Republic of the Philippines

Department of Science and Technology

Advanced Science and Technology Institute

mapping AI

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DOST-ASTI

Data that enables **scientific discovery** and better understanding of our environment

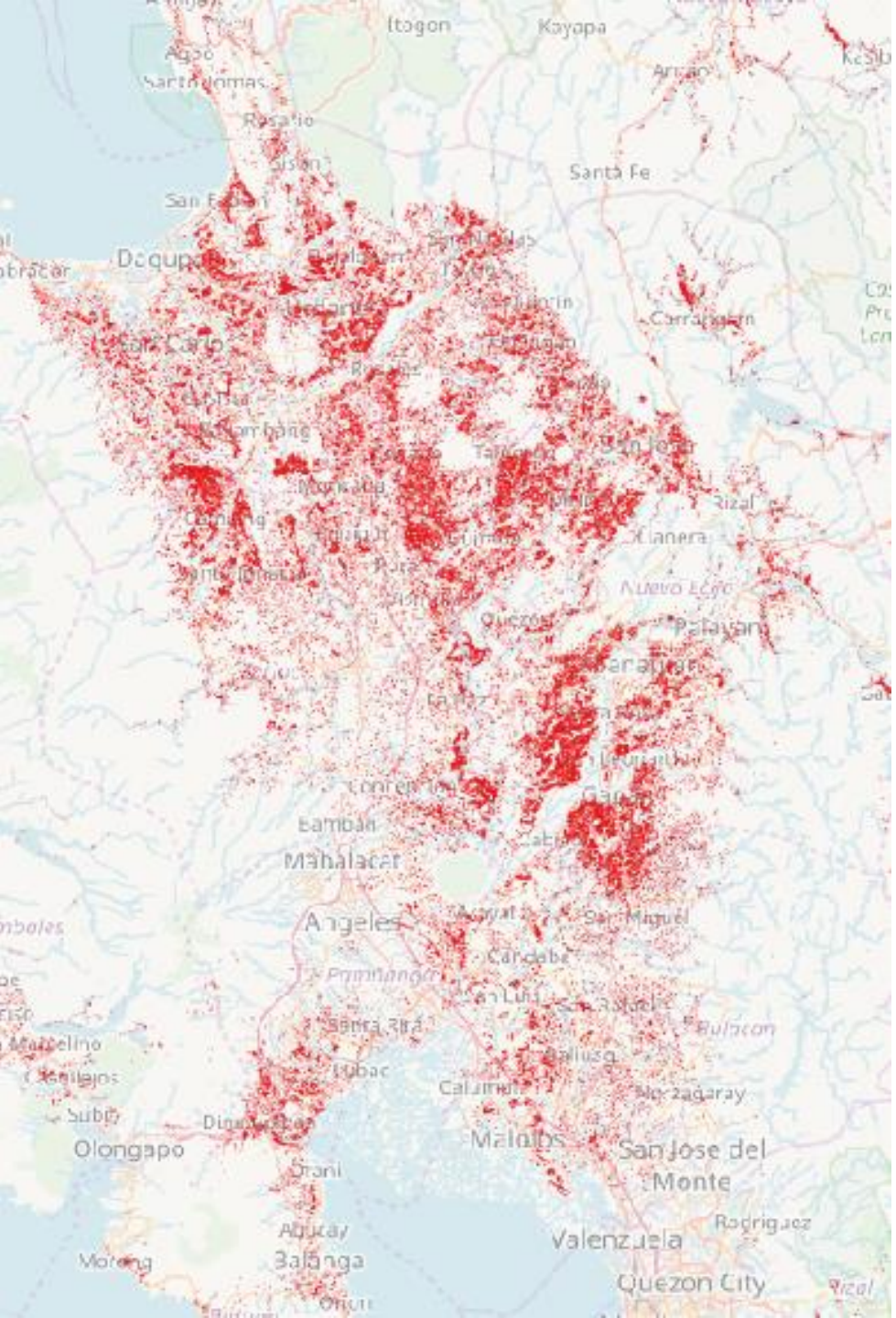
Data that enables **evidence-based policies** for more relevant and responsive programs

Data that enables a **knowledge-based economy** that fosters inclusive innovation

Data for tackling **information poverty**

Why is a country like the Philippines going into space?

The Challenge



Rapid Map Generation

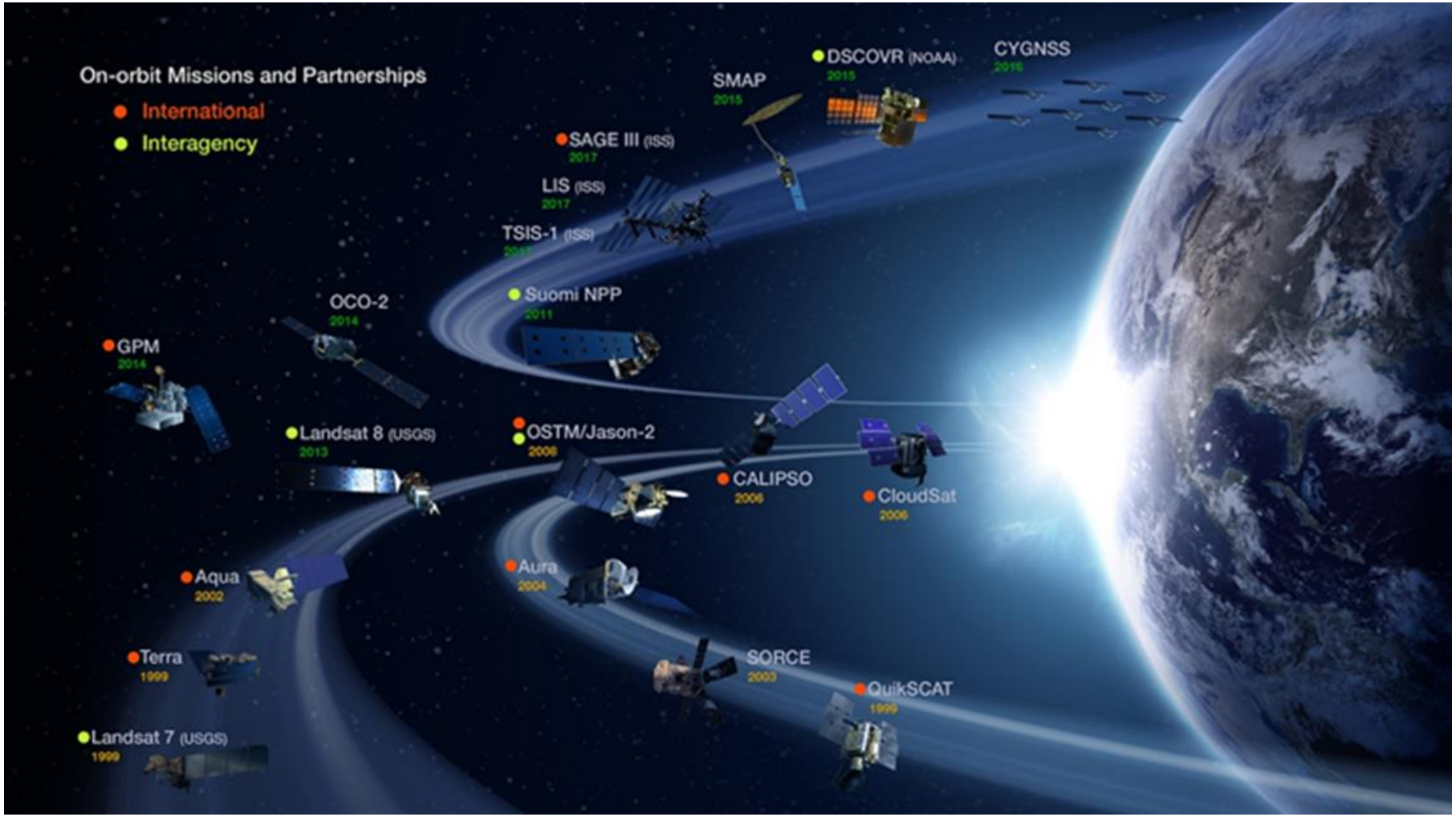
- Disaster response
- Monitoring

https://www.nesdisia.noaa.gov/docs/Global%20Sats%20Graphic.jpg

- Earth Observation (EO) satellites currently account for over **one third** of the operational satellites orbiting the Earth.

