

AI Applications of Earth Observation Data for Disaster Monitoring in the Philippines



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Background :

Satellite earth observation (EO) supports data-driven assessment and decision-making through the provision of timely information over a specific area of interest. This has become increasingly vital in the four thematic areas of disaster risk reduction and management (DRRM) – prevention and mitigation, preparedness, response and rehabilitation and recovery – as rapid assessments can be done for urgent and prompt action.

To better provide analysis-ready data during critical events, the DOST-ASTI, through the Remote Sensing and Data Science Help Desk, or the DATOS Project, is leveraging Artificial Intelligence to develop applications for DRRM using satellite images along with other critical infrastructure such as the Philippine Earth Data Resource and Observation (PEDRO) Center's satellite ground receiving station and the Computing and Archiving Research Environment's (COARE) high-performance computing facility.

Background :

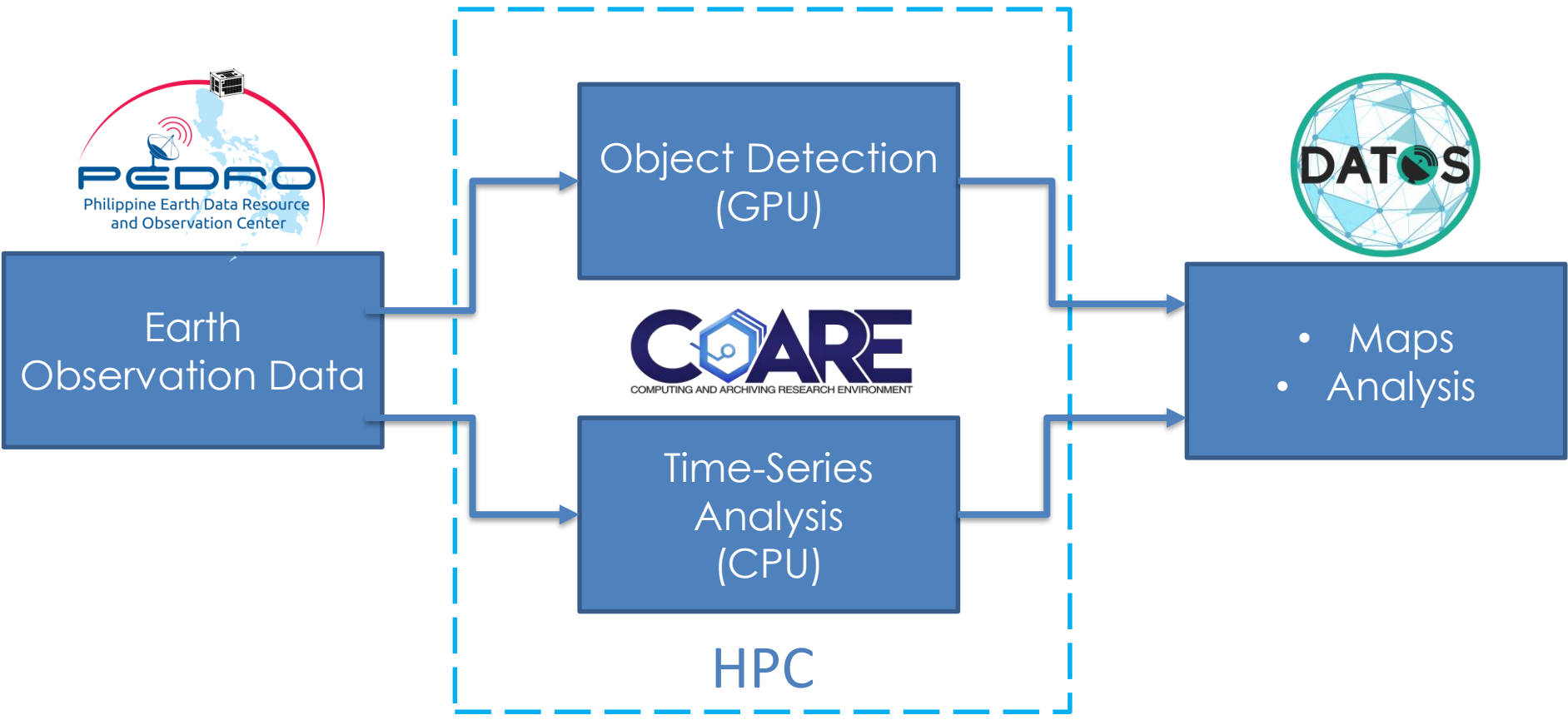
The Remote Sensing and Data Science (DATOS) Help Desk of the Department of Science and Technology-Advanced Science and Technology Institute (DOST-ASTI) uses the agency's High Performance Computing (HPC) facility in processing satellite images for various disaster-related and agricultural mapping outputs.

