** December 2021 News from Sentinel Asia Project Office **

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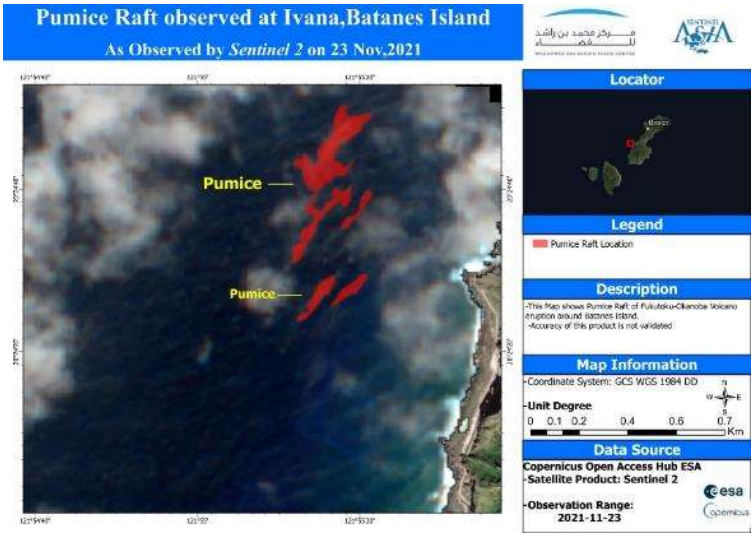
1. [News] Emergency Observation of Disasters (as of 27 December 2021)

   (1) Volcanic eruption influence in the Philippines (GLIDE Number: VO-2021-000191-PHL)
   In August 2021, Fukutoku Okanoba volcano, an underwater volcano in Japanese territory, erupted and ejected a huge amount of pumice stones and debris. These stones floated on the sea surface and a portion of them reached the Philippine coast.
   (https://mb.com.ph/2021/11/23/pumice-stones-debris-spewed-by-japans-underwater-volcano-reach-batanes-shores/)

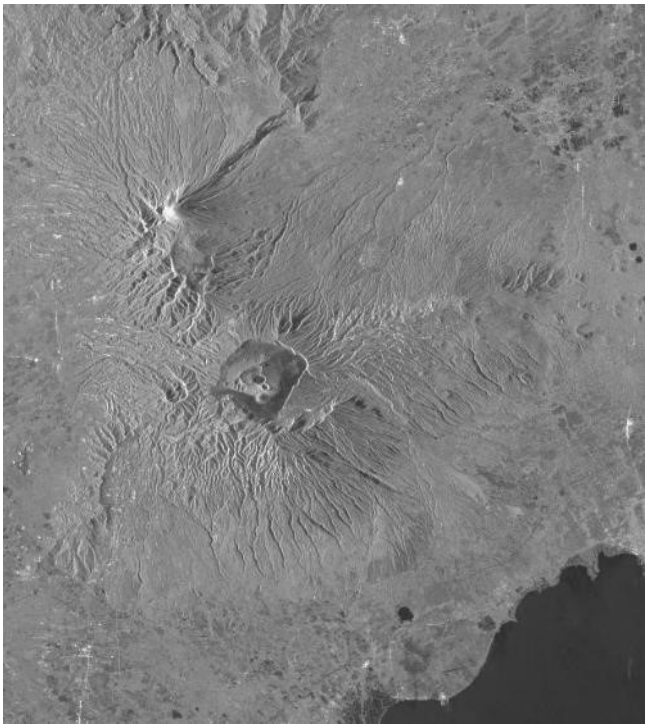
   The Philippine Institute of Volcanology and Seismology (PHIVOLCS) made an EOR to Sentinel Asia on 24 November. This EOR was escalated to the International Disasters Charter. PHIVOLCS assumed the role of Project Manager for this Charter activation. Among Data Analysis Nodes (DANs), the Mohammed Bin Rashid Space Centre (MBRSC) provided its VAPs. Information on the latest response by Sentinel Asia is available at the following link: https://sentinel-asia.org/EO/2021/article20211123PH.html