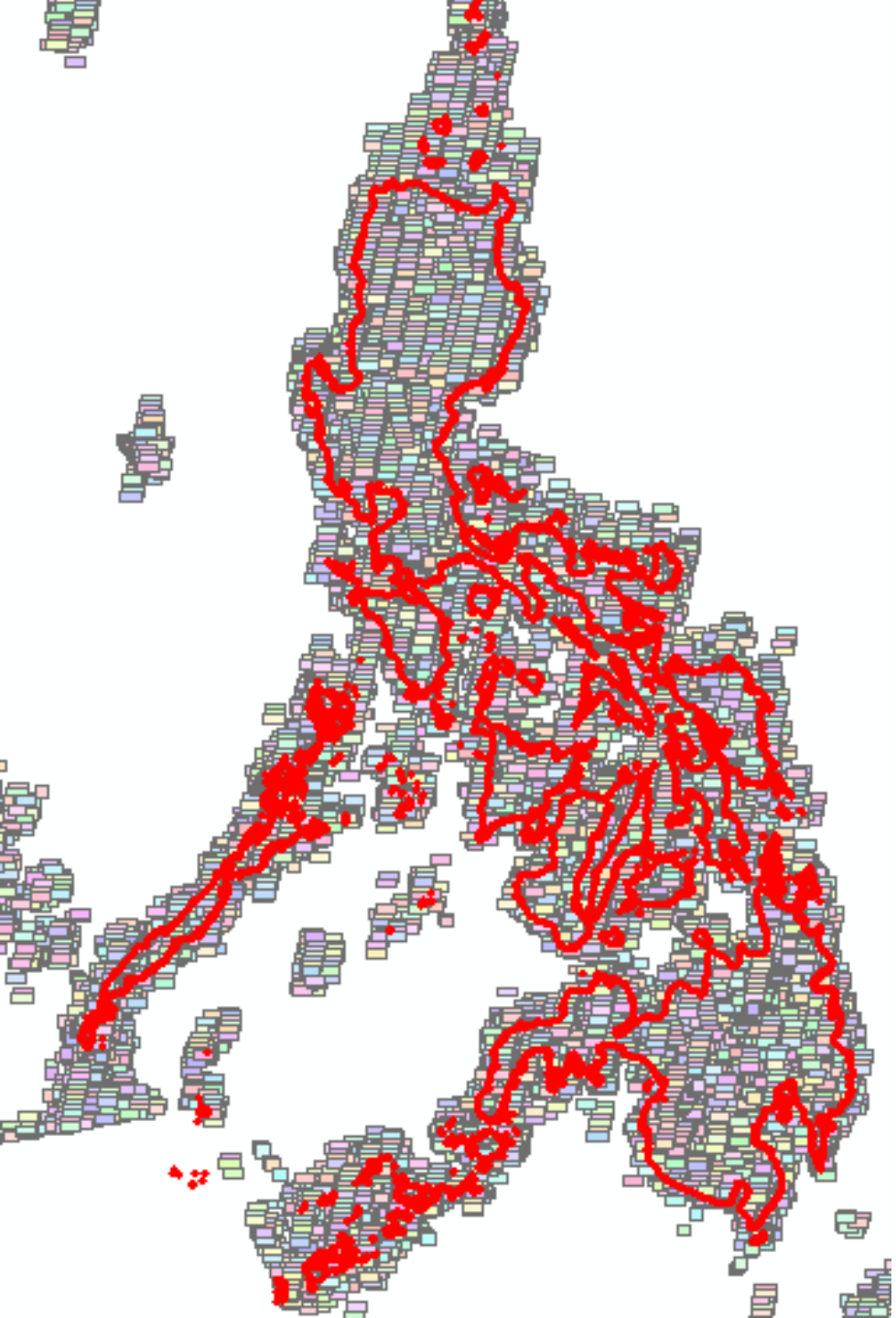
- According to the Union of Concerned Scientists (UCS) satellite database there were **1,980 operational satellites at the end of April 2018,** and **684** of these have a main purpose of either EO or Earth Science.

https://www.pixalytics.com/eo-satellites-in-space-2018/



https://www.aip.org/file/nasa-earth-satellitespng

- NASA's Earth Observing System Data and Information System (EOSDIS) maintains 9 Petabytes of EO Data.



Excessive amount of data

- Earth Observation (EO) data volumes are increasing at a rate of several Terabytes per day.
- PEDRO center stores 13Tb of various EO data excluding open-source data
- Additional 35Tb data from USGS and ESA are also archived by the DATOS Project of DOST-ASTI

