ASEAN Regional Training Course on
Geospatial Big Data Applications for Sustainable Development

5th – 9th August 2019

ASEAN Research and Training Center for Space Technology and Applications (ARTSA)

Sirindhorn Center for Geo-Informatics (SCGI),

Space Krenovation Park,Chonburi Province, Thailand

In Collaboration with Hydro Informatics Institute (HII) , Chulalongkorn University, King Mongkut's Institute of Techmology Ladkrabang, Thailand, Chinese University of Hong Kong (CUHK), United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), The Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific (UNGGIM-AP)

I. Background

The volume of data in the world is increasing exponentially. By some estimates, 90% of the data currently existing worldwide has been created in the last two years, and it is projected to increase by 40% annually[1]. The data revolution encompassing the application of earth observation data, the open data movement, the rise of crowdsourcing, new information and communication technologies (ICTs) for data collection, and the explosion in the availability of big data, together with the emergence of artificial intelligence and the Internet of Things -- is already transforming the society. Multi-temporal earth observation data and crowdsourced geospatial data can help us identify depleting natural resources, diagnose underlying causes and can help us devise informed planning for sustainable development. According to the UN global pulse, to use big data for development, we need to turn imperfect, complex and often unstructured data into actionable information. Although the tools and technologies for analyzing massive amounts of data are rapidly evolving, however no single standard have been developed or exists for generating actionable information. This poses a big challenge to the practitioners and decision-makers to effectively utilize geosptial big-data for decision-making purposes.

As expressed in its Vision 2025, ASEAN highlights the need to promote and ensure balanced social and sustainable environment that meets the needs of the peoples at all times and to work towards a resilient community with enhanced capacity and capability to adapt and respond to social and economic vulnerabilities, disasters, climate change as well as emerging threats and challenges. The Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030), was adopted by ESCAP member States in 2018, to harness space and geospatial applications, including digital innovations to support ASEAN members and other countries in the region, particularly those with special needs, to address regional challenges towards achieving the Sustainable Development Goals (SDGs).

To meet with this challenge, GISTDA, ARTSA, UNOSAT and UNESCAP is offering an introductory course in the use of Geo-spatial Information Technology applications for big data relevant to different domains such as disaster risk management, environmental monitoring, hazard mapping and disaster risk reduction for achieving the SDGs.

II. Learning Objectives
At the end of the course, participants should be able to:
- Define and describe basic concepts and terminology related to Geospatial Big Data Analytics;
- Explain the advantages and limitations of using Geospatial Big Data Analytics;
- Detect flood using RADAR satellite data and damage estimation using Google Earth Engine;
- Monitor disaster situation using a web scraped geodata;
- Utilize big data techniques for monitoring carbon emission, smog and forest fire using Google Earth Engine and;

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[1] https://www.un.org/en/sections/issues-depth/big-data-sustainable-development/index.html

- Undertake the process to prepare actionable information through visual communication.

III. **Course Content**

The course will provide participants with a theoretical understanding of geospatial big data and the context of geospatial data analysis including its application for problem identification, assessment, and decision support. Participants will also be challenged to solve a problem of their choice by developing a simple decision support application.

IV. **Duration and Instructional Methodology**

This is a full-time, face-to-face course with lectures and lab exercises using geospatial big datasets and real case scenarios (60% lab exercises, 40% lectures and discussions). This course is divided into 5 modules. Each module is structured into 4 sessions of 1.5 hours each. The average workload per week is likely to be around 25-30 hours. The course is designed in a way to have a balanced approach between theoretical and practical teaching methods consisting in Power Point presentations, live demos, videos, interactive sessions and geospatial big data analytic exercises. At the end of the course, GISTDA, ARTSA, UNOSAT and UNESCAP will set up a community of practice platform to maximize the learning experience of participants and to provide all required technical backstopping and assistance to training participants during and after the training.