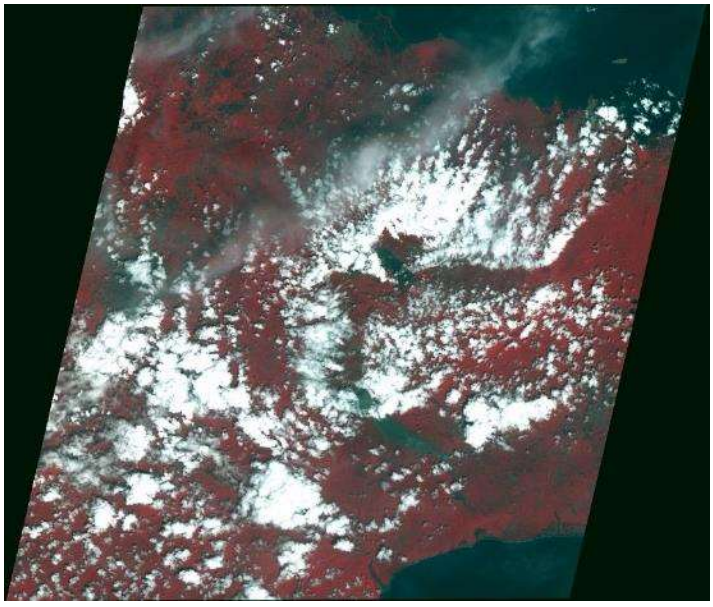
Value-Added Product by MBRSC

(2) Volcanic eruption in Indonesia (GLIDE Number: VO-2021-000194-IDN)
On 4 December 2021, Mount Semeru volcano in Indonesia erupted and produced a hot cloud avalanche with volcanic materials and heavy ashfall. According to ReliefWeb, the Indonesian National Board for Disaster Management (BNPB) reported that the number of fatalities had increased to 15, with 27 people missing and 169 injured. More than 1,700 people were displaced across 19 refugee posts, and 5,205 people and 2,970 houses were affected. (https://reliefweb.int/disaster/vo-2021-000194-idn/)

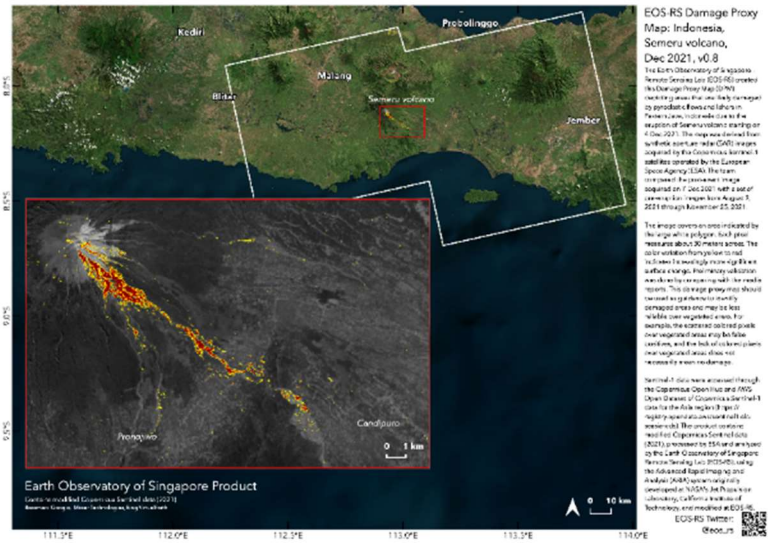
The Japan International Cooperation Agency (JICA) made an EOR to Sentinel Asia on 7 December. This EOR was escalated to the International Disasters Charter. The Asian Institute of Technology (AIT) assumed the role of Project Manager for this Charter activation. Among Data Provider Nodes (DPNs), the Japan Aerospace Exploration Agency (JAXA), the Indian Space Research Organization (ISRO), and the National Applied Research Laboratories (NARL) provided data. Among DANs, the Earth Observatory of Singapore (EOS), Yamaguchi University, and MBRSC provided their VAPs. Information on the latest response by Sentinel Asia is available at the following link:
https://sentinel-asia.org/EO/2021/article20211123PH.html



