. The Secretariat of Sentinel Asia had one session at the Space Applications Working Group (SAWG), which was held on the 27<sup>th</sup> of November. Reports on activities by JAXA, NSPO, AIT, GISTDA, Yamaguchi University, and ADRC were made.



**Photo 6: Group Photo** 

#### 5.2. Documents, Press Releases and Papers

#### 5.2.1. Cooperation Agreement between NARLabs and JPT-3

The National Applied Research Laboratories (NARLabs) and the Joint Project Team for Sentinel Asia Step-3 (JPT-3) signed a Cooperation Agreement in Hsinchu, Taiwan, on the 25<sup>th</sup> of January 2019. The purpose of this Cooperation Agreement is to set forth the contributions of NARLabs to Sentinel Asia concerning Sentinel Asia regional cloud servers.

(news source:

https://www.narlabs.org.tw/en/xmdoc/cont?xsmsid=0I160457997407279810&sid=0J0445764 82119662586)

#### 5.2.2. Broadcast by euronews

Dr. Shiro Kawakita of JAXA was interviewed on euronews regarding disaster management using a JAXA satellite, and efforts made by Sentinel Asia. The interview was broadcast on euronews on the 22<sup>nd</sup> of February 2019, and released on its website. (news source: <u>https://sentinel-asia.org/media/Media.html</u>)

#### 5.2.3. ASEAN Risk Monitor and Disaster Management Review (ARMOR)

The ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre) launched the first edition of the "ASEAN Risk Monitor and Disaster Management Review (ARMOR)" on the 20<sup>th</sup> of March 2019. This first edition of ARMOR has the subtitle "Bridging Science and Decision Making", and aims to provide science-based resources for policymakers and the disaster management community in the ASEAN region. The launch was celebrated at an inauguration ceremony attended by high-level officials of the community, including the Executive Director of the AHA Centre and the Deputy Secretary-General of ASEAN Community and Corporate Affairs.

ARMOR underlines the benefit of Sentinel Asia for the ASEAN region by introducing several cases in which Sentinel Asia was particularly useful, and notably recommends that all national disaster management organizations (NDMOs) of ASEAN Member States should be exposed to the Sentinel Asia platform. The highlight of Sentinel Asia in ARMOR is a remarkable milestone in the Sentinel Asia's history. Through collaboration between the AHA Centre and Sentinel Asia, such virtuous opportunities are expected to continue.

(news source: <u>https://sentinel-asia.org/topics/Topics.html</u>)

#### 5.2.4. Global Assessment Report on Disaster Risk Reduction (GAR)

The UN Global Assessment Report on Disaster Risk Reduction (GAR) is the flagship report of the United Nations on worldwide efforts to reduce disaster risk. The GAR is published biennially by the UN Office for Disaster Risk Reduction (UNDRR), and is the product of the contributions of several nations' public and private disaster risk-related science and research, amongst others. Several members from Sentinel Asia posted an academic report entitled "Development of Sentinel Asia as a platform to facilitate spacebased technology application to disaster management operations" for GAR 2019. (news source: <u>https://www.undrr.org/publication/development-sentinel-asia-platform-</u>

facilitate-space-based-technology-application)

#### 5.2.5. Newsletter

The secretariat of SA publishes a monthly newsletter for member organizations. The following are the topics covered by the newsletters issued in 2019.

#### January 2019

- 1. [News] Emergency Observation of Disasters Occurring in December 2018
- 2. [News] New Sentinel Asia Website
- 3. [News] Cooperation Agreement between NARLabs and JPT-3
- 4. [Announcement] Emergency Observation Request (EOR)
- 5. [Announcement] Requests to JPT Members
- 6. [Events]

#### February 2019

- 1. [News] Emergency Observation of Disasters Occurring in January 2019
- 2. [Report from Members] ADRC participated in Human Resource Development and Space Data Utilization for Disasters Symposium
- 3. [Announcement] Sentinel Asia Annual Report 2017
- 4. [Announcement] Emergency Observation Request (EOR)
- 5. [Announcement] Requests to JPT Members
- 6. [Events]

#### March 2019

- 1. [News] Emergency Observation of Disasters Occurring in February 2019
- 2. [News] Welcome New Member
- 3. [Announcement] Emergency Observation Request (EOR)
- 4. [Announcement] Requests to JPT Members
- 5. [Events]

#### April 2019

- 1. [News] Emergency Observation of Disasters Occurring in March 2019
- 2. [News] The AHA Centre launched the first "ASEAN Risk Monitor and Disaster Management Review

#### (ARMOR)"

- 3. [Announcement] Emergency Observation Request (EOR)
- 4. [Announcement] Requests to JPT Members
- 5. [Events]

#### <u>May 2019</u>

- 1. [News] Emergency Observation of Disasters Occurring in April 2019
- 2. [News] Welcome New Member
- 3. [News] Risk Affects Business Performance
- 4. [Announcement] User Password will be changed in June (Sentinel Asia Step 2 System)
- 5. [Announcement] Message from JICA
- 6. [Announcement] Emergency Observation Request (EOR)
- 7. [Announcement] Requests to JPT Members
- 8. [Events]

#### June 2019

- 1. [News] Emergency Observation of Disasters Occurring in May 2019
- 2. [Announcement] User Password will be changed in June (Sentinel Asia Step 2 System)
- 3. [Announcement] Questionnaire on Sentinel Asia STEP3 and Sendai Framework for DRR
- 4. [Announcement] Emergency Observation Request (EOR)
- 5. [Announcement] Requests to JPT Members
- 6. [Events]

#### July 2019

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

#### August 2019

- 1. [News] Emergency Observation of Disasters Occurring in June 2019
- 2. [News] Development of Sentinel Asia as a Platform to Facilitate Space-based Technology Application
- to Disaster Management Operations
- 3. [Report from Members] 9th Annual UN-SPIDER Regional Support Offices (RSO) Coordination Meeting
- 4. [Report from Members] Development of Sentinel Asia as a Platform to Facilitate Space-based Technology Application to Disaster Management Operations
- 5. [Announcement] Emergency Observation Request (EOR)
- 6. [Announcement] Requests to JPT Members
- 7. [Events]

#### September 2019

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

#### October 2019

- 1. [News] Emergency Observation of Disasters Occurring in September 2019
- 2. [News] New Sentinel Asia system has been released.
- 3. [Announcement] Emergency Observation Request (EOR)
- 4. [Announcement] Requests to JPT Members
- 5. [Events]

#### November 2019

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

## December 2019

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

## 6. Assessment of Sentinel Asia Operations

## 6.1. Analysis of Operational Performance

Figure 20 summarizes the number of days from the occurrence of the 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 2019.



Figure 20: Number of Days Required from Disaster Occurrence to Request

Figure 21 shows the number of days that were required from the date the request is received to activation. Overall, it took 0.24 days from request to activation in 2019. This is an improvement over last year.