V. **Course Content**

Module A1: Introduction to geospatial big data analytics for sustainable development
- Increased understanding of the regional action plan on using geospatial technology
- New trend in geospatial big data and technology for bid data anlaytic

Module A2: Geospatial big data application for disaster risk reduction
- Flood monitoring and damage assessment from time series satellite image using Google Earth Engine
- Disaster monitoring and situational analysis using web-scrapped big data

Module A3: Geospatial big data for environmental management
- Geospatial big data analysis for forest fire management and carbon emission

Module A4: Group project on big data application
- Hands-on exercise on using big data analytics for actionable information for social benefit

Module A5: Data visualisation
- Use of infographic for representing maps and geospatial big data analysis

Description of the modules

Module A1: Introduction to geospatial big data analytics for sustainable development

- **Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018 – 2030) - UNESCAP**

  The Plan of Action is a regionally coordinated, inclusive and country-needs driven blueprint that harnesses space and geospatial applications, to achieve the 2030 Agenda for Sustainable Development. The Plan of Action is fully aligned with ESCAP's Regional Roadmap for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific. It maps the sectoral needs and resources at national and regional levels.

  This topic will increase understanding of the regional action plan on using space and geospatial applications in ASEAN member counties and able to apply to the project and work in the participant's agency.

- **Roles of geospatial big data in geoinformatics application for sustainable development – KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG**

  Achieving sustainable development presents all countries and the global policy community with a set of significant development challenges that are almost entirely geographic in nature. Many of the issues impacting sustainable development can be analyzed, modelled, and mapped within a geographic context, which in turn can provide the integrative framework necessary for global collaboration, consensus and evidence-based decision-making.

  This topic aims to explore a new trend technology of geospatial big data, which can be used to address scientific and societal issues and to develop a potential methodology on how to improve more precise and timely results through big data analytic approaches.

Module A2: Geospatial big data application for disaster risk management

- **Flood monitoring and damage assessment from time-series satellite image using Google Earth Engine - UNOSAT**

  Between July and September 2018 much of Lao PDR was under water. To understand the flood dynamics for the whole country for a duration of two month requires a staggering amount 237 RADAR satellite images to be analyzed. Using a traditional technique of image by image flood extraction would require at least several months to come up with the statistics.

  In this scenario, Google Earth Engine platform will be used to extract flooding duration and extent and a massive scale.

- **Disaster monitoring using web-scrapped big data – CHULALONGKORN UNIVERSITY**

  The combined application of location identification in mobile phones, social network and computers with cloud computing can help faster detection of natural disaster. By combining information related to disaster situation from Twitter and satellite observations, a scientist can build a real-time map of the location, timing, and impact of disaster assessment.

  This topic aims to train the participant to practise writing programing language to extract disaster information and location from Twitter for assessing and monitoring the situation efficiently and timely.

Module A3: Geospatial big data for environmental management

- **Wildland fires, smoke and haze – HYDRO-INFORMATICS INSTITUTE (HII)**

  Wildland fires, smoke and haze are considered as a regional problem. Active fires can be detected and utilized in wildfires control. They emitted carbon, carbon dioxide and other greenhouse gases which will continue to warm the planet well into the future. They damage forests that would otherwise remove CO2 from the air. Moreover, they inject soot and other aerosols into the atmosphere, with complex effects on warming and cooling. To timely cope with this growing problem, a combination of satellite image processing with near real-time data supplied by multi-sensors is needed.

This topic will aim to improve the understanding of big data application for forest fire detection and management where is the source of carbon emissions using Google Earth Engine, Sentinel Hub, NASA FIRMS, NASA WorldView, etc.

- **Big data application for social development – CHINESE UNIVERSITY OF HONG-KONG (CUHK)**
  Big Data refers to data sets of much larger size, higher frequency, and often more personalized information. It will be the next frontier for innovation, competition and productivity. Using machine learning technology, a field of data science known as predictive analytics shows the value in large amounts of data. This advantage can be adapted for social development by understanding society and social interaction in ways we never could before.
  With the group project participants will apply big data analytics for preparing actionable information for social benefits.

Module A4: Group project on big data application

- **Technical visiting at Space Krenovation Park - GISTDA**
  Space Krenovation Park (SKP) was established in 2012 by Geo-Informatics and Space Technology Development Agency (GISTDA). SKP offers a new focus for development on the challenges of meeting global demands in geo-informatics and space technology. SKP comprise of GISTDA's operation centre that monitors and receives data from the THAICHOTE satellite as well as other satellites and the Space Inspirium - first Thailand's space museum. It also serves as an platform for young entrepreneurs in the country to set up their business.
  In this session, all participants will have a chance to visit all facilities in SKP under the guideline of GISTDA's experts and satellite engineer to understand the role space technology support to country development.