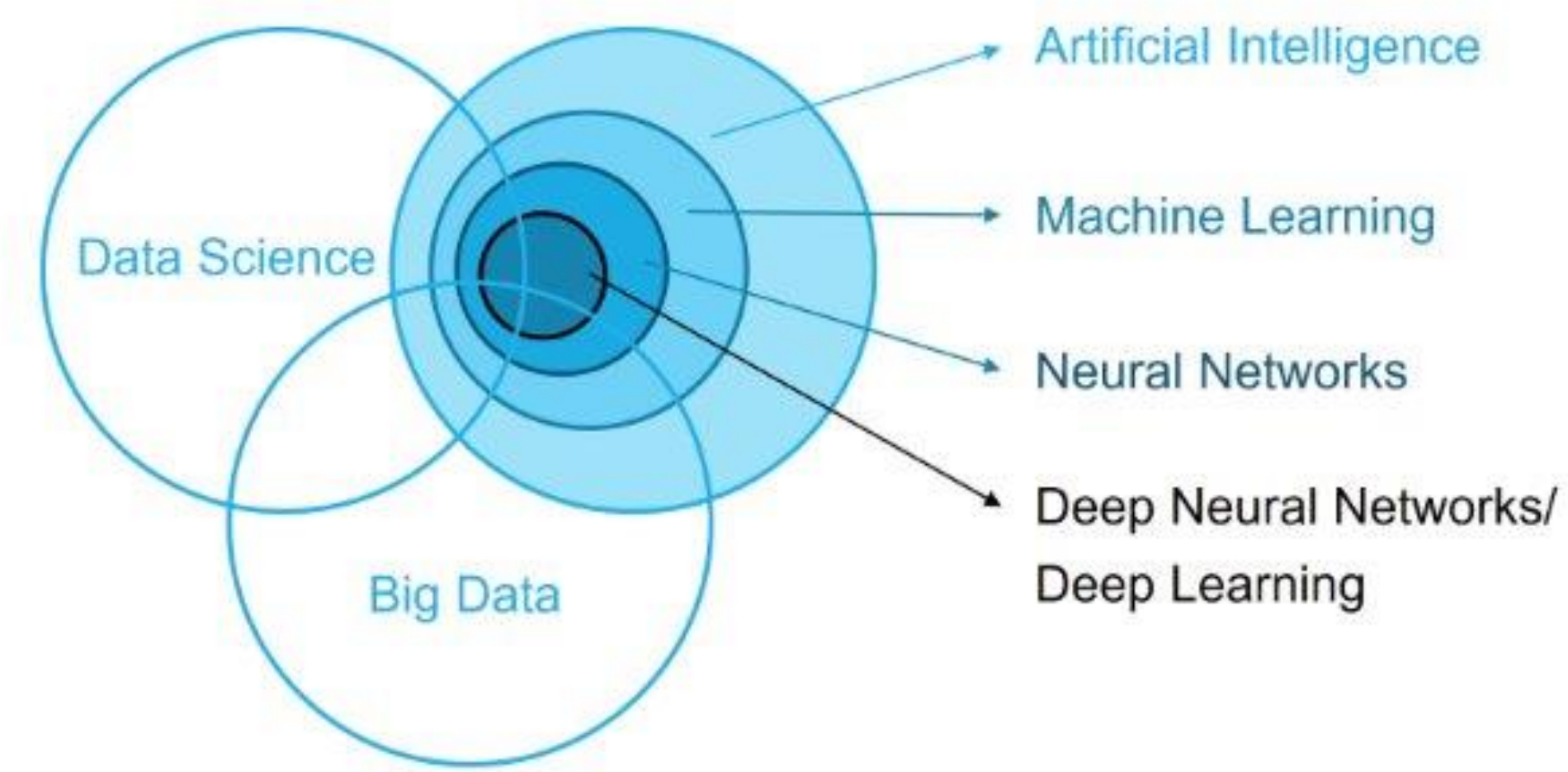
REGION	TARGET			ACCOMPLISHMENT		No. of Farmer
	No. of Seedlings	AREA (Has.)	No. of Seednuts Sown	Seedlings Planted	AREA (Has.)	Participants
I-IVB	600,000	4,195.80	899,286	596,127	4,182.64	3,285
IV-A	900,574	6,297.72	196,731	-	915.03	
V	542,824	3,795.97	1,423,463	-	3,795.97	4,149
VI	324,234	2,267.37	486,715	864,854	2,263.79	3,696
VII	357,323	2,498.76	432,010	320,177	2,466.19	2,530
VIII	564,707	3,949.00	344,000	228,800	1,600.00	1,268
IX	897,142	6,273.72	920,913	636,054	4,541.49	3,676
X	470,612	3,290.99	707,273	407,475	3,289.64	2,115
XI	1,400,050	9,790.56	2,029,721	1,300,000	9,790.21	9,516
XII	1,099,999	7,692.30	1,650,000	1,086,199	7,674.42	5,614
XIII	752,895	5,265.00	1,049,756	499,995	4,882.59	3,002
XIV	517,646	3,619.90	651,585	341,343	3,030.63	1,547
TOTAL	**8,428,004**	**58,937.09**	**10,791,453**	**6,281,024**	**48,432.60**	**40,398**


$$$$$


MONEY

The Solution

Data Science and Artificial Intelligence



https://www.kdnuggets.com/

The Team

Programmers

Artificial Intelligence

Remote Sensing experts

Image Interpretation

GIS experts

Mapping

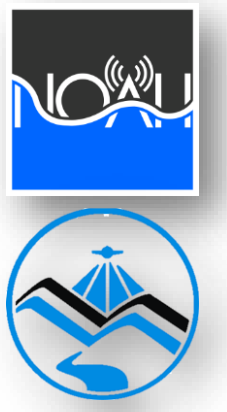
mapping AI

DATOS AI Technologies
(and how to make them)

The DATOS Project

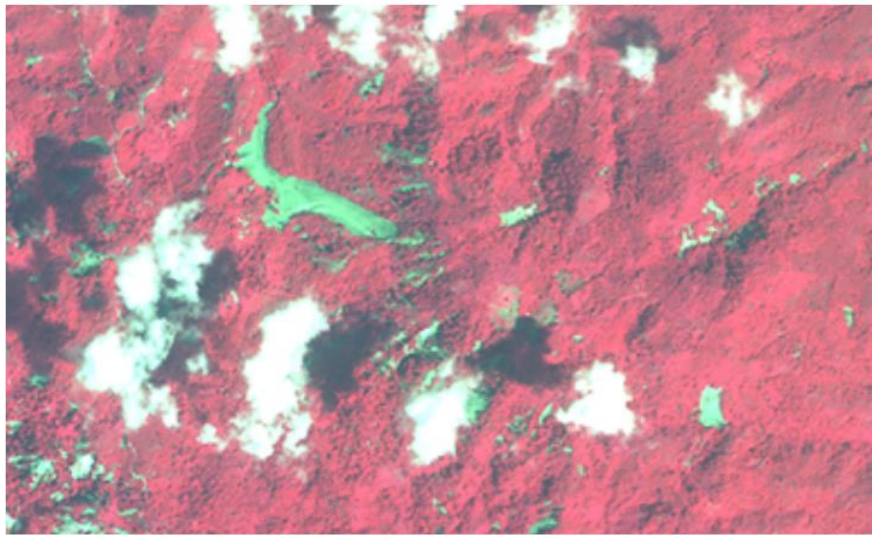
Remote Sensing and Data Science Help Desk