Figure 21: Number of Days Required from Request to Activation

Figure 22 to Figure 23 indicates the average number of days required to provide each data for each year, and the percentage of completed data provisions. Figure 24's Archive Satellite Data indicates that the percentage of provisions improved from 2016, totaling 80.0% in 2019. However, the average number of days required rose to 3.6 days from last year's 2.0.



Figure 22: Average Number of Days Required to Provide Archive Satellite Data and Response Rate for Each Year

Figure 25'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 3.2 days over the past 5 years, from 2015 to 2019.



# Figure 23: Average Number of Days Required to Provide Satellite Data After Disaster and Activation Rate for Each Year

Figure 24's products were 76.0% in 2019, with figures on a steady decline since 2018. The average number of days required for provision was also 4.8 days, indicating that there was low achievement in 2019 for sharing products.



Figure 24: Average Number of Days Required to Provide Products and Activation Rate for Each Year

# 7. Conclusions

Since the start of 2007, we have conducted emergency observation activities for 361 natural hazards, and three organizations joined SA as new members during 2019. JPT members have also conducted a lot of activities in the field through international conferences, specific projects, internal meetings, and more. The following points are conclusive statements based on activities in 2019 and suggestions for 2020.

- In 2019, 28 EORs were submitted and 25 EORs were activated. Around 61% of the EORs were related to floods and earthquakes.
- Five out of 25 Sentinel Asia activations were escalated to IDCs in 2019.
- JICA and RIKEN joined as new JPT members in 2019.
- JAXA made a keynote statement related to Sentinel Asia at the Global Platform held in May 2019.
- · Academic papers related to SA were published in 2019 (e.g. ARMOR, GAR).
- The New Sentinel Asia system "OPTEMIS" was released in October 2019.
- The Standard Operation Procedure (SOP) will be modified in accordance with "OPTEMIS" in 2020.
- JPT members are carrying out activities that coincide with the Sentinel Asia Strategic Plan.

## List of JPT Members

(94 organizations f	from 28 cou	ntrios /rogions	and 17 inter	national orga	hizations)
(94 Organizations i	10111 28 COU	nunes/regions	and 17 inter	national organ	lizationsj

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)		
2	Australia	3	Geoscience Australia (GA)		
		4	Bureau of Meteorology (BOM)		
3	Bangladesh	5	Bangladesh Space Research and remote Sensing Organization (SPARRSO)		
		6	Department of Disaster Management, Ministry of Home and Cultural Affairs		
1		7	National Land Commission		
4	Bhutan	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)		
		14	National Disaster Reduction Center of China (NDRCC), Ministry of Civil Affair		
	China	15	College of Disaster and Emergency Management, Beijing Normal University (BNU)		
7		16	Institute of Geology, China Earthquake Administration (CEA)		~
		17	Sichuan University		<b>v</b>
		18	The Chinese University of Hong Kong (CUHK)		<b>v</b>
			Institute of Mountain Hazards and Environment (IMHE),		
		19	Chinese Academy of Sciences (CAS)		~
8	Fiji	20	National Disaster Management Office, FIJI (NDMO)		
		21	Indian Space Research Organization (ISRO)	<ul> <li>✓</li> </ul>	~
		22	University of Kashmir		
9	India	23	Gauhati University		
		24	Symbiosis Institute of Geoinformatics (SIG) , Symbiosis International University (SIU)		~
		25	National Disaster Management Agency (BNPB)		
		26	Indonesian National Institute of Aeronautics and Space (LAPAN)		~
		27	Institute of Technology Bandung (ITB)		
10	Indonesia	28	Universitas Jenderal Achmad Yani (UNJANI)		
	maonesia	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		~

		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		<b>v</b>
11	Japan	40	Tokyo Institute of Technology (TIT)		<b>v</b>
		41	International Research Institute of Disaster Science, Tohoku University		V
		42	University of Tokyo		~
		43	National Research Institute for Earth Science and Disaster Resilience (NIED)		~
		44	Japan International Cooperation Agency (JICA)		
		45	RIKEN		<b>v</b>
		46	Kobe University		~
12	Kazakhstan	47	National Center of Space Researches and Technologies (NCSRT)		v
		48	Korea Aerospace Research Institute (KARI)	~	~
13	Korea	49	National Disaster Management Research Institute (NDMI)		V
14	Kyrgyz	50	Central Asian Institute of Applied Geosciences (CAIAG)		~
		51	Ministry of Labor and Social Welfare		
15	Lao P.D.R.	52	Natural Resources and Environment Institute (NREI), Ministry of Natural Resources and Environment (MONRE)		
10	Malausia	53	National Security Division, Prime Minister's Department		
10	wataysta	54	Malaysian National Space Agency (ANGKASA)		~
17	Mongolia	55	Information And Research Institute Of Meteorology, Hydrology		
			And Environment (IRIMHE)		
		56	Department of Meteorology and Hydrology (DMH)		
18	Myanmar	57	Myanmar Earthquake Committee (MEC) Myanmar		
		58	Engineering Society (MES)		
		59	Survey Department (SD)		
		60	Department of Water Induced Disaster Management (DWIDM), Ministry of Irrigation		
19	Nepal	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)		
		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		
22	Philippines	69	Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)		V
		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)		~
		73	NOAH Center of the University of the Philippines Resilience Institute		V
23	Singapore	74	Centre for Remote Imaging, Sensing and Processing (CRISP)	~	~
		75	Earth Observatory of Singapore (EOS)		~
	<u></u>	76	Survey Department of Sri Lanka		<b>v</b>
24	Sri Lanka	77	Ministry of Disaster Management		<ul> <li>✓</li> </ul>
		78	National Applied Research Laboratories (NARL)	<b>v</b>	<b>v</b>
25	Taiwan	79	Center for Space and Remote Sensing Research, National Central University (CSRSR, NCU)		~
		80	Geo-Informatics and Space Technology Development Agency (GISTDA)	~	V
		81	Department of Disaster Prevention and Mitigation (DDPM)		
		82	Department of Water Resources (DWR)		
26	Thailand	83	Royal Forest Department (RFD)		
		84	National Park, Wildlife and Plant Conservation Department		
		85	Royal Irrigation Department (RID)		
		86	Land Development Department (LDD)		
		87	Andaman Environment and Natural Disaster Research Center, Prince of Songkla University (ANED, PSU)		~

