*Flood at Tha Din Daeng Temple Complex in Ayutthaya, Thailand*
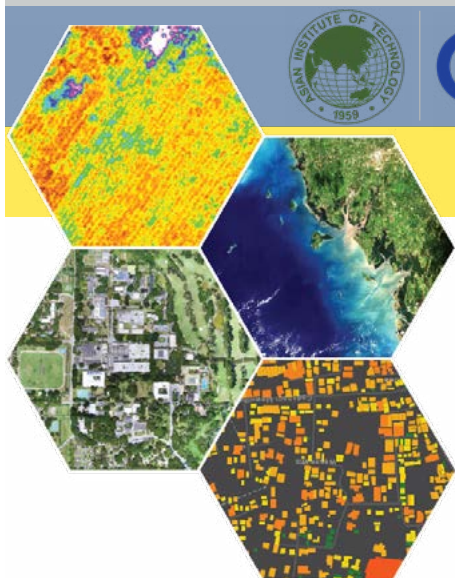
# GEOINFORMATICS CENTER
# January 2022 NEWSLETTER

## Flood Mapping and Validation in Ayutthaya Province

GIC responded to the extensive late wet season flooding that inundated much of central Thailand by investigating flood extent in neighboring Ayutthaya province.

GIC received Synthetic Aperture RADAR (SAR) data from Sentinel Asia Program partners covering Ayuthaya, Thailand in response to the flooding that began in late September 2021. The disaster response team at GIC performed image analysis on multi-temporal satellite imagery to determine the flooded areas throughout the province.

To validate the flood map, GIC mobilized a field team to access the interpreted flooded areas to collect reference data in Ayutthaya province.

The field team used innovative tools to collect the reference data including customizable mobile applications and unmanned aerial vehicles (UAVs). First, a configurable Google application provided navigation to selected flood zones throughout the province. Next, a customized data collection application was used to gather vital field information including flood condition and geospatial coordinates among others, which would later be introduced into a GIS environment for further analysis. The team also recorded aerial video and images of flooded areas using a lightweight UAV. One benefit to this bird's eye view was in exploring the extent of the flooding, making it possible to gain a grander scope of the surrounding areas beyond what is possible at the roadside.

During the day, the team was able to catch up with residents of Ta Din Daeng sub-district,

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Phak Hai District, Ayuthaya, where relief efforts were underway. A small fleet of motor boats was on hand delivering essential supplies to residents in the nearby flooded villages. UAV made it possible to survey the extensive flooding surrounding the Tha Din Daeng Temple Complex located just down the road from the relief boat staging area.

Sentinel Asia is a collective managed by the Asia-Pacific Regional Space Agency Forum (APRSAF) to aid in disaster management with space technology. GIC serves as the Principal Data Analysis Node for Sentinel Asia, playing a vital role in the coordination of satellite data analysis, generation of value added mapping products, and dissemination of the results through the Sentinel Asia system.

GIC's reference data for the late 2021 wet season flooding in Ayutthaya province can be accessed through GIC's mapping portal.


Recoding flooded area refernce data in Ayutthaya


Relief efforts underway at Ta Din Daeng Sub-district

# GIC at the 42nd Asian Conference on Remote Sensing

GIC presented novel research for detecting centroids of objects in aerial images at the 42nd Asian Conference on Remote Sensing (ACRS) which was held from November 22-24, 2021 in Can Tho, Vietnam.

GIC Team Leader Lakmal Deshapriya delivered a presentation describing Centroid-UNet, a new approach to detecting centroids of objects appearing in RGB aerial and satellite imagery with a deep neural network.

The Centroid-UNet model is based on classic U-Net semantic segmentation architecture, which has been optimized for centroid detection. The technique uses Gaussian blobs generated around centroid points to stabilize the training process. The model was tested and evaluated in a case study using high resolution aerial imagery for centroids of buildings and coconut trees. The simplified approach achieved a good accuracy for both object types in comparison to other centroid detection methods.

The next steps will assess the feasibility of using this approach for multi-class centroid estimation.

The code for Lakmal's Centroid-UNet research as well as the trained models are published in GitHub - https://github.com/gicait/centroid-unet

Due to the ongoing COVID-19 pandemic, the majority of the 42nd meeting of ACRS was held online.

ACRS is an annual conference hosted by member countries of the Asian Association on Remote Sensing (AARS). The conference dates back to 1980 with an inaugural meeting in Bangkok, Thailand. Professor Shunji Murai, organizer and catalyst for the first ACRS conference, continues to be an integral part of its success to this day. In 2022 ACRS will be holding its 43rd meeting in Ulaanbaatar, Mongolia. Stay tuned to the AARS website for future ACRS announcements.