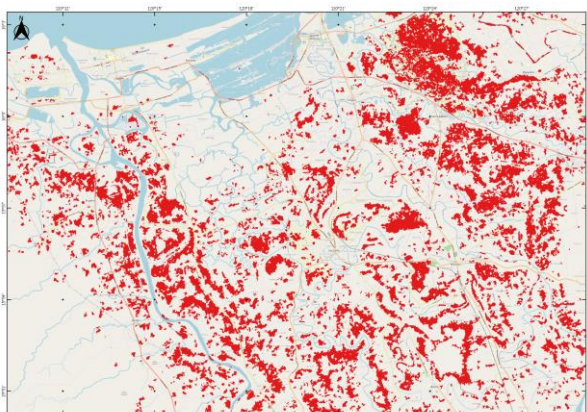
DOST-ASTI acquires terabytes of satellite images from several commercial optical and radar satellite subscriptions through the PEDRO Center Ground Receiving Station, which are stored and processed in the Computing and Archiving Research Environment (COARE) facility. DATOS then applies Artificial Intelligence (AI) or Time-Series Analysis to detect and map out features from these satellite images.



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Map Information
This map shows potentially flooded areas. These areas were identified using composite of three (3) C-band radar images. The map is still subject to validation and the interpretation of remote sensing experts.

FLOOD DETECTION
Using Neural Networks

Data Sources
Sentinel-1A images acquired on 07/19/2018, 07/30/2018, and 08/28/2018 at approximately 5°48'44" Philippine Standard Time, retrieved from the European Space Agency (ESA) Copernicus Open Access Hub (<https://scihub.copernicus.eu/>). Base map by OpenStreetMap.

Legend
Potentially Flooded Areas

0 2.5 5 7.5 10 km



Map Information
This map shows the land cover classification in Tala, Tondo, LA 1000. These data were derived using Planet image dated April 20, 2017, processed using a fully convolutional neural network developed by the DATOS Project. This output is part of an ongoing research project under the DOST-Advanced Science and Technology Institute. The information represented in this map is intended to complement and supplement the current government CHOP officers and is not intended to be a substitute for official land cover classification information from the national government agencies.

LAND COVER CLASSIFICATION
Using Neural Networks

Data Sources
Planet image was taken on April 20, 2017 and retrieved from Planet (<https://www.planet.com/>).

Legend
Forest Cover
Water
Built-up
Vegetation

0 0.4 0.8 1.2 1.6 2 km



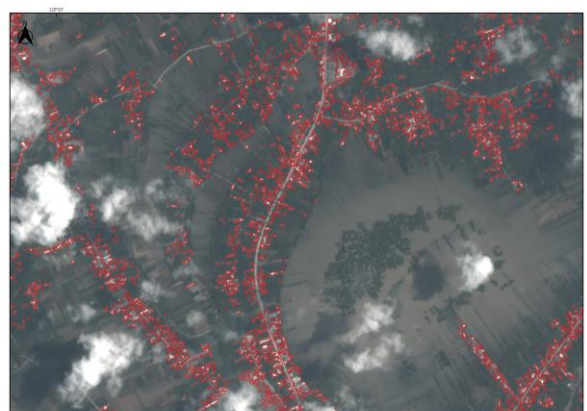
Map Information
This map shows the classified roads in an urban area in Slang Cavite. The roads were derived from a 3m resolution Planet satellite imagery taken on April 30, 2018.

ROAD DETECTION
Using Neural Networks

Data Sources
Planet satellite imagery provided by the Philippine Earth Data Resource and Observation (PEDRO) Center.