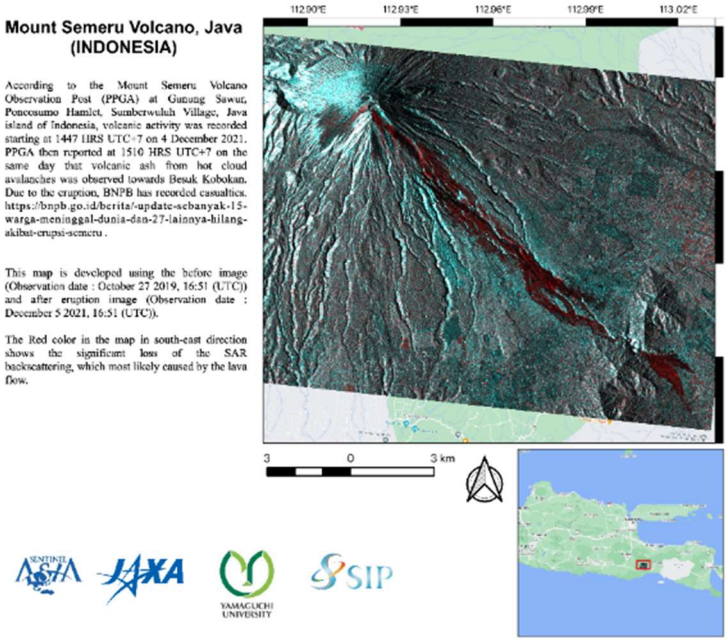
Satellite image (ALOS-2) provided by JAXA



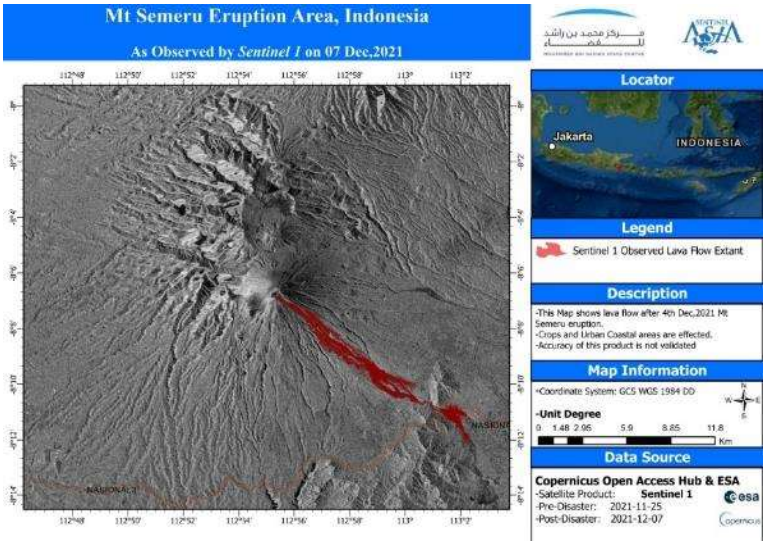
Satellite image (Resourcesat-2) provided by ISRO



Value-Added Product by EOS



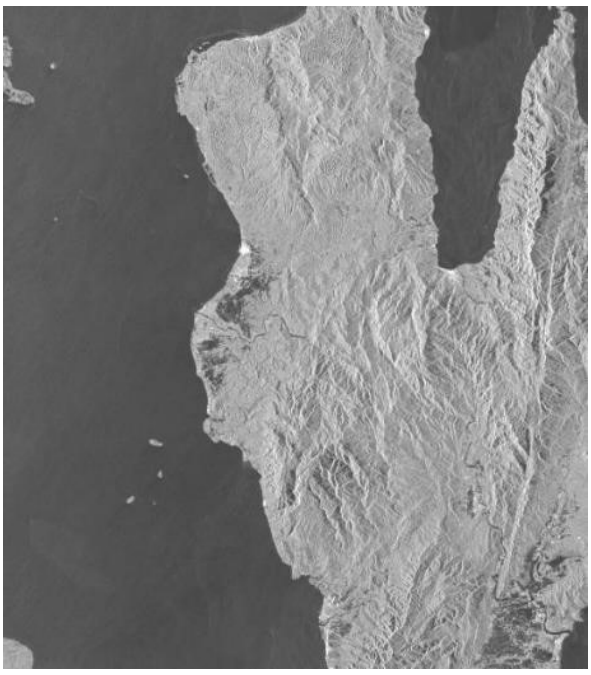
Value-Added Product by Yamaguchi University