# ADB Training to Improve Indonesia Disaster Resilience

GIC shared its expertise in a capacity building program related to earth observation for land subsidence, building stability, flood, agriculture, and aquaculture in Indonesia. The event was held online through the partnership of the European Space Agency (ESA) and the Asian Development Bank (ADB), and hosted by the Indonesian Research Organization for Aeronautics and Space (LAPAN) from November 22-26, 2021.

The 5-day training course, titled Knowledge Sharing & Capacity Building of Earth Observations for Water and Food Security Planning in Indonesia, was sponsored by the Asian Development Bank through (i) the Water Financing Partnership Facility; and (ii) the Japan Fund for Poverty Reduction.

GIC participated in a session which focused on stability mapping for buildings and critical infrastructure. Research associates' Chathumal Madhuranga and Syams Nashrrullah shared GIC's progress in an ongoing ADB's project on Emergency Assistance for Rehabilitation and Reconstruction (EARR) Monitoring in Palu, Central Sulawesi, the site of a devastating September 2018 earthquake that caused more than 4,000 deaths. GIC opted to use the Small Baseline Subset (SBAS) and Persistent Scatterer Interferometry (PSI) technique for Sentinel-1 multi-temporal InSAR data processing for this task. The final output was a map depicting the stability of buildings in Palu with a low, medium, or high motion status based on ground motion levels determined from Sentinel-1 data analysis.

Data access and processing for GIC's ground motion analysis took place in the Geohazard Exploitation Platform (GEP), a cloud-based solution that carries out large scale processing of Earth Observation data, and allows mapping hazard prone land surfaces and monitoring terrain deformation.

During the session GIC also introduced the Project Geoportal, a user-friendly and interactive platform to support the Palu reconstruction monitoring activities and visualize the output of the data processing and analysis. The Geoportal features maps that were created through SAR data analysis including time-series displacement maps and stability maps of buildings and other infrastructure. Additional map layers like active fault lines, liquefaction areas, and resettlement areas assist in understanding underlying geographical concerns as well as ongoing aid efforts.

GIC was joined by Remote Sensing Technology Center of Japan (RESTEC), Terradue, Luxembourg Institute of Science and Technology (LIST), Planetek Italia, and Indonesia's government agencies and universities to round out the other sessions which focused on land subsidence, flood mapping, crop and water use mapping, and aquaculture mapping.



# Virtual training course on Python for Agro-ecological Zoning

GIC held an open online training course from October 25-29, 2021 in collaboration with FAO to introduce the PyAEZ tool to professionals in support of policy and planning exercises related to land-use planning and management. The training focused on the use of a cloud platform (Google Colab) for running Python scripts to generate AEZ output. It covered the various modules implemented in AEZ on agro-climatic analysis, crop-modeling, limiting factors on climate, soil, and terrain analysis, customizing, and running the Python code. There were 25 technicians working on land-use planning in attendance. Prerequisites for the course included skills in Geographic Information Systems and Python. A brief recap of Python, as well as exercises on data pre-processing / preparation, was also introduced. PyAEZ training modules were made available online, including examples, illustrations, and the data used to follow the training course.

# Agro-ecological Zoning Online Training Course

GIC and the United Nations Food and Agriculture Organization's (FAO) Geospatial Unit under the Land and Water Division held an online training course from 11-15 October 2021 to introduce land management professionals to Agro-ecological Zoning (AEZ).

The training course, titled *An Introduction to Agro-Ecological Zoning: A Framework for Agricultural Development and Land Use Planning*, was attended by nearly 100 participants from 22 countries.

AEZ is a land evaluation framework used to predict the potential of land based on its attributes including land suitability and limiting factors related to climate, soil, and terrain. To address these varied topics, a diverse assortment of instructional sessions was devised for the training program by the FAO and GIC teams. Sessions focused on data requirements for AEZ, Global AEZ Methodology, LULC concepts, hands-on analysis of climate data, crop modeling, crop parameters, water balance on soil and crop water stress, yield, limiting factors, soil, topography, interpretation of crop summary table, and AEZ country applications.

The AEZ methodology was developed by FAO in the late 1970's as a way to evaluate land at the continental scale. The process defined agro-ecological zones based on similar soil and climate characteristics which conveyed agricultural production potential. Over time the AEZ development team expanded to the global scale with the release of a Global AEZ product at the turn of the millennium. The latest iteration, GAEZ 4.0, debuted in June 2021 as the most interactive version yet. GAEZ 4.0 takes advantage of modern web-GIS technology to give users the experience of visualizing land management data on a web platform.

The sessions for this training course can be accessed at [GIC's Youtube page](#).



# Tajikistan Stakeholder Workshop for Weather Insurance

GIC held an inception workshop for a new project involving an assessment of the feasibility for weather index insurance for Tajikistan on October 08, 2021.