The DATOS Project



.gov.ph

COARE

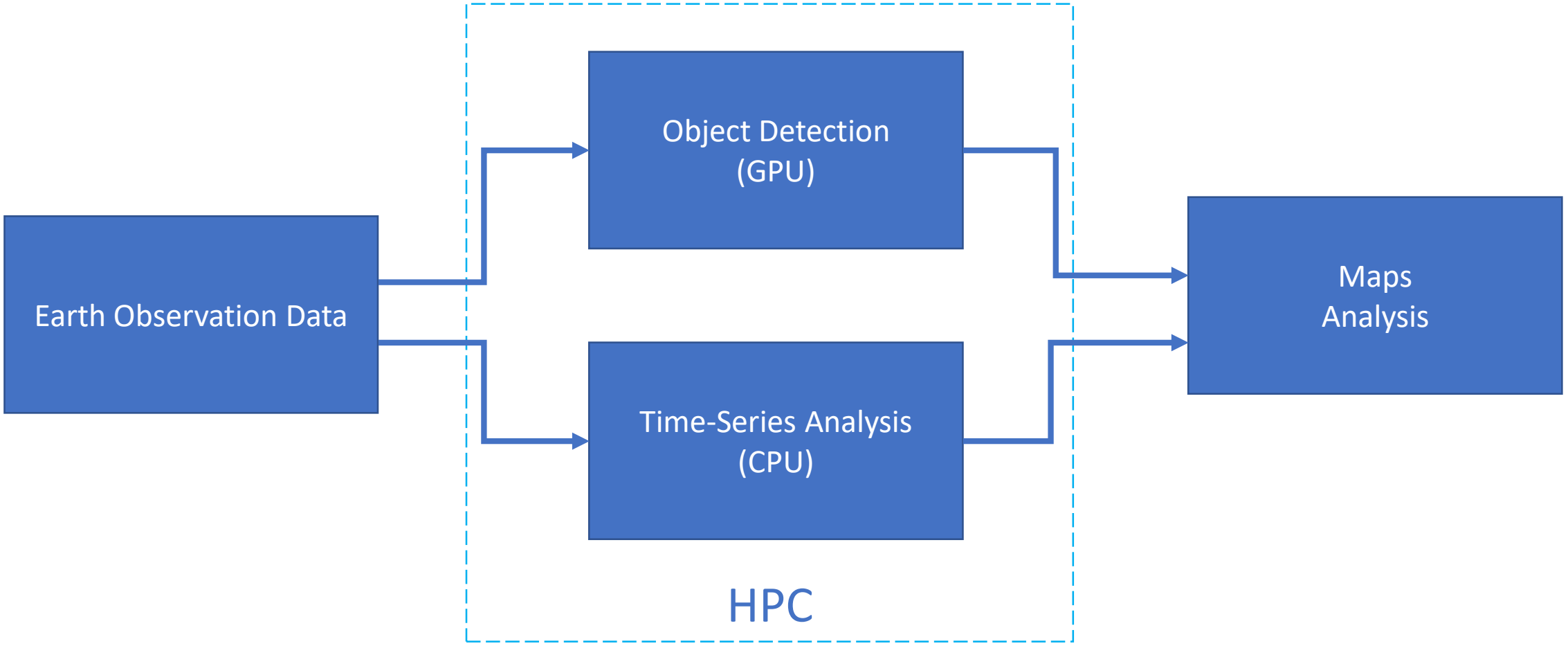


DATOS

PEDRO
Philippine Earth Data Resource and Observation Center

PREGINET

PROCESSES

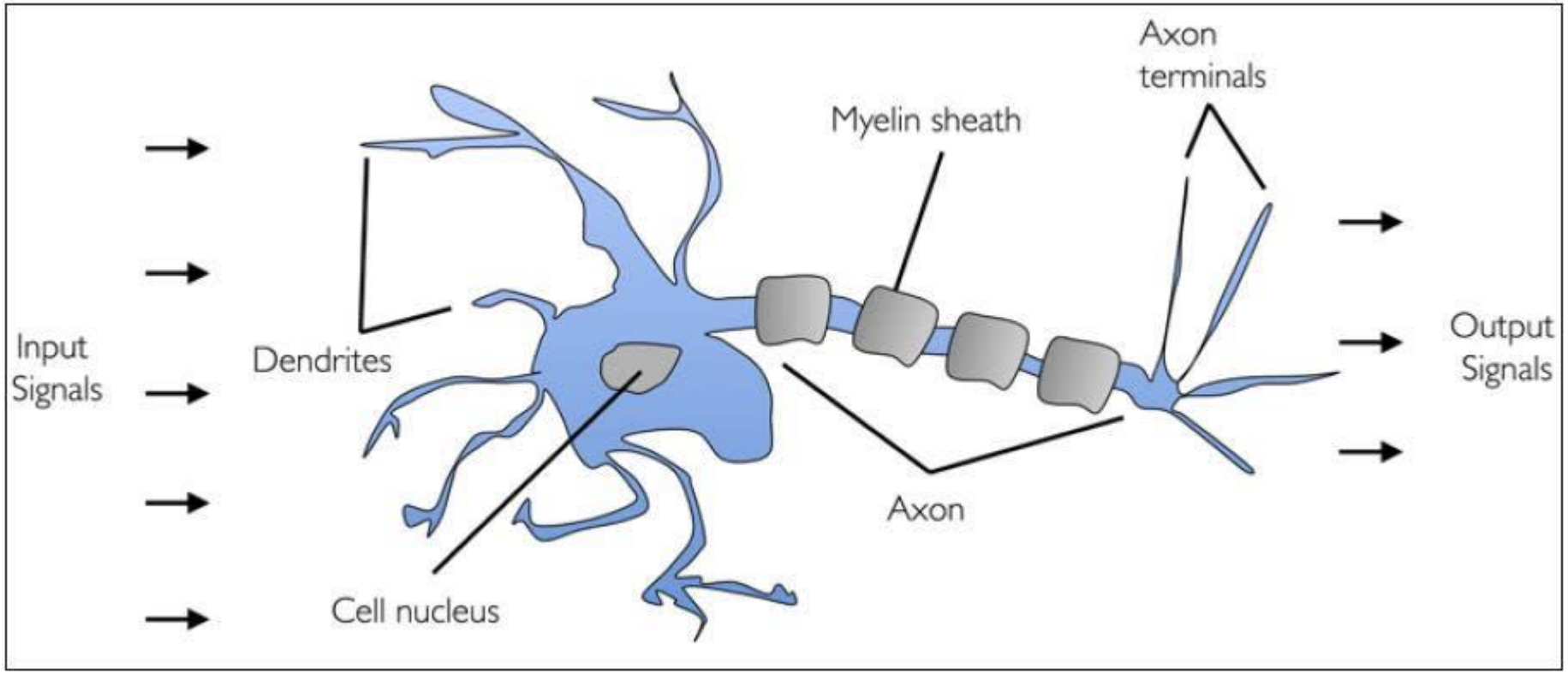

Earth Observation Data
Object Detection
(GPU)
Time-Series Analysis
(CPU)
HPC
Maps
Analysis