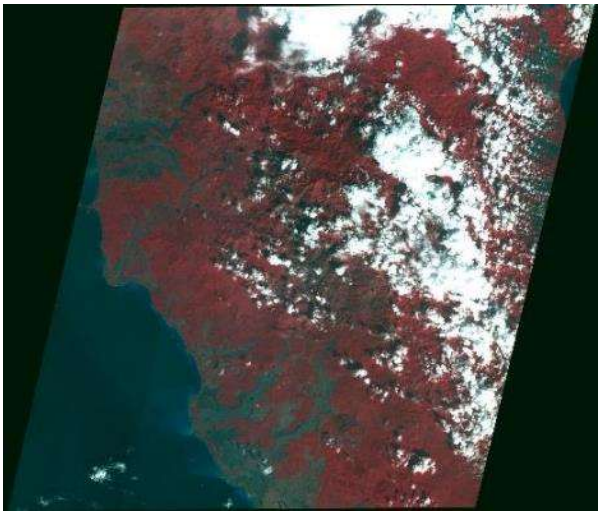
Value-Added Product by MBRSC

(3) Tropical Storm Odette in the Philippines (GLIDE Number: TC-2021-000202-PHL)
Super Typhoon Rai (Odette) made landfall on the Philippines on 16 December 2021. ReliefWeb reported that according to the National Disaster Risk Reduction and Management Council (NDRRMC) and the Department of Social Welfare and Development (DSWD), it killed at least 258 people, injuring 568 people and displacing 631,000 people as of 23 December.

Manila Observatory (MO) made an EOR to Sentinel Asia on 15 December anticipating the approach of the typhoon. Among Data Provider Nodes (DPNs), JAXA, ISRO, NARL, and the Geo-Informatics and Space Technology Development Agency (GISTDA) provided data. Among DANs, EOS and AIT provided their VAPs. Information on the latest response by Sentinel Asia is available at the following link:
https://sentinel-asia.org/EO/2021/article20211123PH.html