Module A5: Data visualization

- **Prepare actionable information through visualization - UNOSAT**
  Infographics - a clipped compound of "information" and "graphics" - are graphic visual representations of information, data or knowledge intended to present information quickly and clearly. Infographics have been around for many years and recently the increase of a number of easy-to-use, free tools have made the creation of infographics available to a large segment of the population.
  This topic aims to let everyone understand the concept of infographic and demonstrate infographic application for mapping representing the result of geospatial big data analysis.

VI. Organizers

- ASEAN Research and Training Center for Space Technology and Applications : (ARTSA)
- Ministry of Higher Education, Science, Research and Innovation:
  Geo-Informatics and Space Technology Development Agency (Public Organization) (GISTDA)
- United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)
- UNITAR's Operational Satellite Applications : (UNOSAT)

VII. Collaborator

- Hydro Informatics Institute (HII), Thailand
- Chulalongkorn University, Thailand
- King Mongkut's Institute of Techmology Ladkrabang, Thailand
- Chinese University of Hong Kong (CUHK), China
- United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA)
- The Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific (UNGGIM-AP)

VIII. **Date & Place**

    Date   : Monday 5th – Friday 9th August 2019 (5 days)

    Place   : ARTSA, Sirindhorn Center for Geo-Informatics Building,

                                         Space Krenovation Park (SKP), SriRacha, Chonburi, Thailand.

    Location   : 13.102001 N,100.928833 E

IX. **Expected Participants from ASEAN countries**

The course is designed to accommodate ASEAN participants, who work in the government sector with geoinformatics background and professional experiences. Experience in basic programming and algorithm development is also recommended. Participation is limited to a maximum of 20 participants.

X. **Language**

The language of the training course will be conducted in English.

XI. **Lecturers**

The lecturers will be conducted by experts on geospatial big data from Thailand, UNESCAP, UNOSAT and prominent organizations.

XII. **Software**

Lab exercises will be based on free to use and opensource tool like QGIS, Orange, R (programing language) and Google Earth Engine.

XIII. **Class Size**

The number of participants is limited to 15-20 (max.) to ensure quality support provided by the instructors.

XIV. **Certificates**

Students will be given a certificate issued by GISTDA, UNESCAP and UNITAR upon successful completion of the course.

XV. **Financial Support**

There are two groups of participants, self support participants and funded participants, available for this course. Both groups are supported with local expenses by local host (ARTSA and GISTDA, Thailand) **excluded** the life and health insurance.

UNESCAP and UNOSAT-UNITAR also offering the airfare grant for limited number of funded participants on competitive bases. A panel of judges from the local organiser and co-organiser in its sole discretion will review all application and decide on the fund recipient.

The applicant for funded participant must be a government officer from an ASEAN country or an official of the ASEAN Secretariat or the AHA Center.

	Self support participant	Funded participant
Local Expenses		
Registration fee	Supported by Local Host	Supported by Local Host
Lecture materials		
Meals and break refreshment		
Local transportation and airport transfer		
Accommodation (IN 4 Aug / OUT 10 Aug)		
One Round Trip Ticket	Self funded	Supported by UNESCAP and UNOSAT-UNITAR
Life and health insurance	Self funded	Self funded

Please indicate in the online course registration form if you would like to apply for the airfare grant as funded participant or self funded participant. (See at How to apply and required document)
Applicants of both groups will go through the selection process by the Committee.

XVI. **How to apply and requied document**

All applicants are requested to submit the application through **ONLINE APPLICATION FORM** with required documents as below detail list.

(1) Online Application form can be accessed at **http://artsa.gistda.or.th/geobigdata2019**
(2) One Copy of Passport*
(3) Curriculum vitae (Maximum 2 pages)*
(4) One letter of recommendation: e.g. from your supervisor, head of the department or head of organization who knows your work well (the recommendation form is available on training course website).

Note: (2) and (3) should be prepared in PDF format and should be attached in the online application form

XVII. **Important Dates**

Call for course application	01 June 2019
Course application deadline	30 June 2019
Announcement of selected participants	5 July 2019
Sending invitation letter and attendance forms to all selected participants (for VISA purpose)	5 – 10 July 2019
Deadline for attendance form submission	20 July 2019
Travel to SKP, Thailand	4 Aug 2019
Geospatial Big Data Course	5 – 9 Aug 2019

Remarks:
- Only complete applications, with all the requested information, will be considered.
- The invitation letter will be sent to only selected applicants for visa formalities at the same time.