Legend
Detected Roads using AI

0 250 500 750 1000 m



Map Information
This map shows the detected built-up in Dapog, Pangasinan. The built-up areas were derived from a 3m Planet satellite imagery taken on July 25, 2018. This output is part of an ongoing research project under the DOST-Advanced Science and Technology Institute.

BUILT-UP DETECTION
Using Neural Networks

Data Sources
Planet image taken on July 25, 2018 and retrieved from Planet (<https://www.planet.com/>).

Legend
Detected Built-up

0 0.2 0.4 0.6 0.8 1 km



Map Information
This map shows the detected mango trees in Barangay Cita, Batang. The mango trees were derived from a commercialized 3m Planet satellite image taken on January 13, 2018. The output is part of an ongoing research project under the DOST-Advanced Science and Technology Institute.

MANGO TREE DETECTION
Using Neural Networks

Data Sources
Digital Globe image taken on January 13, 2018 and retrieved from the PEDRO Portal.

Legend
Detected Mango Trees

0 0.02 0.04 0.06 0.08 0.1 km



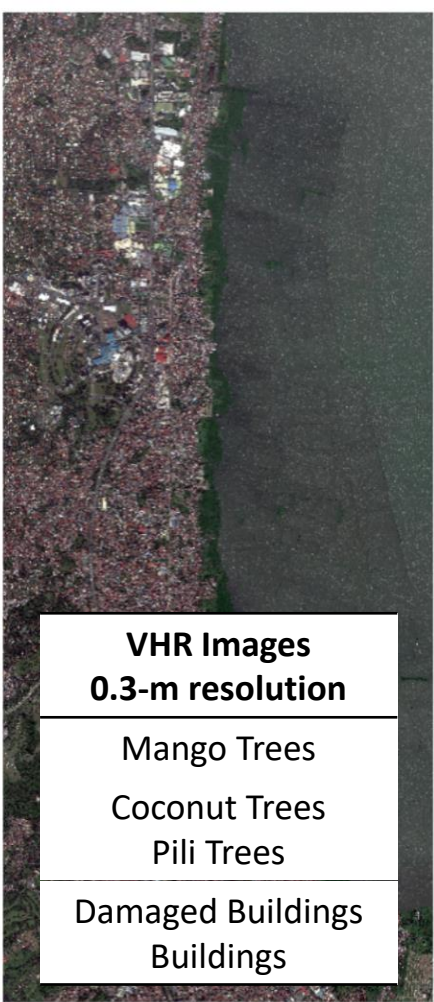
Map Information
This map shows the classified sugarcane areas in a portion of Conception, Tarlac. The sugarcane areas were identified using C-band radar images. The map is still subject to validation and the interpretation of remote sensing experts.

SUGARCANE DETECTION
Using Dynamic Time Warping

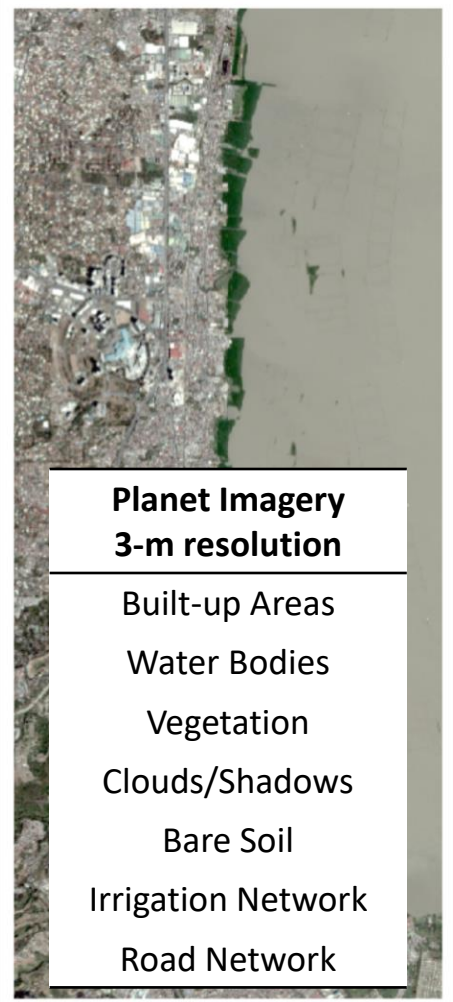
Data Sources
Sentinel-1 images retrieved from the European Space Agency (ESA) Copernicus Open Access Hub (<https://scihub.copernicus.eu/>).