27	United Arab Emirates	88	Mohammed Bin Rashid Space Centre (MBRSC)	~	~
		89	Vietnamese Academy of Science and Technology (VAST)	v	~
		90	Ministry of Agriculture and Rural Development (MARD)		
28	Vietnam	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)		
		95	Asian Institute of Technology (AIT)		~
		96	The ASEAN Secretariat		
		97	United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)		
	International Organization	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)		
29		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)		<b>v</b>
		106	Asian Development Bank (ADB)		~
		107	ASEAN Coordinating Centre for Humanitarian Assistance on		
		108	World Wide Fund for Nature (WWE) - Pakistan		
		109	Asian Disaster Preparedness Center (ADPC)		~
		110	Myanmar Information Management Unit (MIMU)		· ·
		111	UN World Food Programme (W/EP)		· ·
		111		8	52
				0	55 rc of Dog 2020

as of Dec 2020

			Number of requested EOR (by year)															N	umber	of requ	lested	EOR (b	y eacl	h disast	er)												
	quest	/ation	ection	rtage of /ation	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	) Tota		Flo	bod	Earth	nquake	Land	dslide	Тур	hoon	Fore	est fire	Vol Eru	canic iption	Сус	lone	Oil	Spill	otł	ners
	Rec	Activ	Rej	Percel Acti	Num.			Num.	(%)	Num.	(%)	Num.	(%)	Num.	(%)	Num.	(%)	Num.	(%)	Num.	(%)	Num.	(%)	Num.	(%)												
Indonesia	53	46	7	86.8	7	2	5	9	2	4	2	4	2	7	3	4	2	53		17	32.1	13	24.5	4	7.5			2	3.8	12	22.6					5	9.4
Vietnam	47	41	6	87.2	2	2	4	7	2	1	2		2	3	12	6	4	47		34	72.3	0	0.0	1	2.1	8	17.0	1	2.1					2	4.3	1	2.1
Philippine	38	36	2	94.7	1	1	6	1	4	4	3	1	2	4	4	2	5	38		11	28.9	8	21.1			11	28.9	1	2.6	2	5.3	2	5.3			3	7.9
India	23	19	4	82.6			1	4	3	1	2	2	1	2	1	3	3	23		13	56.5	1	4.3			1	4.3	1	4.3			4	17.4			3	13.0
Japan	22	22	0	100.0		2		1	4	1	3	3	2	1		2	3	22		10	45.5	5	22.7	3	13.6	1	4.5			3	13.6						
Nepal	21	20	1	95.2	1	2	2	1	2	1	1	1	4	2	2		2	21		13	61.9	2	9.5	2	9.5	1	4.8	1	4.8							2	9.5
Taiwan	15	15	0	100.0				2	1				2	5	3	2		15		4	26.7	2	13.3	1	6.7	6	40.0							1	6.7	1	6.7
Thailand	14	12	2	85.7	2	3		1	2	1	1				1	2	1	14		12	85.7	1	7.1											1	7.1		
Myanmar	14	12	2	85.7		1			2		1		2	4		3	1	14		8	57.1	4	28.6	1	7.1							1	7.1				
Pakistan	12	8	4	66.7	1	2		3	1		1		2	2				12		5	41.7	2	16.7	4	33.3											1	8.3
Sri Lanka	12	11	1	91.7			1	2	2	1		1	1	1	1	2		12		10	83.3			1	8.3							1	8.3				
China	11	9	2	81.8		2		1	1	2	1	1			2		1	11		2	18.2	5	45.5	3	27.3			1	9.1								
Bangladesh	9	9	0	100.0	3			1					1	2	2			9		5	55.6			2	22.2							2	22.2				
Tajikistan	7	7	0	100.0	1			2	1	1		1	1					7		4	57.1	1	14.3	1	14.3											1	14.3
Kazakhstan	6	4	2	66.7				1	2	3								6		3	50.0							2	33.3							1	16.7
Bhutan	7	5	2	71.4				2		1			2	1			1	7		4	57.1							3	42.9								
Mongolia	6	0	6	0.0	1		2	2	1									6		2	33.3							3	50.0							1	16.7
Australia	5	5	0	100.0		1	3		1									5		3	60.0					1	20.0	1	20.0								
Kyrgyzstan	6	3	3	50.0				1	3	1							1	6		1	16.7	1	16.7	2	33.3											2	33.3
Brunei	5	3	2	60.0					3	1		1						5		4	80.0													1	20.0		
Cambodia	3	3	0	100.0				2	1									3		3	100.0																
Solomon	3	3	0	100.0	1						1	1						3		1	33.3	1	33.3													1	33.3
Malaysia	3	3	0	100.0							2	1						3		2	66.7							1	33.3								
Lao PDR	4	4	0	100.0		1								1		1	1	4		3	75.0															1	25.0
Korea	3	3	0	100.0											1	1	1	3				2	66.7					1	33.3								
Fiji	3	3	0	100.0						1				1			1	3		1	33.3					1	33.3					1	33.3				
Tonga	2	2	0	100.0								1				1		2														2	100.0				
PNG	2	2	0	100.0						1						1		2						1	50.0					1	50.0						
Afghanistan	1	0	1	0.0								1						1		1	100.0																
New Zealand	1	1	0	100.0					1									1				1	100.0														
Turkey	1	1	0	100.0									1	1	1		1	1	<b> </b>					1	100.0												
Vanuatu	1	1	0	100.0									1					1														1	100.0				
United Arab Emirates	1	1	0	100.0				t								1		1	╡┟				1						1		1	1	100.0				
Total	361	314	47	-	20	19	24	43	39	25	20	19	25	36	32	31	28	361		176	-	49	-	27	-	30	-	18	-	18	-	15	-	5	-	23	-

1	ADRC	Participation for the international Conferences 26th Session of the Asia-Pacific
		Regional Space Agency Forum (APRSAF-26)
2	AHA Center	AHA Centre Disaster Situation Update for Tropical Storm PODUL and Tropical
		Depression Kajiki in Lao PDR
3	CAIAG	"Kumtor" Landslide in Kyrgyzstan (December 2019)
4	Chiba University	Damage assessment of the 2019 Typhoon Hagibis
5	DMC	Preparation of the Disaster Risk Index for Tsunami, Drought, Flood and Landslide
	(Sri Lanka)	
6	EOS	EOR Responses and Publications from EOS as a Data Analysis Node
7	GIC-AIT	Activities carried out as Principal Data Analysis Node (P-DAN) for Sentinel Asia
8	GISTDA	OPTEMIS system development
9	GISTDA	GISTDA contribution in supporting Disaster management
10	ICIMOD	Mapping floods in Bangladesh caused by Cyclone Amphan to support
		humanitarian response
11	ICIMOD	Streamflow prediction for flood warning and satellite-based inundation mapping
		for the HKH region
12	ISRO	Support to Sentinel Asia
13	JAXA	Support from the Sentinel Asia community in response to the typhoon "Hagibis"
14	Malaysian	MYSA Establishment and Participation in Sentinel Asia
	Space Agency	
15	Manila	Presentation of DAN Updates, 7th Joint Project Team Meeting (JPTM) for
	Observatory	Sentinel Asia STEP-3 (JPTM 2019), Bangkok, Thailand
16	MONRE	Summary of 2019 results through SA system activation
17	NARL	The 39th IEEE International Geoscience and Remote Sensing Symposium
		(IGARSS) 2019
18	NARL	70th International Astronautical Congress (IAC)
19	RIKEN	Preliminary CNN-based inundation Depth Mapping in East Japan after the
		Typhoon Hagibis
20	Tohoku	Mapping Tsunami Disaster Impact of Indonesia by Satellite Remote Sensing
	University	