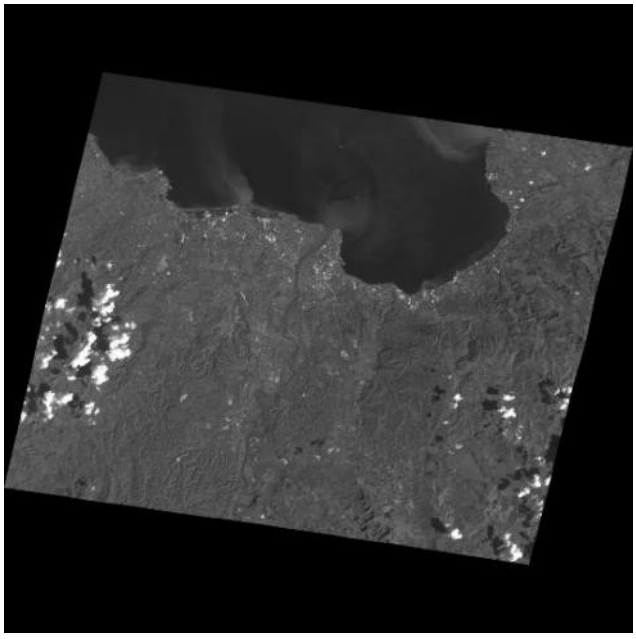


Satellite image (ALOS-2) provided by JAXA

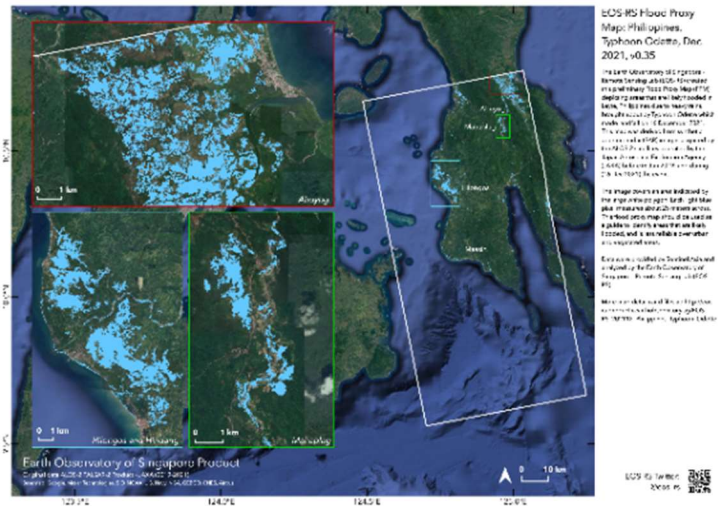


Satellite image (Resourcesat-2A) provided by ISRO

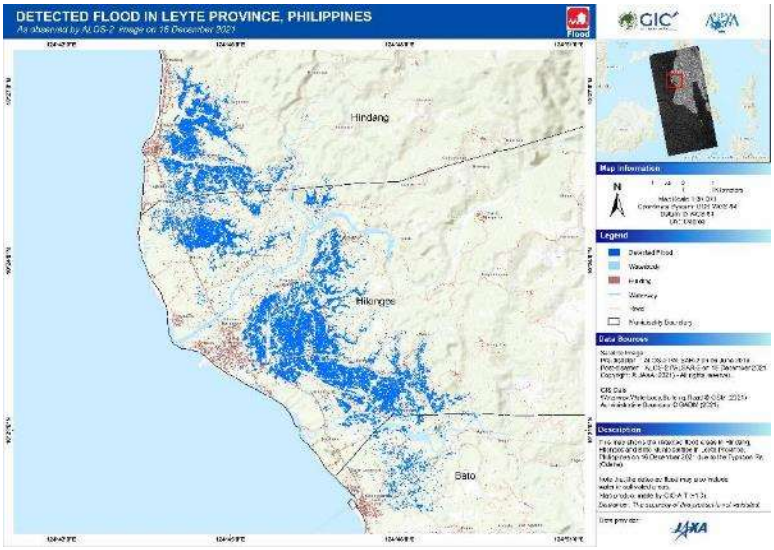
Satellite image (Formosat-5) provided by NARL



Satellite image (Theos-1) provided by GISTDA



Value-Added Product by EOS



Value-Added Product by AIT

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2. [Event] Summary report of the Sentinel Asia session at the APRSAF-27

The 27th session of the Asia-Pacific Regional Space Agency Forum (APRSAF-27) was held online from 30 November to 3 December 2021. The APRSAF-27 was co-organized by the Vietnam Academy of Science and Technology (VAST), the Ministry of Education, Culture, Science and Technology (MEXT) of Japan, and JAXA with the slogan "Expand Space Innovation through Diverse Partnerships."

On 1 December, a dedicated Sentinel Asia session was organized and hosted by the Sentinel Asia Secretariat in close collaboration with the Steering Committee members as part of Satellite Applications for Societal Benefit Working Group (SAWG) of the APRSAF-27. The session heard the following six presentations:

(1) "Sentinel Asia - Trend of Emergency Observation Request" (ADRC)
(2) "Sentinel Asia Status Report" (JAXA)
(3) "NSPO-NARLabs Engagement in Sentinel Asia" (NARLabs/NSPO)
(4) "Integration of Satellite data and Crowdsourced information through a Mobile App for the Sentinel Asia" (GIC/AIT)
(5) "Development of Mirror Target Calibration for Optical Satellite Data" (Yamaguchi University)
(6) "Using Earth Observation to help Pacific countries managing disaster risk reduction and response" (Pacific Earth Observation Council)

Through the Sentinel Asia session itself and its report by the SAWG co-chair in the high-level segment of the APRSAF (Plenary Session), the APRSAF-27 witnessed the development of the Sentinel Asia Step-3 system, led by the Technical Team composed of GISTDA, NARLabs/NSPO with Academia Sinica, and JAXA. The APRSAF-27 noted that the Sentinel Asia community had significantly upgraded its activities to address the entire disaster management cycle, with the contribution to the Sendai Framework in mind. Such activities included the establishment of "Standard Operating Procedure for making Emergency Observation Request (EOR) to Sentinel Asia" in several countries, a mobile application for sharing in-situ disaster information developed by AIT, a project by Yamaguchi University aimed at enhancing the reliability of optical satellite data, and an initiative by the University of Tokyo to extract building map from satellite data. Finally, the APRSAF-27 appreciated that NARLabs/NSPO had expressed their intention to provide Sentinel Asia with Formosat-8 satellite data after its launch.

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3. [Report] Brief Report on Sentinel Asia Training Programme on “Space Technology for Flood Forecast Modelling” organized by NRSC (ISRO), and IWMI under Sentinel Asia (*article contribution from ISRO and IWMI)

Background

Sentinel Asia is an international cooperation platform in which space agencies, disaster management agencies, and international organizations collaborate to combat natural disasters in the Asia-Pacific region on voluntary basis by using earth observation satellite data and Web-GIS technologies. Towards building a disaster-resilient society, the Sentinel Asia community has envisaged capacity-building programmes in strengthening of Sentinel Asia activities. To address such need, at the Joint Project Team Meeting in Bangkok in 2019, a specific Training Workshop was organized for the first time in which member organizations mutually train with their respective expertise and knowledge. In the Training Workshop, Indian Space Research Organisation (ISRO) and International Water Management Institute (IWMI) conducted training programmes on “topological and hydrological modelling”, and “emergency response mapping using multisource satellite data”. During the Sentinel Asia steering committee (SC) meeting organised in 2020 in Hyderabad, India, further discussions took place on strengthening the capacity-building programmes under Sentinel Asia. Following the SC meeting in 2020, ISRO and IWMI jointly proposed to expand the achievements, by volunteering themselves in providing capacity building for the benefit of the Sentinel Asia community. To begin with, the following capacity-building programmes were envisaged under Sentinel Asia:

(1) Space Technology for Drought Risk Management by National Remote Sensing Centre (NRSC)/ISRO, India in association with IWMI during 19-20 July, 2021
(2) Space Technology for Flood Forecast Modelling by NRSC/ISRO in association with IWMI during 27-28 October, 2021
(3) Emergency Response Mapping and Crisis Management by IWMI in association with ADRC and NRSC/ISRO in February 2022 (TBC).