OBJECT DETECTION

OBJECT DETECTION

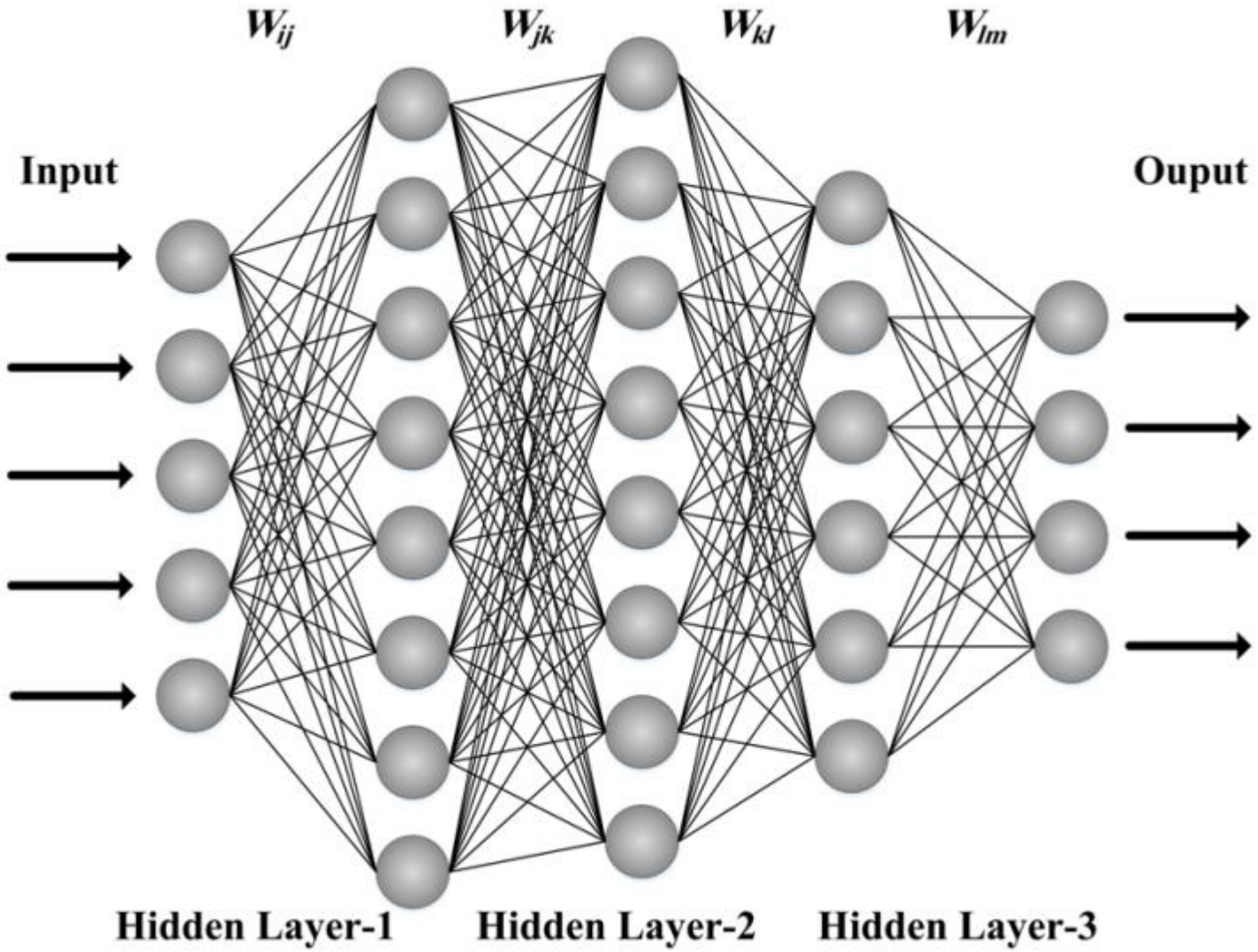
OBJECT DETECTION

OBJECT DETECTION

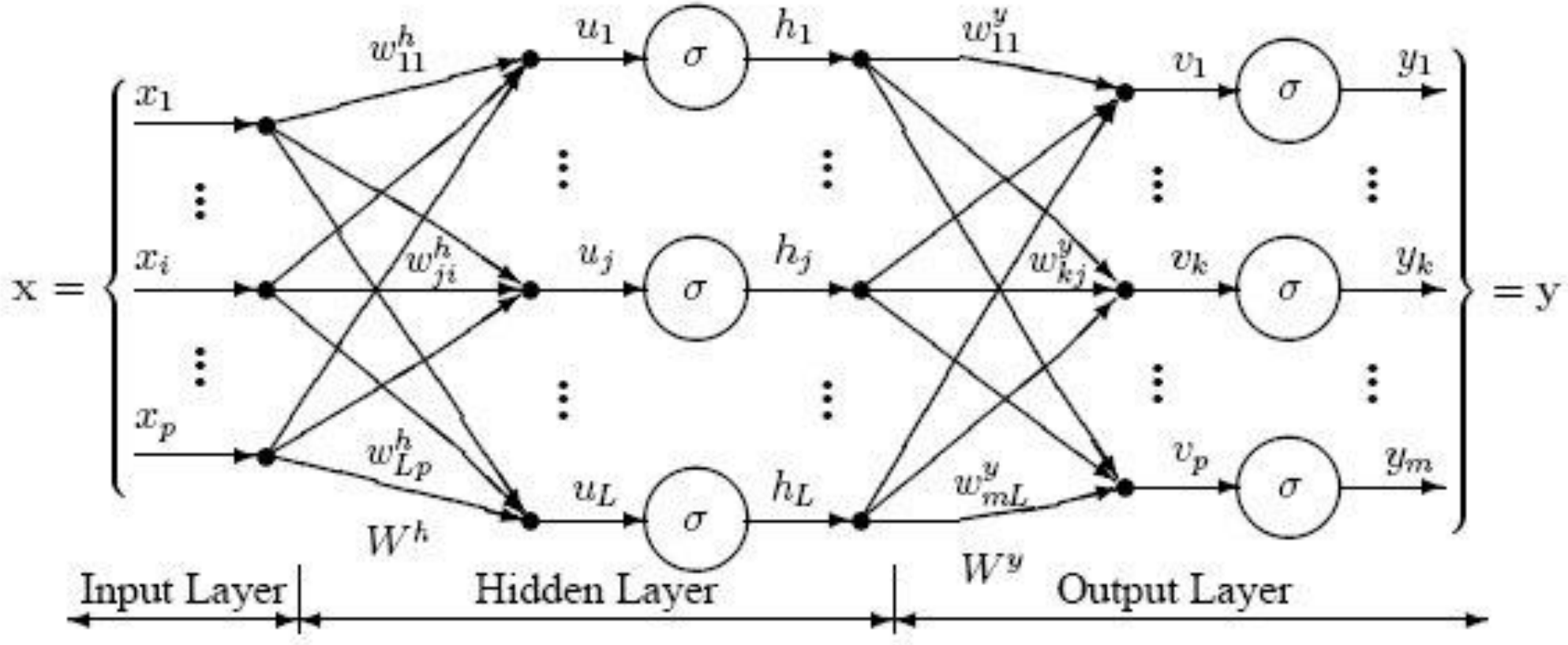


OBJECT DETECTION

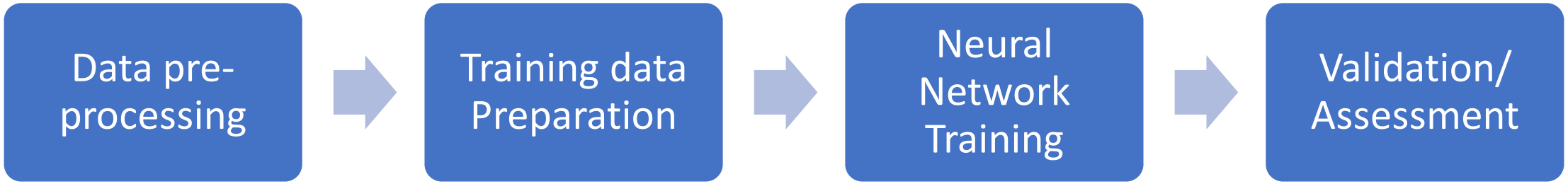
OBJECT DETECTION



OBJECT DETECTION



OBJECT DETECTION



Radiometric Corrections/
SAR Calibration

Geometric Corrections

Object/
Pixel-based classification

Digitization

QA

Parameter Tuning
(input channels)

Hyperparameter Tuning
(Epochs, learning rate, etc)