JPT member report "Sentinel Asia Activity in 2019"

21	Udayana	3rd Human resource development and space data utilization for Disaster
	University	
22	University of	3rd Human resource development and space data utilization for disaster
	Tokyo	
23	VIGMR	Preliminary CNN-based inundation Depth Mapping in East Japan after the
		Typhoon Hagibis
24	Yamaguchi	Contribution for EOR activity (Flood in Kyushu, Japan)
	University	

Organization	Asian Disaster Reduction Center (ADRC)
Title	Participation for the international Conferences 26th Session of the Asia-Pacific Regional Space Agency Forum (APRSAF-26)
Type of Activity	International Conference
Date	26 - 29 November 2019

The 26th Session of the Asia-Pacific Regional Space Agency Forum (APRSAF) was held from 26 to 29 November 2019 in Nagoya, Japan. It was co-organized by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and JAXA. APRSAF was established in 1993 to enhance space activities in the Asia-Pacific region. Attended by space agencies, governments, and international organizations such as the United Nations as well as companies, universities and research institutes, this forum is the largest space-related conference in the Asia-Pacific region. APRSAF has four Working Groups: the (1) Space Applications Working Group (SAWG), (2) Space Technology Working Group (STWG), (3) Space Environment Utilization Working Group (SEUWG), and (4) Space Education Working Group (SEWG). APRSAF participants share information about their activities and future plans for their countries and regions in each working group. APRSAF also supports international projects designed to find solutions to common issues such as disaster management and environmental protection. The Sentinel Asia initiative is one such activity and involves the use of space-based information in the form of satellite images for disaster management. ADRC has been tasked with the responsibility of receiving emergency observation requests from ADRC member countries and JPT members. ADRC joined SAWG and reported on trends in Sentinel Asia emergency observation requests and its future action plans.



ADRC's presentation

Organization	The ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre)
Title	AHA Centre Disaster Situation Update for Tropical Storm PODUL and Tropical Depression Kajiki in Lao PDR
Type of Activity	Providing satellite data for disaster emergency situation
Date	09 – 13/09 and 14/10 2019

The ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre) is an intergovernmental 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 responsibility for the AHA Centre is to conduct Disaster Monitoring and Analysis in ASEAN Region. In an emergency situation when there is a significant disaster occurred in one or more of the ASEAN members' state, the AHA Center will carry out an emergency response. One of the things is issuing a situation update report regarding the disaster. In September 2019, through Disaster Monitoring and Analysis units, The AHA Centre published a situation update for the Tropical Storm PODUL and Tropical Depression Kajiki in Lao PDR. In this situation update, there is an analysis of the floods area from the ARIA-SG team at Earth Observatory Singapore (EOS) for Sentinel ASIA. This product contained in The AHA Centre Situation Report <u>09</u>, <u>10</u>, <u>11</u>, <u>12</u>, <u>13</u> September, and <u>14</u> October 2019. The AHA Centre also utilize the other product of Sentinel ASIA for internal correspondence.



(Product of Sentinel Asia in The AHA Center Situation Update, 2019)

Organization	Central Asian Institute for Applied Geosciences (CAIAG)
Title	"Kumtor" Landslide in Kyrgyzstan (December 2019)
Type of Activity	SA annual report in 2019 –EORs-
Date	2019

1. Emergency Observation of Disasters Occurring in December 2019.

1.1. Landslide in Kyrgyzstan

Landslide was occurred in Eastern part of Kyrgyzstan. On the morning of December 1 2019.

Central Asian Institute for Applied Geosciences (CAIAG, Kyrgyzstan) made an Emergency Observation Request (EOR) to Sentinel Asia on 12 December after landslide event. Among Data Provider Nodes (DPNs), Japan Aerospace Exploration Agency (JAXA), Indian Space Research Organization (ISRO), Geo-Informatics and Space Technology Development Agency (GISTDA) and National Applied Research Laboratories (NARL) provided their observation data. The information on the latest response by Sentinel Asia is available from the following link. <u>https://sentinel-asia.org/EO/2019/article20191201KG.html</u>



- Landslide named "Kumtor" occurred in Issyk-Kul region of Kyrgyzstan on 1 December 2019 at 05:43 AM (<u>https://blogs.agu.org/landslideblog/2019/12/03/kumtor-mine-new-landslide/</u>), a landslide of waste rock dumps occurred at the site in the valley of the Lysyi stream of the Kumtor mine. During the evacuation of the employees, it turned out that two of them were missing.
  - 2.1. The 26 rescuers and more than 10 employees of Kumtor Gold Company were involved in the search but unfortunately searches have yielded no results.
  - 2.2. Due to the incident, open-pit mining had been temporarily suspended.

2.3. The location on the dump where was landslide shifted abruptly does not threaten the main production facilities of the mine and is located at a safe distance from the central quarry, tailing dump and Petrov Lake. It is also noted that waste dumps do not contain any harmful substances and do not pose a threat to the environment.



Product by Ulan Abdybachaev, CAIAG

- 3. Unfortunately, due to the COVID-19 pandemic and activated of lockdown in Kyrgyzstan we non made validation of get results in field work.
- 4. CAIAG has network of hydrometeostations. The station TARA (<u>Taragai</u>) is locating on 3530 m above above see level in this region where was landslide event and additionally equipped with an STS-2 seismometer. Young scientist of CAIAG Altynbek uluu Talantbek downloaded and postprocessed seismogram for landslide event.
- 5. So, according in this seismogram was corrected the time of start of movement and it is 05:42:45,4 of 1 December (Local time) and that corresponds by Greenwich time is 23:42:45,4 at 30 November 2019. Full time of duration of movements is 60 second and ranking as (i) Duration of start (stage of preparing of displacement) is 6,46 sec., (ii) duration of main displacement is 23,54 sec., and (iii) duration stage of rate decay of displacement is 30 sec.

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The seismogram of landslide displacement, product by Altynbek uluu T., CAIAG

Organization	Chiba University, Japan
Title	Damage assessment of the 2019 Typhoon Hagibis
Type of Activity	EOR
Date	13/10/2019~16/10/2019

Typhoon Hagibis passed through Japan on October 12, 2019, bringing heavy rainfall over half of Japan. The International Charter Space and Major Disasters (Charter) and Sentinel Asia was activated for this event on October 11, 2019, 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 October 13. We downloaded several pre- and post-event SAR intensity images and optical satellite images, to grasp the affected area. We generated the color composites of temporal SAR images in the Kanto Region and Nagano Prefecture, Japan. The expansion of water regions had been observed in the Tama and Tonogawa Rivers. Meanwhile, wide inundations were confirmed in the Chikuma, Naka, and Kuji rivers. For the Chikuma river, visual interpretation was conducted. For the Naka and Kuji rivers, the inundations were extracted by the differences in the backscatter intensity.