Legend
Classified Sugarcane Areas
Validated Sugarcane Areas

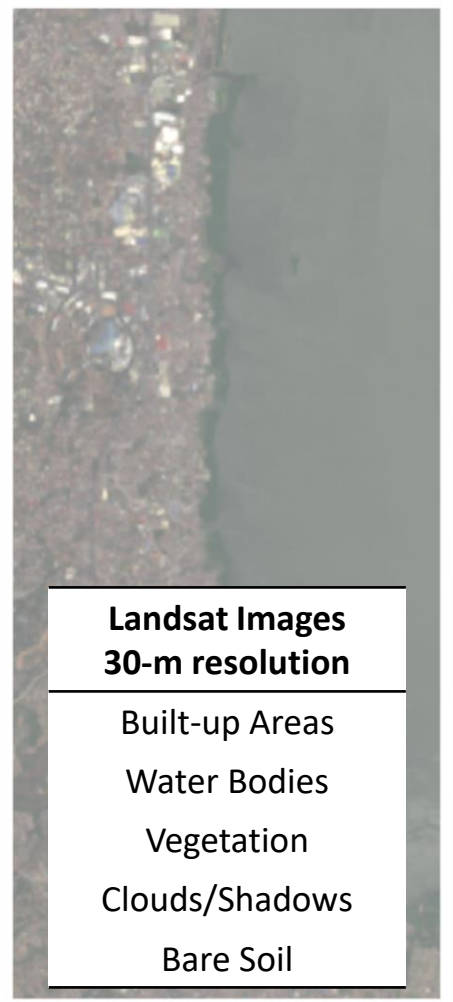
0 500 1000 1500 2000 m



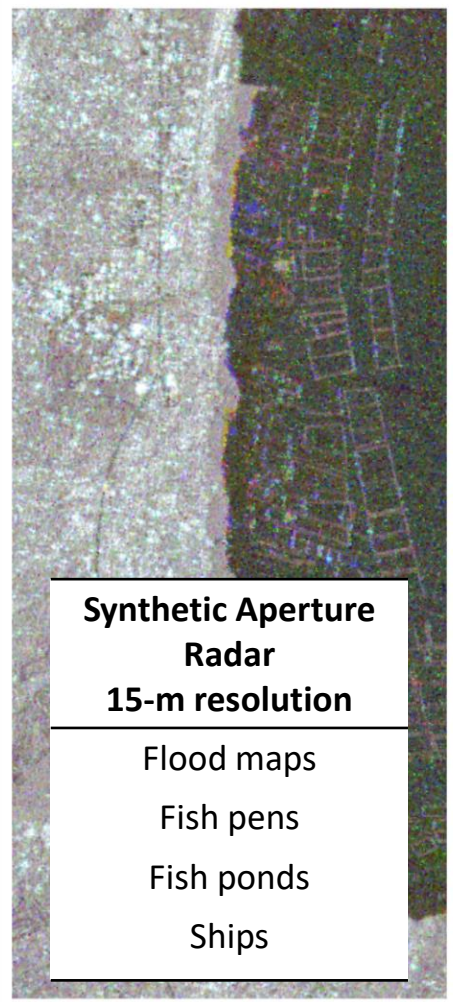
<p>VHR Images 0.3-m resolution</p>
<p>Mango Trees Coconut Trees Pili Trees</p>
<p>Damaged Buildings Buildings</p>



<p>Planet Imagery 3-m resolution</p>
<p>Built-up Areas Water Bodies Vegetation Clouds/Shadows Bare Soil Irrigation Network Road Network</p>