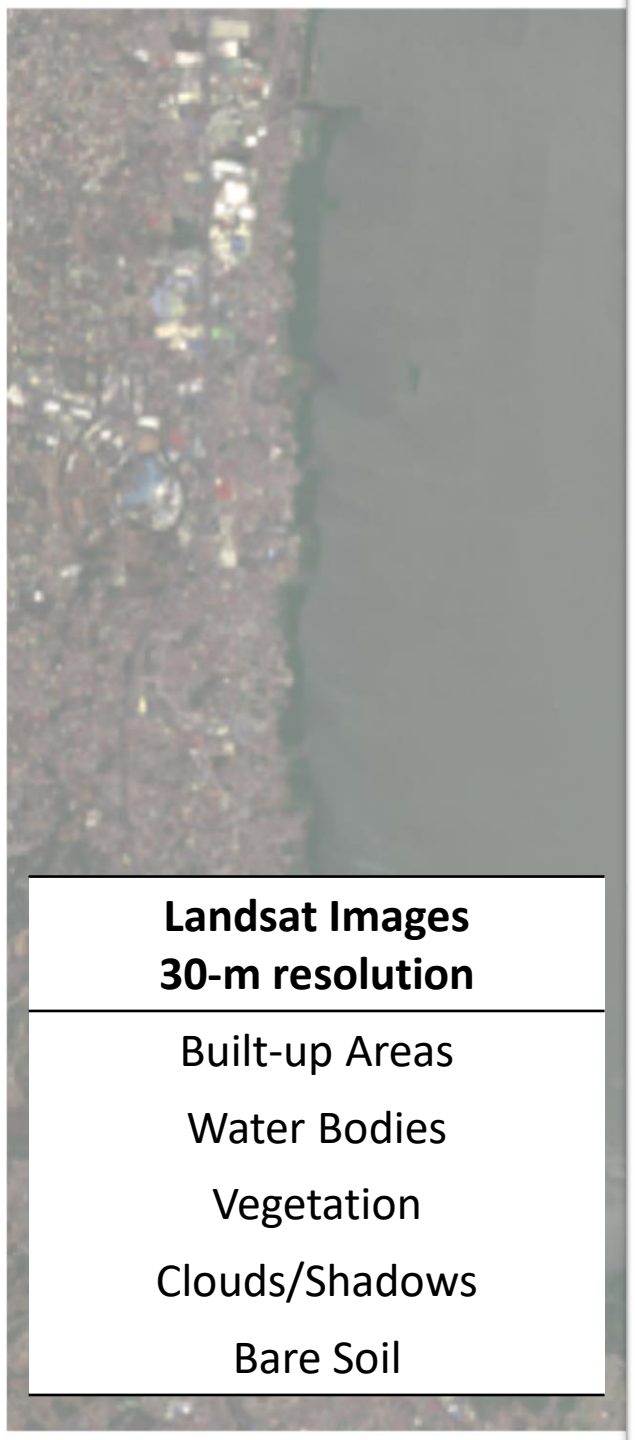
Jaccard Index

Statistical Analysis

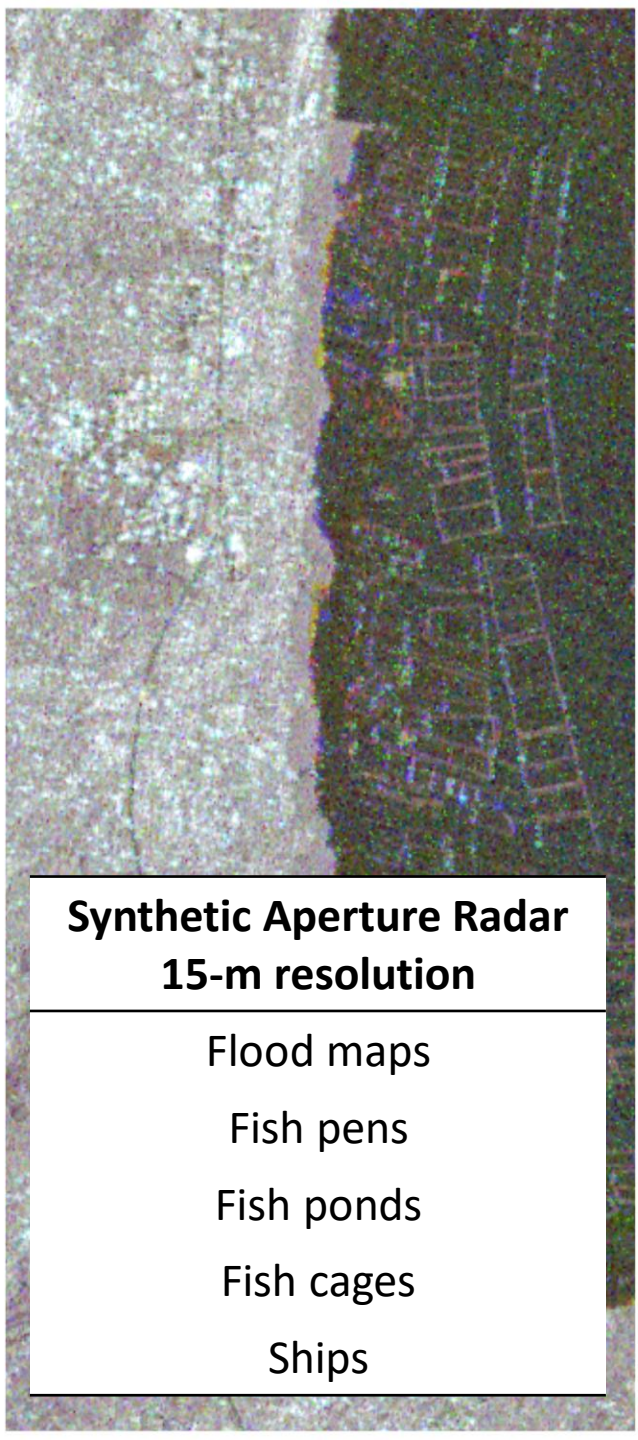
AI Models

VHR Images 0.3-m resolution
Mango Trees
Coconut Trees
Damaged Buildings

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



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



Synthetic Aperture Radar 15-m resolution
Flood maps
Fish pens
Fish ponds
Fish cages
Ships