Color composite of three-temporal SAR intensity images in the Kanto Rgeion

Organization	Disaster Management Center (DMC)
Title	Preparation of the Disaster Risk Index for Tsunami, Drought, Flood and Landslide
Type of Activity	Disaster Risk Identification
Date	2019

The objective of this study is to develop Risk index maps describing the Flood, Drought (Drinking water scarcity), Landslide, Tsunami disaster risk characteristics of the existing vulnerability and capacity considering population as the element at risk. It will be the sources of information on the level of risk in districts.

This risk index can be used primarily by local, regional, and central government officials to plan and stimulate efforts to reduce risks from frequent hazards and to prepare for emergency response and recovery. Further, this will support as a tool to compare the risk level in one district to another. This will be served as a base for further detailed risk analysis for the preparation of institutional policies, funding proposals planning, and statistics and DRM activities.

Historical flood data spanning for the past 2 decades was used to map the flood-prone areas of Sri Lanka. Disaster Management Center – Sri Lanka has engaged in Sentinel Asia activations during major disasters over the past decade. The value-added products generated during these occasions were used to identify and verify flood-prone areas in this project.

The following figures illustrate flood risk zones in three levels for some of the districts of Sri Lanka.



Organization	Earth Observatory Singapore (EOS), Nanyang Technological University
Title	EOR Responses and Publications from EOS as a Data Analysis Node
Type of Activity	EOR and Publication
Date	Year of 2019

With the aid of the ARIA-SG system, our mission controllers, and in close collaboration with the Disaster Response Lead in NASA JPL, we have responded to a total of 10 Emergency Observation Requests within the Sentinel-Asia network in 2019. These responses include floods, typhoons, and earthquakes. A catalogue of products products product from our responses can also be found on: <u>http://ariasg-products.earthobservatory.sg/</u>.



Figure 2: Flood Proxy Map created by the EOS team from the 2019 Sept Laos Flood (Left). AHA, an ASEAN disaster management organization, used our flood maps to compute exposure metrics (top right) to provide insights for supplies to be flown into Laos (bottom left). Meeting at EOS with AHA representative post-response (bottom right).

We also reached out to users of our products and have managed to gather feedback from disaster management stakeholders of how our products have been utilized. In particular, the AHA Centre (ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management) has been actively using our products for its 'Flash Updates' to local governments. During the Laos Flood event in September 2019, AHA Centre used our maps to estimate the amount of people affected and supplies needed for the humanitarian response effort (Figure 2).



Figure 3: Comparison of FPM covering the Tokyo prefecture with aerial imagery from GSI (1b, 2b) and modified false color composites of optical imagery from Planet (3b - reflectance, 3c - NDWI). From Tay *et al.* (2020).

Furthermore, responding to the Typhoon Hagibis EOR, using ALOS-2 data from Sentinel-Asia, together with Planet's satellite optical imagery and Geospatial Information Authority of Japan's aerial imagery of flood situation, has provided our responders a rare opportunity to extensively validate our flood mapping techniques (Figure 3). The findings from this investigation are published in Scientific Data:

 Tay, C.W.J., Yun, SH., Chin, S.T. et al. Rapid flood and damage mapping using synthetic aperture radar in response to Typhoon Hagibis, Japan. Sci Data 7, 100 (2020). https://doi.org/10.1038/s41597-020-0443-5

Organization	Geoinformatics Center, Asian Institute of Technology
Title	Activities carried out as Principal Data Analysis Node (P-DAN) for Sentinel Asia
Type of Activity	Value-Added Product Generation for Disaster Activations
Date	01/06/2019 - 31/03/2020

As the Principal Data Analyses Node (P-DAN) of Sentinel Asia, the Geoinformatics Center of the Asian Institute of Technology (GIC/AIT), Our mission is to produce Value Added Product (VAP) as early as possible to support end-users for their operations after disaster occurrence and coordinate with local partners to collect data for product validation and damage assessment purposes.

Since June 2019, there were 23 activations requested by 15 countries in the region, including Bhutan, China, Fiji, India, Indonesia, Iran, Japan, Korea, Kyrgyzstan, Laos, Myanmar, Philippines, Thailand, Turkey, and Vietnam. GIC has processed 22 total number of requests for emergency observations during the period from July 1st, 2019, to March 31st, 2020. Most of the requests were sent by the Philippines (4 activations; 18.18%), followed by Vietnam and Indonesia (3 activations; 13.64%), Japan (2 activations; 9.09%). The rest of the requests (45.45%) were submitted by Bhutan, China, Fiji, India, Iran, Kyrgyzstan, Laos, Myanmar, Thailand, and Turkey; each with one request for activation; and eight of these events were escalated to the International Disaster Charter (IDC).

Regarding to Project Management (PM) activities, The GIC/AIT has undertaken PM activities for two events, including storm and hurricane in Fiji (December 31st, 2019) and flooding in Indonesia (January 7th, 2020).



Value Added Product Generation in 2019 According to the Disaster Type

Organization	Geo-Informatics and Space Technology Development Agency (GISTDA)
Title	OPTEMIS system development
Type of Activity	Sentinel Asia STEP-3 Contribution
Date	-

GISTDA has contributed to Sentinel Asia STEP-3 development by introducing, testing, and deploying OPTEMIS (Operation Planning Tool for Earth-observation Mission) to Sentinel Asia system. OPTEMIS is an in-house developed tool by GISTDA. It is an integrated system for requesting and optimizing the multi-Satellite tasking with features of automatic workflow and one-stop service users friendly.

The success timeline is as followings:

- 1. OPTEMIS v1.0 was deployed and put into full service since JPTM 2019 as of November 2019
- It was continuously developing after the full deployment. (Currently, OPTEMIS v2.0 was installed in ASGC server in November 2020 and currently under system and security test by JAXA. And OPTEMIS disaster reporting system (mobile app) is now under design and development phase.)

Organization	Geo-Informatics and Space Technology Development Agency (GISTDA)
Title	GISTDA contribution in supporting Disaster management
Type of Activity	Providing Satellite Data
Date	2019

GISTDA supported the disaster management activities by providing hundreds satellite images as a Data Providing Node both MS and PAN images.