Following the successful completion of the first capacity-building programme, the second Asia Pacific webinar on Space Technology for Flood Forecasting has been jointly organised by NRSC/ISRO and IWMI. About 80 participants from 13 Sentinel Asia countries/regions including ISRO and IWMI have participated in the programme. The training programme was coordinated by the Sentinel Asia Secretariat.

Flood Forecasting and Space Technology

In recent decades, flood damage trends have been increasing exponentially across the globe. This is a consequence of change in climatic conditions, changes in upstream land use and a

continuously increasing concentration of population and assets in flood-prone areas. A variety of mitigation measures can be implemented to minimize the impact of flooding. Satellite technology can provide vital information on the hydrology and topography of the catchment that plays a major role in spatial flood early warning. Flood forecasting is one of the best non-structural methods of flood damage mitigation being adopted globally. Remote sensing satellites provide key data for monitoring floods and cyclones in near real time. While spatial flood forecast modelling forms the keystone during the preparedness phase, flood forecasting provides an edge by proving the information well before the occurrence of the event. This flood forecasting is one of the best non-structural methods of flood damage mitigation methods that can give spatial flood alerts well in advance of the event. Due to the availability of high-resolution digital terrain models, as well as advanced hardware and software, early warnings and alerts for spatial floods are gaining importance in recent years. Satellite technology can provide vital information on the hydrology and topography of the catchment that plays a major role in spatial flood early warning.

Scope of the training programme

Capacity building is a powerful tool in disaster risk reduction and a very important element towards building a disaster-risk-resilient society. The objective of the programme has been to appraise the participants from Sentinel Asia member countries/regions on the potential and current status of EO technologies in operational flood forecast modelling and spatial flood inundation modelling using hydrological and hydrodynamic modelling techniques.

The programme has consisted of expert presentations/lectures and an interactive session to make it more impactful. The scope for augmenting applications of technology, research data gaps, its limitations and information-sharing opportunities were planned and documented for the future course of action towards promoting the technology for flood disaster risk reduction.

Proceedings of the 2-day training programme (27-28 Oct 2021)

This webinar brought together a total of around 80 experts and practitioners from different Sentinel Asia member countries/regions. The inaugural Session of the training Programme included a welcome by Dr. V. V. Rao, Deputy Director, Remote Sensing Applications, NRSC and brief remarks by (a) Mr. Miyoshi Takanori, Sentinel Asia Secretariat, (b) Dr. Mark Smith, Director General, IWMI, and (c) Dr. Raj Kumar, Director, NRSC. The 2-day webinar was conducted for the Asia Pacific region during 27-28 October, 2021. This is the second webinar conducted by ISRO in association with IWMI in continuation to the Drought Webinar as part of the capacity-building event of this kind in which Sentinel Asia members mutually help build capacity with their respective experience and expertise. In this inaugural session, it was stressed that the Sentinel Asia community would continue to support and foster mutual capacity building among members through cooperation. The inaugural session was completed with a formal vote of thanks by Dr. K H V Durga Rao, NRSC, ISRO.

During the key remarks, experts emphasized that floods are an important hydro-meteorological disaster causing huge economic losses with cascading effects, hence the need for using space-based inputs as a solution coupled with institutional partnership and the importance of community awareness in bringing effective flood disaster risk reduction was highlighted. The ever-increasing flood frequency and magnitude of disastrous flood events especially in South Asia and Southeast Asia is a major cause of concern. Therefore, this current training programme was quite relevant to develop understanding among the participants of the nature of disasters and the scope for new technologies to minimise/mitigate losses from such disasters using space technology for predicting and forecasting flood events in advance to enable sufficient lead time to respond. All the speakers in the inaugural Session have indicated the need for organising flood management-related capacity-building programmes, more frequently for the benefit of Sentinel Asia member countries/regions.