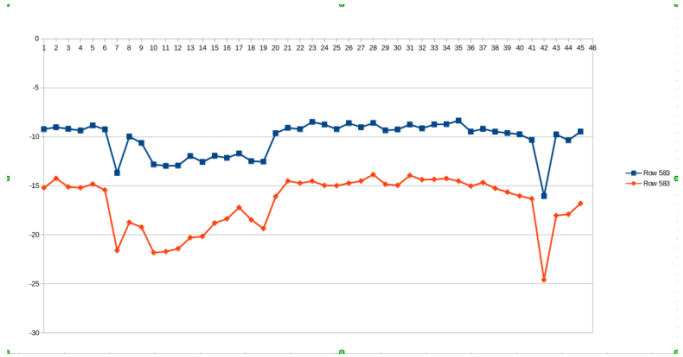
TIME-SERIES ANALYSIS

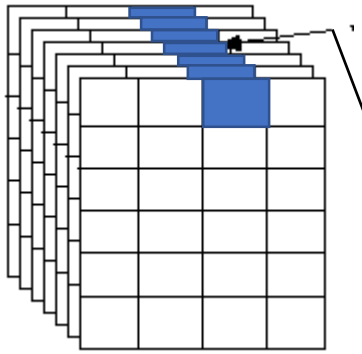
TIME-SERIES ANALYSIS WORKFLOW

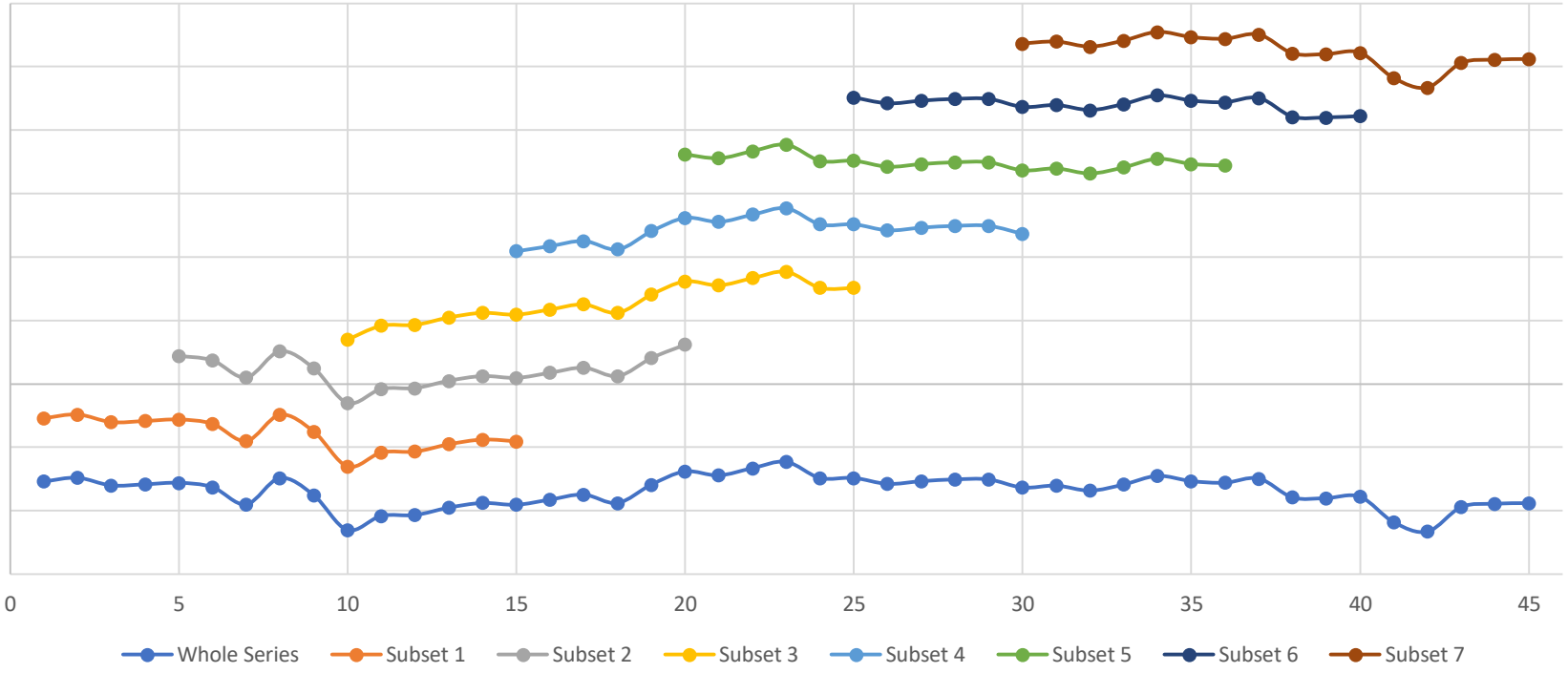
Voice Recognition

TIME-SERIES ANALYSIS WORKFLOW

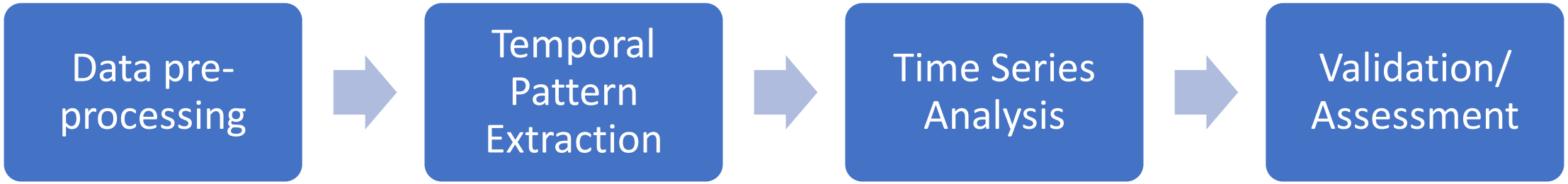
Temporal Signature







TIME-SERIES ANALYSIS WORKFLOW



SAR Calibration

Geometric Corrections

Sample Selection

Parameter Tuning

Signature-matching

Accuracy Assessment

Statistical Analysis

Applications

Project Monitoring