No	ACQ date	Country	Disaster Type	MS	PAN	PS	Mosaic	Number of images
1	06/04/2019	Korea	Fire	4	16	0	0	20
2	07/04/2019	Korea	Fire	4	12	0	0	16
3	04/05/2019	India	Flood	4	14	0	0	18
4	04/05/2019	India	Flood	8	24	0	0	32
5	05/05/2019	India	Rood	4	14	0	0	18
6	06/06/2019	Turkey	Landslide	2	10	0	0	12
7	06/06/2019	Turkey	Landslide	2	10	0	0	12
8	06/06/2019	Turkey	Landslide	4	14	0	0	18
9	28/06/2019	China	Earthquake	5	15	0	0	20
10	25/06/2019	Bhutan	Flood	2	7	0	0	9
11	26/06/2019	Bhutan	Flood	2	6	0	0	8
12	27/06/2019	Bhutan	Flood	6	14	0	0	20
13	29/06/2019	Bhutan	Flood	4	3	0	0	7
14	28/06/2019	Vietnam	Earthquake	1	6	0	0	7
15	28/06/2019	Vietnam	Earthquake	1	5	0	0	6
16	02/07/2019	Vietnam	Earthquake	4	12	0	0	16
17	15/09/2019	Lao	Flood	2	6	0	0	8
18	22/08/2019	Myanmar	Landslide	3	10	0	0	13
19	06/09/2019	Vietnam	Flood	3	12	0	0	15
20	08/09/2019	Vietnam	Flood	5	15	0	0	20
21	11/09/2019	Vietnam	Flood	5	15	0	0	20
22	02/10/2019	India	Flood	2	7	0	0	9
23	03/10/2019	India	Flood	2	5	0	0	7
24	03/10/2019	India	Flood	2	6	0	0	8
25	05/10/2019	India	Flood	3	5	0	0	8
26	06/10/2019	India	Flood	2	6	0	0	8
27	13/10/2019	Japan	Storm	7	22	0	0	29
28	14/10/2019	Japan	Storm	10	32	0	0	42
29	15/10/2019	Japan	Storm	8	17	0	0	25
30	16/10/2019	Japan	Storm	11	31	0	0	42

Summary of Thaichote's Satellite Images for Sentinel Asia in 2019

No	ACQ date	Country	Disaster Type	MS	PAN	PS	Mosaic	Number of images
31	21/10/2019	Japan	Storm	11	33	0	0	44
32	30/10/2019	Philippine	Earthquake	3	7	0	0	10
33	31/10/2019	Philippine	Earthquake	3	7	0	0	10
34	12/11/2019	Vietnam	Flood	8	24	0	0	32
34	13/11/2019	Vietnam	Flood	4	10	0	0	14
35	11/12/2019	Philippine	Storm	2	5	0	0	7
36	11/12/2019	Philippine	Storm	3	5	0	0	8
37	12/12/2019	Philippine	Storm	3	7	0	0	10
38	12/12/2019	Philippine	Storm	2	6	0	0	8
39	12/12/2019	Kyrgyzstan	Landslide	3	8	0	0	11
40	14/12/2019	Kyrgyzstan	Landslide	1	6	0	0	7
41	14/12/2019	Kyrgyzstan	Landslide	2	6	0	0	8
42	16/12/2019	Kyrgyzstan	Landslide	2	7	0	0	9
43	16/12/2019	Kyrgyzstan	Landslide	3	7	0	0	10
			Total	172	509	1	Grand Total	681

Summary of Thaichote's Satellite Images for Sentinel Asia in 2019

Organization	International Centre for Integrated Mountain Development			
Title	Mapping floods in Bangladesh caused by Cyclone Amphan to support humanitarian response			
Type of Activity	ICIMOD Blog https://www.icimod.org/article/mapping-floods-in-bangladesh-caused-by-cyclone-amphan- to-support-humanitarian-response/			
Date	27/May/2020			

Cyclone Amphan made landfall in Bangladesh and eastern India on 20 May 2020. The massive tropical cyclone resulted in the loss of at least 96 lives and caused extensive damage to infrastructure. To make matters worse, communities in the southwest coastal districts of Bangladesh are now facing floods from the subsequent heavy rains and tidal surges while having to adhere to social distancing norms during the ongoing COVID-19 pandemic. The flooding is interrupting the return to normal life for millions of people who were relocated to community shelters (despite fears of an outbreak of COVID-19) after the cyclone struck.

ICIMOD prepared flood inundation maps for Bangladesh by analysing satellite imagery from the Copernicus Sentinel-1 satellite and Sentinel Asia. These maps provide a synoptic overview of the extent of inundation caused by the floods. They can aid disaster management agencies in prioritizing relief and rescue activities in the worst affected areas.



Figure. SAR based flood inundation map on 22 May 2020 for the Cyclone Amphan affected area.

Organization	International Centre for Integrated Mountain Development			
Title	Streamflow prediction for flood warning and satellite-based inundation mapping for the HKH region			
Type of Activity	ICIMOD Blog https://www.icimod.org/article/streamflow-prediction-for-flood-warning-and-satellite-based- inundation-mapping-for-the-hkh-region/			
Date	02/August/2020			

The monsoon floods in the Hindu Kush Himalayan (HKH) region are worsening the humanitarian crises caused by the COVID-19 pandemic and the recent Cyclone Amphan in Bangladesh and India. Millions of people have been affected in Nepal, India (Bihar and Assam), and Bangladesh. The crisis is far from over, with more monsoon rain forecast in the coming days and weeks.

In this context, timely information on current and upcoming floods can help government and humanitarian agencies manage disaster response and relief activities better.



Figure. Figure 4: Inundated areas in different regions: a. Nepal Terai; b. Bangladesh; c. Assam, India; d. Bihar, India.

Organization	INDIAN SPACE RESEARCH ORGANISATION (ISRO)
Title	Support to Sentinel Asia
Type of Activity	Providing Satellite data as Data Provider Node (DPN)
Date	DD/MM/2019

During 2019, NRSC, ISRO has contributed in the Sentinel Asia activities as Data Provider Node. NRSC, ISRO has successfully responded to various Emergency Observation Requests of Sentinel Asia (EOR's) pertaining to 11 countries (shown in Fig 1) with the help of 30 Indian Remote Sensing Series (IRS) satellite datasets comprising of Resources -2/2A and Cartos tseries.

NRSC, ISRO has attended all meeting organized by Sentinel Asia and made presentations on the support provided by ISRO and on various technical activities being carried out by NRSC. ISRO has also represented in Face-face to meeting of Steering Committee held at Si Rachi, Thailand and participated and made presentations at 7<sup>th</sup> JPTM held at Bangkok at the end of 2019. Delivered lecture and conducted practical to all the participants on flood early warning using space based inputs.

During 2019, ISRO has activated sentinel Asia towards support to Cyclone "FANI", Assam an Bihar floods-2019 and as part of it has received data from ALOS PALSAR-2 and THEOS-1 satellite datasets.



## ISRO Support to Sentinel Asis EOR's during 2019

Fig 1: EOR's responded by NRSC, ISRO during 2019 (Satellite datasets are shown in brackets)
Organization	Japan Aerospace Exploration Agency (JAXA)
Title	Support from the Sentinel Asia community in response to the typhoon "Hagibis"
Type of Activity	EOR
Date	October 2019

A Category V typhoon "Hagibis" hit Japan on 12 October 2019, and brought record-breaking rainfall and strong winds in eastern Japan, causing widespread, devastating floods and mudflows. Over 100 people were killed, approximately 500 people were injured, and innumerous number of houses were destroyed or affected by the disaster.