Fig 1: Inaugural Session of 2-day Webinar on Space Technology for Flood Forecasting & Modelling on Oct 27, 2021 (Virtual Mode)

Technical Session – 1: In this session, four presentations were given. It started with a brief presentation on “Hydrological Modelling” by NRSC, setting the base for the rest of the presentations. The presentation highlighted the importance of flood forecasting, different methods of flood forecasting, routing methods and deriving the hydrological and hydrodynamic parameters for flood forecasting using space-based inputs.

The second presentation in this Session was a demo on Flood Forecasting Modelling by NRSC, ISRO. The demo was addressed in introducing the participants to Hydrological Modelling

using open-source modelling software of HEC-HMS (Hydrological Engineering Centre-Hydrological Modelling System) and its utility. Topographic parameter extraction using satellite-based inputs like DEM (Digital Elevation Model), LULC (Land Use and Land Cover), and Soils were demonstrated. Preparation of meteorological models and integration with basin models was discussed. Flood forecast hydrograph computation, its calibration and validation were also demonstrated.

The third presentation in this Session was on Flood Inundation Simulation Modelling using a high-resolution Digital Terrain Model (DTM) by NRSC, ISRO. The presentation highlighted the stark differences between satellite-based flood mapping and flood inundation simulation using hydrological and hydrodynamic inputs with DEM as a primary input. It has brought out the need for flood inundation simulation and different models being used globally for deriving inundation simulation followed by the data requirements. The presentation also brought out the advantages and disadvantages of both 1D and 2D approaches and their relevance for simulation under different flow conditions.

Day 1 of the technical session concluded with a demo on flood inundation simulation using open-source software (HEC-RAS) by NRSC, ISRO. The demo showcased the creation of a terrain model, geometric mesh, boundary conditions and running the simulation in 2D unsteady flow condition for one of the reaches of Sabari River, India, as a case study. The demo concluded with results showing the water depth, velocity, etc. and an animation showing the flood progression and recession in an interactive session with the participants.

Technical session 2: In this session, there were six presentations. The day started formally with a recap of Day 1 and a discussion on the various presentations delivered on Day 1 by Dr. K H V Durga Rao. Subsequently, the first presentation of Day 2 was an invited lecture on Cyclogenesis, Forecasting Systems and Extreme Rainfall events by an expert speaker from the India Meteorological Department. The presentation gave good insight into the approaches followed in India and elsewhere on genesis, formation, prediction of landfall and dissipation of cyclonic systems and various aspects related to cyclone-based impacts on weather systems. The presentation highlighted technical elements related to forecasting systems on cyclones and storm surges and the impact of extreme rainfall events on land processes.

The second presentation in this session was on flood forecasting and early warning system in the cloud framework by IWMI Sri Lanka. The presentation focused on the importance of cloud-based services for flood forecasting and early warning systems for large basins and their importance in reducing computation time and storage requirements. Further, the presentation showcased the success stories of risk transfer/flood insurance in the Bagmati basin of Nepal and has ascertained the importance of flood insurance as a land-use regulation practice and incentivising people. It also showcased the success story of the Zambezi basin case study in

West Africa.

The third presentation in this session was an invited lecture on urban flood modelling by Indian Institute of Technology (IIT), Bombay. The presentation discussed at length the concepts of hazard, risk and vulnerability in urban floods. It clearly brought out the different types of vulnerabilities and how to derive various parameters to derive flood risk maps. The presentation concluded with case studies of urban flood modelling of Mumbai city, deriving of flood risk assessment maps for the Mithi river and part of the Mahanadi basin, Odisha State, and also introduced the participants to various models that can be implemented to address urban flood modelling.

The fourth presentation of the day was on an operational flood early warning system - case studies by NRSC, ISRO. The presentation covered the development of spatial flood forecast model for the Tapi and Godavari River Basins, India, using space-based inputs. It also covered spatial flood inundation simulation models using a high-resolution digital terrain model and web-enabled spatial flood early warning system. Real-time operation using IMD rainfall data was presented during the session.

In the brief session on interactive presentations, there were two presentations by participants from the Philippines and Singapore. The presentation by the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) showcased the disaster profile of their country, frequency and magnitudes of floods and cyclones, measures for mitigating / responding to various disasters, disaster management in their country, satellite-derived ready-data products, flood inundation modelling, etc.

The presentation by Earth Observatory of Singapore (EOS) included a brief presentation on microwave data analysis for flood response and intricacies in analysing the microwave data to derive flood inundation layers. The presentation also comprised case studies related to flood mapping and monitoring in their country.
Some of the participants interacted with the experts on specific aspects of drought occurrence in their regions and the scope for developing customised information products.