The main goal of this workshop was to consult stakeholders on the potential of Weather Index Insurance (WII) in the context of Tajikistan, and current global best practices on WII were also introduced during the workshop.

Twenty participants were in attendance from Tajikistan government agencies such as the Ministry of Agriculture, the Agency for Hydrometeorology, the Ministry of Finance, and the Agency on Statistics. Furthermore, representatives from the banking, insurance, and agriculture industries also took part in the workshop.

Through active participation from many attendees, the current status of the agriculture insurance sector in Tajikistan and data availability was discussed during the inception workshop.

Following opening remarks by UNEP Tajikistan and AIT, GIC Director Dr. Manzul Hazarika provided the project background and scheduled activities. Lakmal Deshapriya, GIC Research Associate, explained the detailed data requirements for selecting suitable crops, initial locations, and meteorological stations needed for feasibility assessment.

# pLitter Workshop at Mae Fah Luang University

GIC held an interactive workshop at Mae Fah Luang University (MFU – Chiang Rai, Thailand) to introduce *pLitter,* a new online platform for enhancing a machine learning model to identify plastic litter in streets and waterways with citizen science.

GIC-AIT showcased *pLitter's* plastic litter annotation capabilities for a group of 140 students from Dr. Panate Manomaivibool's "Products and Environmental Impact" class in the Natural Resources and Environmental Management Program. The workshop was jointly organized by GIC-AIT and MFU under the United Nations Environment Programme (UNEP) CounterMEASURE Project, an initiative tackling regional marine plastic pollution. Dr. Manomaivibool opened the workshop by addressing new challenges to in-situ data collection brought on by the COVID-19 pandemic and the novel approach offered by GIC-AIT to address this issue.



Annotation Workshop to detect Plastics led by Sriram Reddy

At the core of the workshop, Dr. Kavinda Gunasekara—leader of the GIC team for the CounterMEASURE project—introduced students to *pLitter* and the concept of tackling marine plastic litter with mapping technology. In this approach, GIC implements both citizen science and machine learning to produce a plastic litter identification model in which citizen scientists are directly involved in training the model to identify plastic litter. The resulting output is a map depicting plastic waste distribution covering an entire study area.

"There are two types of citizen science we have understood during the development of our plastic litter identification model. Type 1 involves creating the model prediction by contributing images of plastic waste in the environment to our online platform, pLitter. Type 2 requires marking instances of plastic waste in those contributed images which serve as training data for the model, a process called annotation," Dr. Gunasekara said in his presentation. During the workshop, Dr. Gunasekara asked students to contribute as the second type of citizen science to understand the image annotation process in *pLitter.*

Although the participating students shared a background in environment, nearly half of the group previously had some exposure to machine learning in their university curriculum. Existing interest in the topic was met with enthusiasm to get involved in the annotation exercise.