XVIII. **Institutions**

Geo-informatics and Space Technology Development Agency (GISTDA)
The space technology and geo-informatics applications of GISTDA are meant to bring benefits to the general public while its satellite database are being used for their Natural Resources Information Centre. GISTDA also provides data services related to space technology, and geo-informatics while it provides technical services to

build the institutional capacity on the use of remote sensing and GIS. GISTDA is also engaged in researche and development (R&D) and implements other space related activities such as development of nano satellites for natural resources survey. The headquarter is located at The Government Complex, Ratthaprasasanabhakti Building, Bangkok, Thailand.

ASEAN Research and Training Center for Space Technology and Applications (ARTSA)

ARTSA is engaged in knowledge transfer and research in the region and is also responsible for establishing and expanding networks of academic and research institutions through collaborations among ASEAN countries including supporting in areas related to natural resources management, environmental management, and emergency response. The operational concept of the center is to increase ASEAN personnel capacity in the area of space technology and geo-informatics applications and raise awareness through research and knowledge transfer based on classroom training, on the job training, research projects, academic network, etc..

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)

The Economic and Social Commission for Asia and the Pacific (ESCAP) serves as the United Nations' regional hub promoting cooperation among countries to achieve inclusive and sustainable development. The largest regional intergovernmental platform with 53 Member States and 9 associate members, ESCAP has emerged as a strong regional think-tank offering countries sound analytical products that shed insight into the evolving economic, social and environmental dynamics of the region.

The Commission's strategic focus is to deliver on the 2030 Agenda for Sustainable Development, which is reinforced and deepened by promoting regional cooperation and integration to advance responses to shared vulnerabilities, connectivity, financial cooperation and market integration. ESCAP's research and analysis coupled with its policy advisory services, capacity building and technical assistance to governments aims to support countries' sustainable and inclusive development ambitions.

UNITAR'S Operational Satellite Applications Programme (UNOSAT)

UNOSAT is a technology intensive programme active in all aspects of applied research relating to satellite solutions, from earth observations to telecommunication, positioning and navigation. UNOSAT delivers satellite solutions, geographic information to organizations within and outside the UN system to make a difference in the lives of communities exposed to poverty, hazards, and conflict, or affected by humanitarian and other crises. The main office of UNOSAT is located on the CERN site in Meyrin, Geneva, and regional offices at Bangkok, Nairobi and N'djamena.

The Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific (UNGGIM-AP)

The Regional Committee of UN-GGIM-AP is one of the five regional committees of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM). It was initially established in 1995 as the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) in accordance with the resolution adopted at the Thirteenth UN Regional Cartographic Conference for Asia and the Pacific in 1994, and rebranded as UN-GGIM-AP in 2012, subsequent to the establishment of UN-GGIM in 2011. As the representing body of the National Geospatial Information Authority of 56 countries in Asia and the Pacific region, the UN-GGIM-AP aims to promote the use of geospatial information for identifying problems and finding solutions, so that the economic, social and environmental benefits of geospatial information will be maximized in Asia and the Pacific region. The Economic and Social Council adopted the resolution "Strengthening institutional arrangements on geospatial information management" at its 48th plenary meeting on 27 July 2016. The resolution requests, the regional commissions of the United Nations shall provide relevant support to the work of the regional bodies of the UN-GGIM and the outcomes and benefits of the activities of those bodies shall be equally disseminated to all member

States in each region. To implement this resolution, ESCAP has taken over the secretariat of UN-GGIM-AP since November 2018, in order to strengthen the capacity of the member States in geospatial information management and to facilitate the dissemination of the outcomes and benefits of the activities of the Committee to the member States in the region.

Chinese University of Hong-Kong

Founded in 1963, The Chinese University of Hong Kong (CUHK) is a forward-looking comprehensive research university with a global vision and a mission to combine tradition with modernity, and to bring together China and the West. CUHK teachers and students hail from all around the world. CUHK graduates are connected worldwide through an extensive alumni network. CUHK undertakes a wide range of research programmes in many subject areas, and strives to provide scope for all academic staff to undertake consultancy and collaborative projects with industry.