Concluding remarks
The Sentinel Asia Secretariat extended its gratitude to ISRO and IWMI for organizing this webinar, by reiterating the significance of capacity-building activities and recalling the previous webinar on drought management conducted by ISRO and IWMI in July 2021. He expressed his wishes and continued support to expand this endeavor for the benefit of the Sentinel Asia community.

ISRO and IWMI indicated that with the availability of open-access satellite data and easily

accessible advanced techniques such as cloud platforms, it is possible to develop robust flood monitoring and management systems for timely action to reduce flood risks. It was also concluded that a regional cooperation mechanism among the Sentinel Asia member countries/regions needed to be established further to share the analysis-ready flood-related data, knowledge and expertise for enhancing flood disaster risk-reduction capabilities.

Webinar brochure with details of technical presentations

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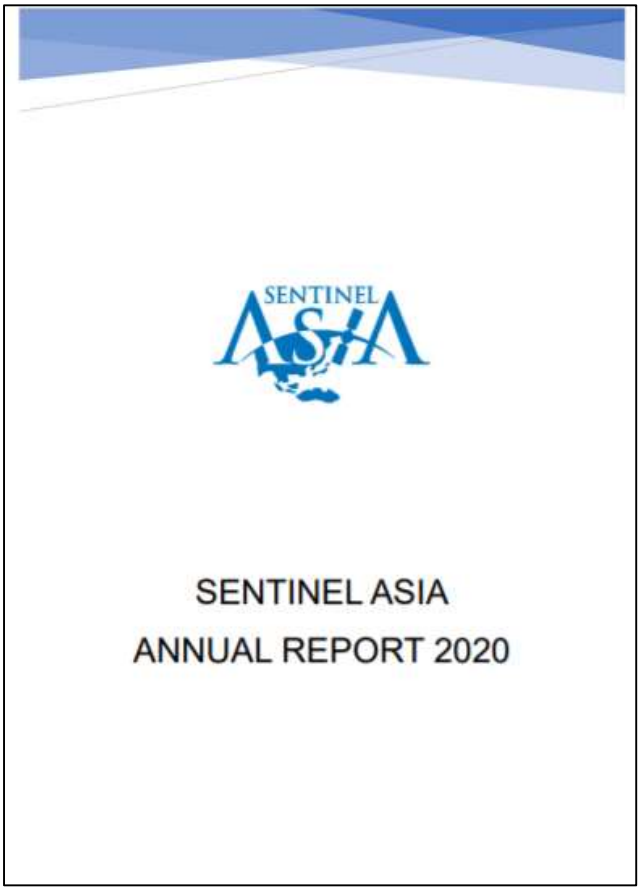
4. [Report] Sentinel Asia Annual Report 2020 has been published!

Sentinel Asia's activity report for the year 2020 has been published. The report features, among others, (i) a detailed review on EORs conducted in 2020 including good practices. (ii) external relations such as news, publications, and reports on conferences, and (iii) an analytical survey of Sentinel Asia's operations.

In 2020, Sentinel Asia's annual general meeting "Joint Project Team Meeting (JPTM)" was forced to be called off due to the COVID-19 pandemic. In this regard, this Annual Report provided JPT members with an alternative opportunity to report their Sentinel Asia-related activities, which would have been provided as part of the JPTM. In response to the invitation by the Sentinel Asia secretariat team, 24 JPT members contributed their activity reports, which are printed in the Appendix section of the Annual Report.

The Annual Report is available on the Sentinel Asia webpage at
https://sentinel-asia.org/reports/Reports/SA_Annual_Report_2020.pdf



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5. How to send an Emergency Observation Request

JPT member organizations are entitled to send an Emergency Observation Request (EOR) for disasters in the Asia-Pacific region. Please refer to https://sentinel-asia.org/e-learning/Emergency_Observation_Request.html.

EOR Order Desk:
Asian Disaster Reduction Center (ADRC)
HP: http://www.adrc.asia/
E-mail: sarequest@adrc.asia
FAX: +81-78-262-5546,
TEL: +81-78-262-5540

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6. Using Sentinel Asia Operation System, OPTEMIS

Sentinel Asia launched a new operation system, OPTEMIS. Please refer to the website on how to create an account for OPTEMIS. https://sentinel-asia.org/e-learning/Emergency_Observation_Request.html

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