Faced by the disaster risk, ADRC on behalf of JAXA and the Japanese authorities submitted an EOR to Sentinel Asia on 11 October, prior to the occurrence of disaster, which contributed to prompt and opportune support from the Sentinel Asia community. For this EOR, as DPN members, GISTDA, ISRO, NSPO/NARL (together with JAXA) conducted emergency observations with their satellites and provided the data. Then, as DAN members, AIT, Chiba University, EOS, Riken, Yamaguchi University, provided analyzed products. Also, this EOR was escalated to the International Disaster Charter ("Sentinel Asia Escalation"), with Yamaguchi University playing the role of Project Manager. On behalf of the Japanese people, we would like to extend our sincere gratitude to all Sentinel Asia members who have supported us.



support from DPN members

support from DAN members

Organization	MALAYSIAN SPACE AGENCY (MYSA)
Title	MYSA Establishment and Participation in Sentinel Asia
Type of Activity	MYSA Establishment and Participation in Sentinel Asia
Date	2019

On 20<sup>th</sup> February 2019, has marked another achievement for space The Malaysian Cabinet has approved the establishment of Malaysian Space Agency (MYSA) through the merging of Malaysian Remote Sensing Agency (MRSA) and National Space Agency (ANGKASA).

This mergence which operationalizes in December 2019, is set to improve work efficiencies by optimizing the use of existing resources and facilities to ensure the development and management of the national space sector in a strategic, organized and comprehensive manner.

Previously, Malaysia through ANGKASA has involved in several activities organized and hosted under Sentinel Asia (SA) platform. As we face the challenges posed by the COVID-19 pandemic, Malaysia looks forward to working closely with all stakeholders including SA in solidifying international solidarity to realize the potential of space sector for the benefit of humanity.

Organization	Manila Observatory
Title	Presentation of DAN Updates, 7th Joint Project Team Meeting (JPTM) for Sentinel Asia STEP-3 (JPTM 2019), Bangkok, Thailand
Type of Activity	Meeting
Date	12-14 November 2019

Please write about your activity related to Sentinel Asia in 2019.

Ms. Flordeliza P. del Castillo represented the Manila Observatory (MO), as a DAN, during this meeting. She presented the report (in attached jpeg of ppt slides) of our DAN activities for 2018. These slides included:

- An orientation of the beginnings and historical activities of the MO
- Our mission and research programs
- Our EO mapping and future plans
  - The continuous generation of static and dynamic layers largely through projects or programmatically,
  - Satellite-based extraction of spatial information through EO,
  - Periodic EO process documentation for downloading of satellite imageries and RS-GIS mapping,
  - Training on EO through mapping as well as upload of EO maps in the MO Geoportal
- MO's EO protocol
- MO's future plans as an institute

Feedback on the MO's EO protocol was given during the JPTM 2019, that it takes too long. With this in mind, Ms. Ma. Flordeliza P. del Castillo and Mr. Randell G. Teodoro were authorized to directly download satellite imageries for EO in accordance with each's expertise: Ms. Castillo for flooding; Mr. Teodoro for earthquake.

Organization	Department of national remote sensing – VietNam Ministry of natural resources and environment
Title	Summary of 2019 results through SA system activation
Type of Activity	EOR
Date	24/06/2019
	05/09/2019
	11/11/2019

## 24/06/2019:

Heavy rain occurs in many districts of Lai Chau province, the rainfall is measured from 50mm to 80mm. Heavy rains prolonged with flash floods and floods causing damage to many state projects; houses, property, crops of the people and initially recorded damage to people. Immediately after a flash flood disaster, we sent a request for support to Sentinel Asia through ADRC, as a result received 2 types of satellite images as follows:

On June 26, received 02 ALOS-2 scenes (pre-disaster scene); On June 28, received 02 scenes of ALOS-2 (post-disaster scene); On June 29, received two ALOS-2 scenes (post-disaster photos - color composite); On June 29, received 01 scene of Resourcesat-2 AWiFS-2 (post-disaster scene)

## 05/09/2019:

Northern of Vietnam and provinces from Thanh Hoa to Quang Binh will have heavy rains from 1st to 5th September 2019, rainfall over the whole range from 300-700mm. Many areas may be subject to flash floods and flooding. Through support from SA system we have received the following results:

On September 7, received 01 scene of Resourcesat-2A AWiFS-2; On September 8, received a FOMOSAT FS5 G000 MS L1A scene; On September 10, received 02 AIT products (with digital data in the form of SHAPE file); On September 10, receipt of 02 EOS products (with digital data in SHAPE file format); Product form Web GIS

## 11/11/2019:

Due to the influence of the circulation of typhoon No. 5, from October 31st, heavy rains spread from Phu Yen to Quang Nam and the Central Highlands provinces, causing the rivers to rise rapidly. Through support from SA system we have received the following results:

On November 9, received 03 IRS-R2A scenes; On 11/11 and 12/11 received 05 THEOS level 2A scenes (Pan and MS); On November 14, received 05 ALOS-2 scenes (post-disaster scenes); On 11/17 received 01 FORMOSAT-5 scene; Product form Web GIS



Integrating VNRedSat satellite image into digital terrain model data of 3 villages isolated by heavy rains, flooding and flash floods (Xa Na village, Na Meo commune, Quan Son district, Thanh Hoa province)

Organization	National Applied Research Laboratories (Taiwan)
Title	The 39th IEEE International Geoscience and Remote Sensing Symposium (IGARSS) 2019
Type of Activity	International Symposium
Date	07/28/2019 - 08/02/2019

The 39th International Geoscience and Remote Sensing Symposium (IGARSS) took place from 28 July to 2 August 2019 in Yokohama, Japan. IGARSS has been hosted by the IEEE Geoscience & Remote Sensing Society (GRSS) annually since 1981. It is representative of an international conference in the domain of global earth science and remote sensing. Dr. Franz Cheng from the National Applied Research Laboratories (NARLabs), representing Steering Committee of Sentinel Asia, is honored to be invited to deliver a Plenary Keynote Speech on "Sentinel Asia-Evolution and Current Status." After the Plenary, Dr. Cheng receives the privilege to meet the Japanese Emperor Naruhito and to report the Sentinel Asia contributions to countries in Asia Pacific region. Dr. Cheng also exchanges information with another keynote speaker Prof. Dr. Gilberto Câmara, Director of GEO (Group on Earth Observations), on operations of Sentinel Asia. Dr. Câmara warmly invited Sentinel Asia to join GEO as an Observer. (Note that APRSAF is currently holding a GEO Observer membership.)



Dr. Cheng delivered a Plenary Keynote Speech in IEEE IGARSS 2019 Symposium (Fig 1) The Japanese Emperor Naruhito gave a talk to welcome the scientists (Fig 2) and met distinguished guests including GEO Director Prof. Dr. Gilberto Câmara (Fig 3 far left).