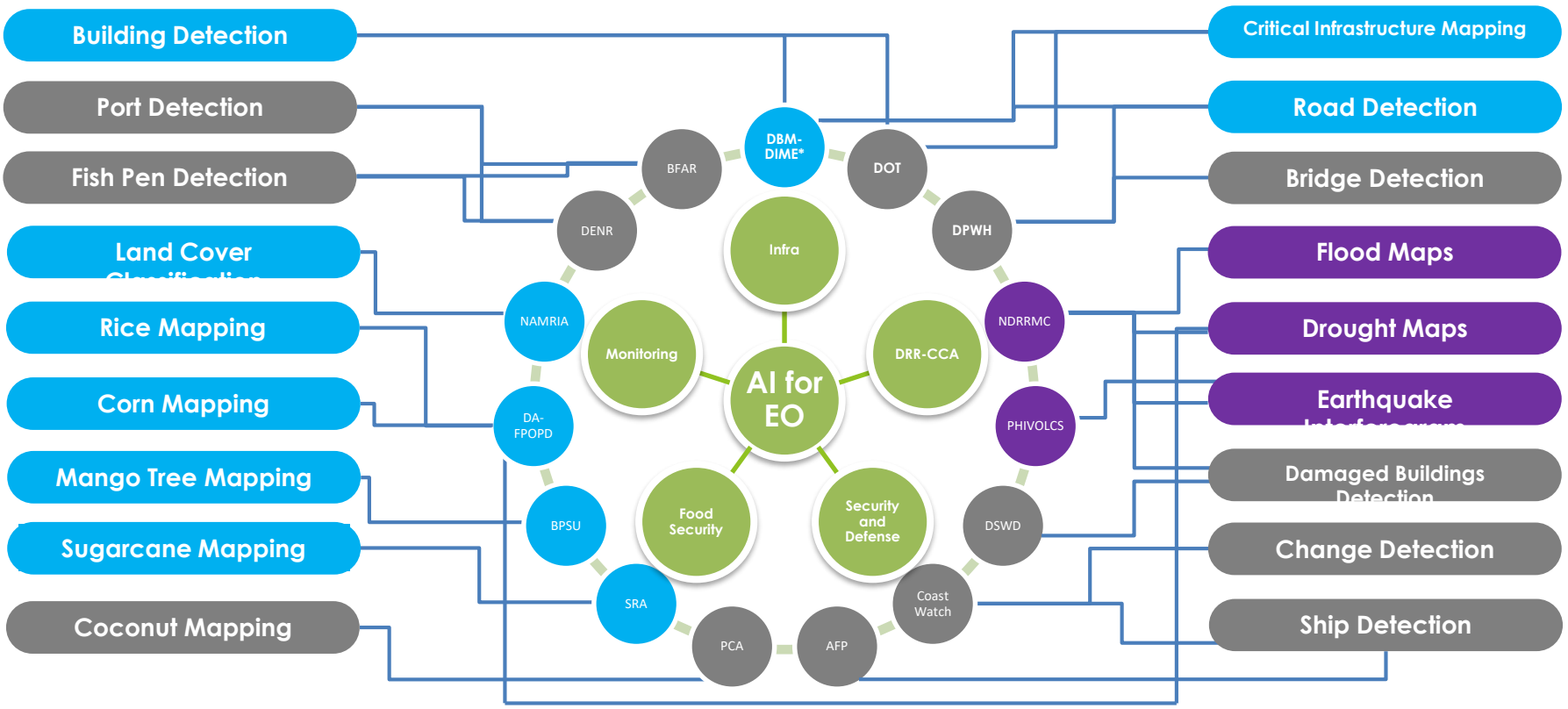


<p>Landsat Images 30-m resolution</p>
<p>Built-up Areas Water Bodies Vegetation Clouds/Shadows Bare Soil</p>



<p>Synthetic Aperture Radar 15-m resolution</p>
<p>Flood maps Fish pens Fish ponds Ships</p>

MIND MAP OF USERS



Legend:
■ Agencies that have MOA on Research Collaboration with DOST-ASTI through DATOS
■ Agencies that are recipients of DATOS outputs as needed
■ Agencies with ongoing talks and/or possible users

*MOA is through DOST Main Office

The DATOS Project developed techniques to extract features from remotely-sensed data through automation of remote-sensing workflows and the use of Neural Networks. Examples are automated flood detection from multi-temporal SAR images, land cover detection, road network detection, mango tree detection and agricultural plantation mapping.

Moving forward, DOST-ASTI is looking to further expand the reach and adoption of its space-based tools and applications through a combination of stakeholders' meetings and trainings. These initiatives seek to capacitate other government agencies to be able to ingest, process, and analyze earth observation data, creating a community of users for better incidence impact to the Filipino people.