Participants Signing "P" for the pLitter Annotation Platform

There were 9 categories of objects to be annotated by the students: plastic bottles, clothes/textiles, facial masks, piles of litter, plastic bags, rope, single-use plastics (SUPs), trash bins, and wrappers/sachets. Led by GIC's Sriram Reddy, the hands-on session began with a demonstration on the annotation process in *pLitter* followed by independent annotation by the students. In total, 2,830 images were reviewed during the workshop, with plastic annotated in 1,683 images (of the 2,830 images there were 1,147 without plastic in them) into the 9 categories, with plastics forming the majority of the annotations.
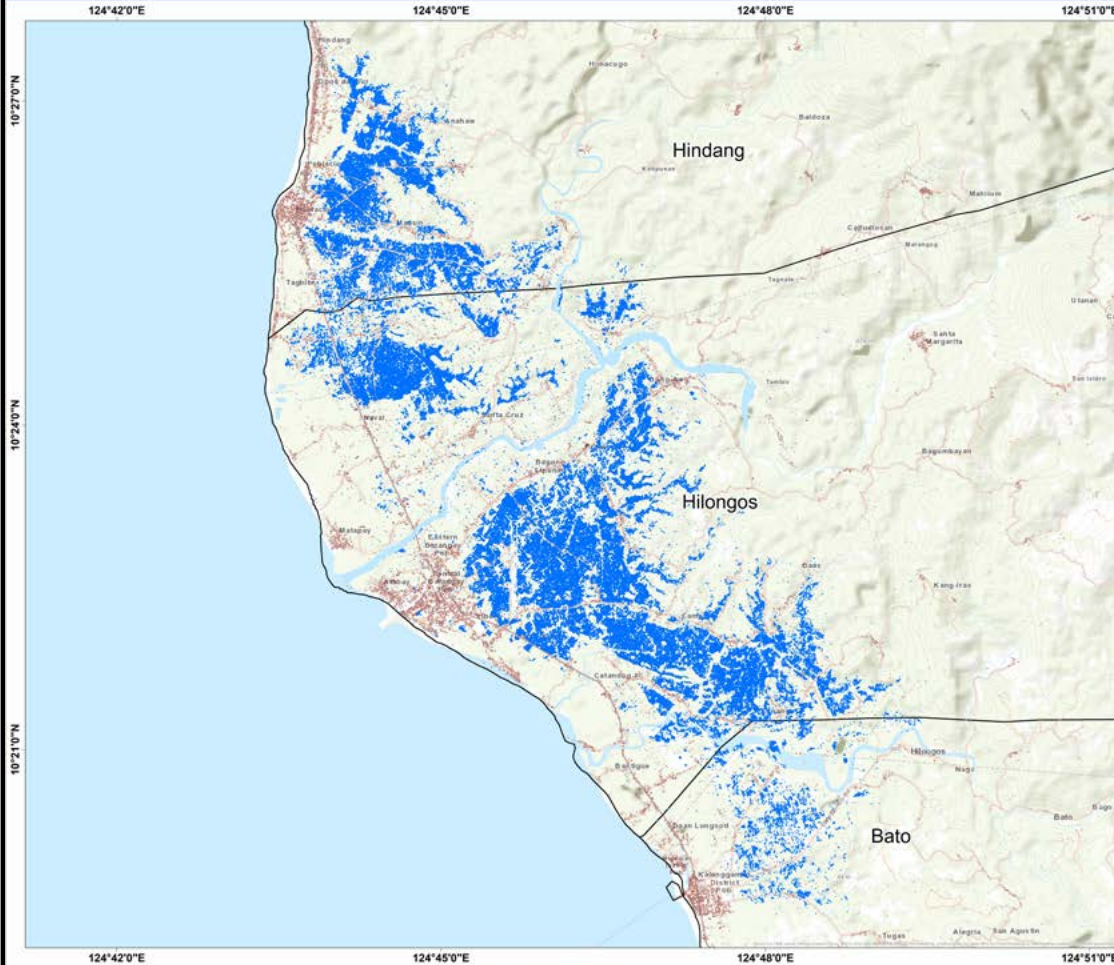
To spur model improvement and boost citizen scientist involvement, *pLitter* is also capable of receiving plastic litter image uploads where contributors can be involved in the Type 1 form of citizen science described by Dr. Gunasekara.

With the objective for increasing the awareness of plastic pollution, Aprilia Rinasti – GIC's moderator for the workshop – found that 43.2% of students who participated in the workshop were strongly aware of the issue and eager to contribute more.

# Featured Sentinel Asia Value Added Product: Philippines Flood - December 2021



**DETECTED FLOOD IN LEYTE PROVINCE, PHILIPPINES**
As observed by ALOS-2 image on 16 December 2021

Hindang

Hilongos

Bato

**Map Information**

N

1    0.5    0    1 Kilometers
Map Scale 1:30,000
Coordinate System: GCS WGS 84
Datum: D WGS 84
Unit: Degree

**Legend**

- Detected Flood
- Waterbody
- Building
- Waterway
- Road
- Municipality Boundary

**Data Sources**

Satellite Image:
Pre-disaster   : ALOS-2 PALSAR-2 on 06 June 2019
Post-disaster : ALOS-2 PALSAR-2 on 16 December 2021
Copyright: © JAXA (2021) - All rights reserved.

GIS Data:
Waterway, Waterbody, Building, Road © OSM (2021)
Administrative Boundary © GADM (2021)

**Description**

This map shows the detected flood areas in Hindang, Hilongos and Bato Municipalities in Leyte Province, Philippines on 16 December 2021 due to the Typhoon Rai (Odette).

Note that the detected flood may also include water in cultivated areas.
Map product made by GIC-AIT (v1.0).
Disclaimer: The accuracy of this product is not validated.

Data provider:

JAXA

The above image is a valued added product (VAP) created by GIC depicting flooding in Leyte Province, the Philippines, brought on by Typhoon Odette. Both east and west coasts of Leyte suffered flooding due to sustained downpours. Typhoon Odette made landfall on December 16, 2021 with wind speeds up to 270 km/hr. The intense storm caused extensive damage to water, electricity, and communication infrastructure. Up to this point nearly 400 have died from 2021's most destructive typhoon to hit the Philippines. Typhoon Odette marks the 15th typhoon to hit the Philippines in 2021. GIC operates as the Principal Data Analysis Node (P-DAN) for the Sentinel Asia Program, a collective managed by the Asia-Pacific Regional Space Agency Forum to aid in disaster management with space technology. Maps like the one above are disseminated to national  governments and line agencies during disasters to improve response activities.

**AIT** Asian Institute of Technology

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