Organization	National Applied Research Laboratories (Taiwan)
Title	70 <sup>th</sup> International Astronautical Congress (IAC)
Type of Activity	International Conference
Date	10/21/2019 - 10/25/2019

70th International Astronautical Congress (IAC), hosted by the American Institute of Aeronautics and Astronautics (AIAA), was held from 21 to 25 October 2019 in Washington, D.C., United States. IAC is the world's largest annual integrated space meeting, attracting thousands of space experts, scholars, manufacturers, and representatives of space agencies from various countries. As a means to promote Sentinel Asia to the global community, NARLabs presented "A Preliminary Evaluation of Sentinel Asia in Response to Natural Disasters in Asia Pacific Region" in IAF (International Astronautical Federation) Earth Observation Symposium. Dr. Shirou Kawakita of Sentinel Asia Secretariat and Dr. Koji Suzuki of Asian Disaster Reduction Center co-authored this paper. This paper showcased preliminary statistics of Sentinel Asia performance and recent efforts in improving the system in Step-3 phase. Current endeavors in the evolved new emergency response system were also reported, they included OPTEMIS (Operation Planning Tool for Earth-observation MISsion, contribution from GISTDA, Thailand) and implementation of cloud servers (contribution from Academia Sinica, Taiwan, and ISRO, India).



Organization	Geoinformatics Unit, RIKEN Center for Advanced Intelligence Project (AIP)
Title	Preliminary CNN-based inundation Depth Mapping in East Japan after the Typhoon Hagibis
Type of Activity	Disaster Emergency Response
Date	14/10/2019

On October 12, 2019, Typhoon Hagibis hit East Japan, triggering floods and landslides. The Geoinformatics Unit, RIKEN Center for Advanced Intelligence Project, conducted a preliminary mapping of the affected areas using Sentinel-1 SAR data provided by ESA. To detect the flooded areas, we carried out a change detection analysis using pre-event SAR data acquired on October 6, 2019, and a post-event SAR data from October 13 (local time), 2019. Then, to detect the inundation depth, we regression model from Sentinel-1 detection to DSM-based inundation depth. The regression model was based on a deep Convolutional Neural Network (CNN).



Flood depth mapping results.

Organization	International Research Institute of Disaster Science, Tohoku University
Title	Mapping Tsunami Disaster Impact of Indonesia by Satellite Remote Sensing
Type of Activity	Workshop, Research
Date	28/Nov./2019

Our group was funded by Japan Science and Technology Agency (JST) to conduct a joint research with Indonesian colleagues from National Institute of Aeronautics and Space, Remote Sensing Application Center and National Disaster Management Authority (BNPB). In this collaboration, we conducted a comprehensive research on mapping the impact of the tsunami events in 2018 in Indonesia with combined approach of remote sensing with advanced machine learning, field observation and GIS analysis, throughout the international collaboration. We achieved a significant goal to develop a robust satellite remote sensing method and mapping technology for identifying tsunami impacts and vulnerabilities in emergency response efforts. The outcomes are expected to be utilized in emergency observations and disaster response efforts. The statistical analysis of field data provided the useful insights to understand tsunami vulnerability of Indonesia with the form of "Tsunami Fragility Curve". This is also a remarkable achievement to contribute on understanding tsunami risks and structural vulnerabilities and urban planning for tsunami-resilient community.

The workshop titled "J-RAPID Report Symposium for Anak Krakatau volcano eruption and Sunda Strait tsunami" was hosted by JST and RESTEK (Ministry for Research and Technology) in Jakarta on 28 Nov., 2019.

Organization	Udayana University
Title	3rd Human resource development and space data utilization for Disaster
Type of Activity	Workshop
Date	09/01/2020

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)





Organization	The University of Tokyo
Title	3rd Human resource development and space data utilization for disaster
Type of Activity	Conference
Date	09/01/2019

The University of Tokyo participated in the 3<sup>rd</sup> international conference on Human resource development and space data utilization for disaster, organized by Udayana University and Yamaguchi University, with the support of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan. The University of Tokyo presented selected outputs from research and development, entitled "Applications of Earth Observation Data from Small-scale Satellites for Disaster Management by Combinations with Open Geospatial Data." The presentation initiated discussions on further research and development of utilizing the space infrastructure and resources for disaster risk management, and also technical transfer of the advanced applications over international collaboration programs.



Slides in the presentation showing a result of automated co-registration and application to change detection.

Organization	Economic Geology and Geomatics Department, Vietnam Institute of Geosciences and Mineral Resources (VIGMR)
Title	Organized workshop "Natural Disaster Management for Sustainable Development" from 10 <sup>th</sup> – 15 <sup>th</sup> September 2019 Implemented projects on Disaster Risk Reduction
Type of Activity	Research and Workshop
Date	2019

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. VIGMR joined Sentinel Asia in 2018 and reported on its activities related to disaster management and its future action plans.

In 2019, Economic Geology and Geomatics Department has implemented several activities related to Sentinel Asia as below:

- Organized Workshop "Natural Disaster Management for Sustainable Development", 10<sup>th</sup> – 15<sup>th</sup> September 2019. The workshop is highly appreciated the presence of HE Mr. Paul Jansen, Ambassador of Belgium in Vietnam and other guests from Disaster Management Authorities of Vietnam and other interested groups includes: Researchers, Policy Makers, NGOs, Community Leaders and DRR specialists. The participants shared knowledge and expertise with policy makers, universities, research institutions and industry and private partners; analysis of climate change impact, consideration of increased risk and vulnerability as well as actions for capacity building, awareness raising and infrastructure works. They pointed out the needs to establish a multi-actor partnership between Belgian and Vietnamese stakeholders to share knowledge and practice on the topic of natural hazards management (landslide and other hazards) in mountainous areas, where people are most vulnerable. They also shared the newest technology solutions for disaster management in Vietnam. In the framework of the workshop, VUB and VIGMR scientists investigated some landslide areas in Hoa Binh province, trained the volunteers (Geo-observer) using a smartphone app and collected data of landslide events. Other field-trip surveys were carried out to investigate large landslide spots in Đà Bắc district (22<sup>th</sup> - 25<sup>th</sup> November 2019).

- Implemented project "Establishing a multi-hazard and resilience observatory for Hanoi" granted by UKRI in cooperation to BGS. With goal of building a multi-hazard observatory, the comprehension data including landslide, soil space, weathering crust, rainfall, river discharge, flood level, v.v ... of Hanoi catchment were collected and analyzed. The satellite images of Red River catchment also were collected and analyzed to establish land cover and land use maps. In addition to satellite data, field surveys were conducted to choose the preferred location for the observation station. The established observatory in an experimental scale will contribute to enhance resilience and minimize negative impacts for Hanoi area as well as improve knowledge of multi-hazard and its chain-action mechanism in the study of DRR for river catchment.



Workshop "Natural Disaster Management for Sustainable Development" held in Hanoi



Field-trip survey at landslide spots in Hoa Binh province

Organization	Center for Research and Application for Satellite Remote Sensing, Yamaguchi University
Title	Director
Type of Activity	Contribution for EOR activity (Flood in Kyushu, Japan)
Date	August 2019

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. Also, Yamaguchi university has been providing VAPs as DAN in case of EOR. We provided flooding product which is covered Saga Prefecture when tragic heavy rain hit in August 2019.