Hydro-Informatics Institute (HII)

HII a public organization under the Ministry of Higher Education, Science, Research and Innovation, was originally established by the initiative of His Majesty the King Bhumibol Adulyadej, aiming to develop a coherent plan to improve water resource management in Thailand. With agriculture as the backbone of Thailand's economy, HII's research on water resource management and agricultural practices have been increasingly notable. Since 2010, HII has maintained the High Performance Computing facilities that enable research branching from intelligent monitoring systems, weather and flood modeling, simulation, information processing, and information dissemination that support the policy makers in coping with flood and drought management.

Chulalongkorn University

Its a World-class National University with 102 years of education and knowledge to serve the nation with dignity and integrity. The university was originally founded during King Chulalongkorn's reign as a school for training royal pages and civil servants in 1899 (B.E. 2442) at the Grand Palace of Thailand. It was later established as a national university in 1917, making it the oldest institute of higher education in Thailand. Chulalongkorn University is one of the National Research Universities being supported by the Office of National Education Standards and Quality Assessment of Thailand. Moreover, It is the only university in Thailand which is a member of the Association of Pacific Rim Universities (APRU)

King Mongkut's Institute of Technology Ladkrabang

King Mongkut's Institute of Technology Ladkrabang (KMITL or KMIT Ladkrabang for short) is a research and educational institute in Thailand. KMITL consists of seven faculties and four colleges with a total enrollment of more than 29,729 undergraduate and graduate students: Faculty of Engineering, Architecture, Industrial Education, Science, Agricultural Technology, Information Technology and Agroindustry together with College of Nano technology, Data storage technology and applications, Administration and Management and International College.

XIX. Course Coordination:

Ms.Manpreet Sachasiri, GISTDA (manpreet@gistda.or.th)
Mr.Jakrapong Tawala, UNOSAT-UNITAR (jakrapong.tawala@unitar.org)
Ms.Patricia Budiyanto, UNESCAP (budiyanto@un.org)

XX. Course Schedule (DRAFT)

	Module 1 5 Aug 2019	Module 2 6 Aug 2019	Module 3 7 Aug 2019	Module 4 8 Aug 2019	Module 5 9 Aug 2019
S1 09:00-10:15	Opening Session [PPT] Course Introduction, *GISTDA&ARTSA* [PPT]	Case Study 1 Disaster Monitoring using Web-scrapped Big Data, *Chulalongkorn University* [LAB_EX]	Case Study 3 Wildland Fires, Smoke and Haze, *HII* [LAB_EX]	Roles of Geospatial Big Data *KMITL* [PPT]	Roundtable on Way Forward (Countrywise) [RT]
			Coffee and tea break		
S2 10:30-12:00	(10:30-11:00) Plan of Action *UNESCAP* [PPT] (11:00-12:00) Intro to GEO BIG Data Analytics *UNOSAT* [PPT]	Case Study 1 (Continued) [LAB_EX]	Case Study 3 (Continued) [LAB_EX]	Group Project [ASN]	Evaluation Certificate Closing Ceremony
12:00-13:30			LUNCH		
S3 13:30-15:00	Intro to GIT(GIS, RS) *UNOSAT* [LAB_EX]	Case Study 2 Flood Monitoring Simulation GEE, *UNOSAT* [LAB_EX]	(13:30-14:00) Good practices of Big Data Application *CUHK* [PPT] (14:00-15:00) Case Study 4 Big Data Application for Social Development, *UNOSAT* [LAB_EX]	Technical visiting *GISTDA* [RT]	
			Coffee and tea break		

S4 15:15-16:30	Intro to GEE for Big Data Analytics *UNOSAT* [LAB_EX]	Case Study 2 (Continued) [LAB_EX]	Case Study 4 (Continued) [LAB_EX]	Data Visualization *UNOCHA* [PPT+IA]	
16:30-17:00	Wrap-up & Self-Study	Exercise Continuation – Q&A	Exercise Continuation – Q&A	Exercise Continuation – Q&A	

[PPT]:   Power Point Presentation
[PPT+IA]:   Power Point Presentation with Interactive exercise
[LAB_EX]:   Lab Exercise
[RT]:   Round Table and Group Discussions
[ASN]:   Assignment
[END]