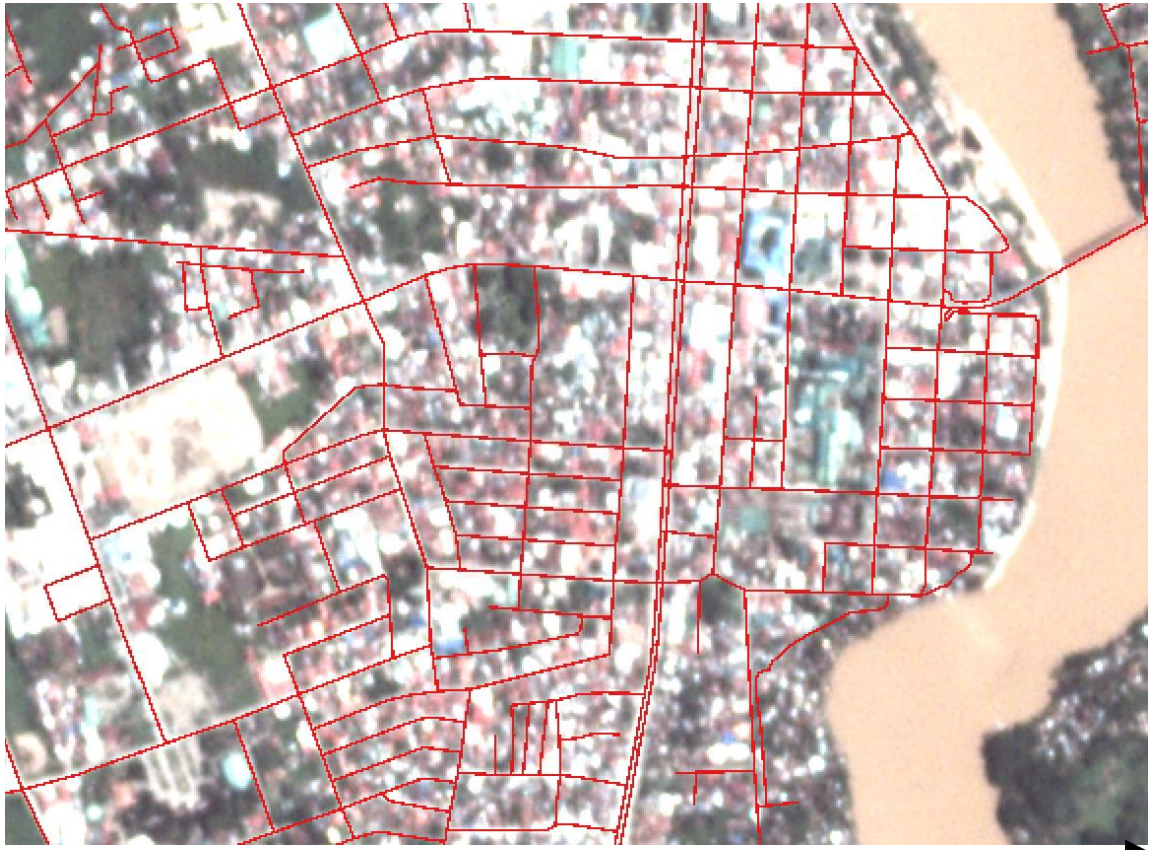
Road Network Prediction

- *Planet Dove Imagery*
- *3-meter resolution*

APPLICATIONS

Project Monitoring

Prediction using the Planet AI for Roads



APPLICATIONS

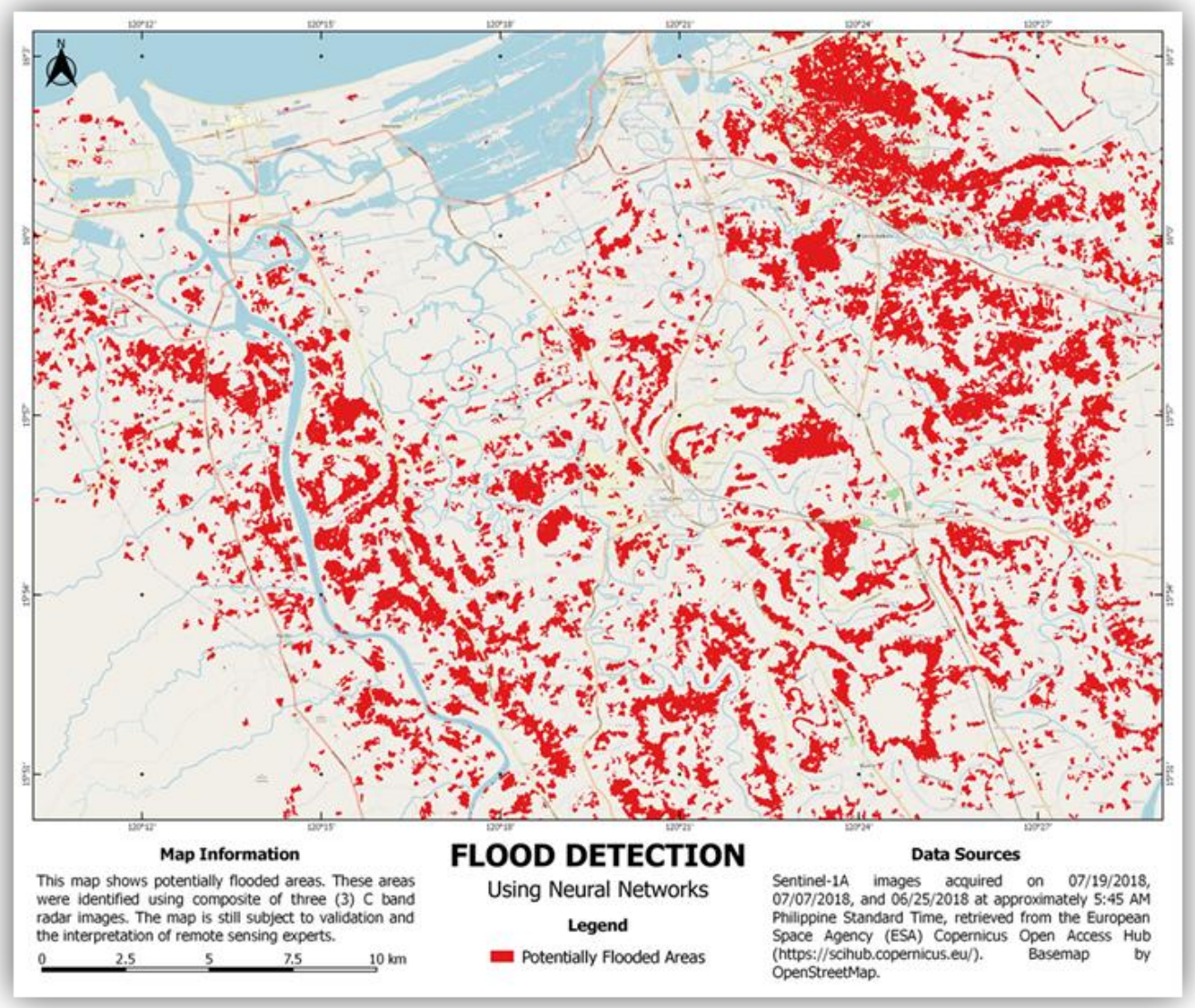
Project Monitoring

APPLICATIONS

Disaster Mapping

Flood Situation Mapping

- *Multi-temporal SAR Imagery*
- *Sentinel-1A, 1B*

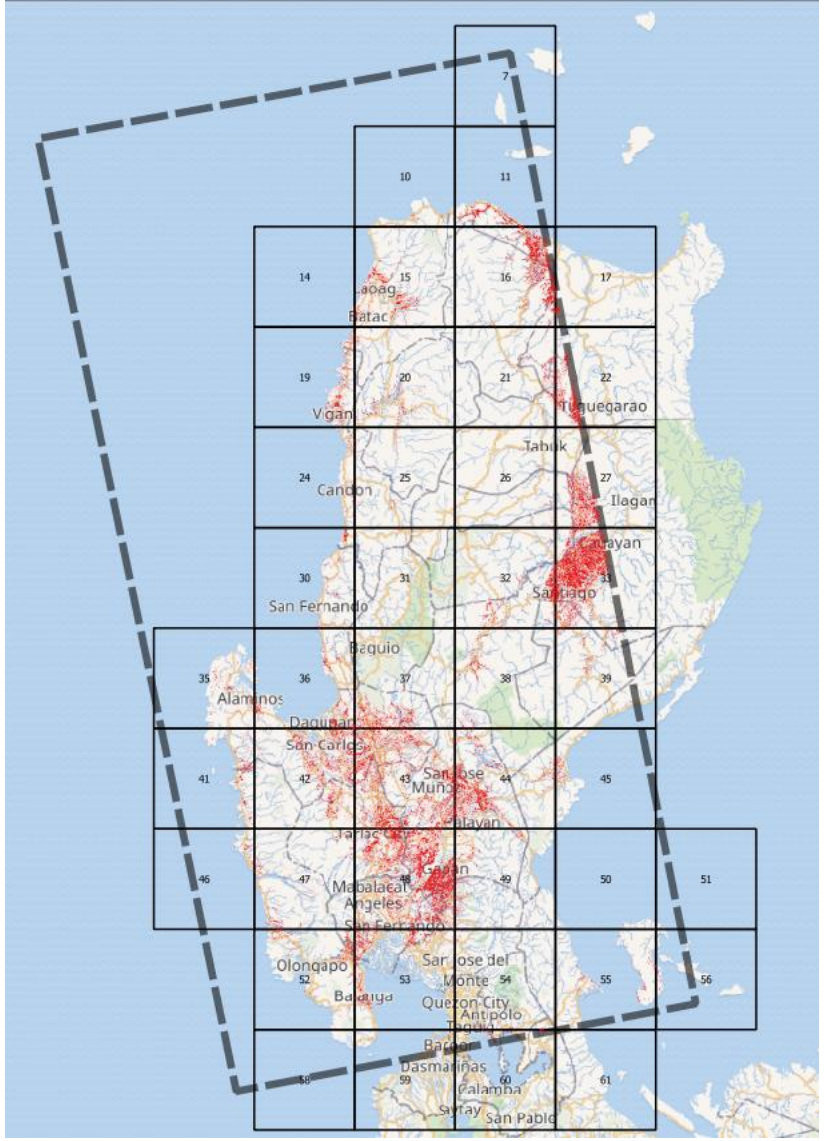


APPLICATIONS

Disaster Mapping

Flood Situation Mapping

- *Multi-temporal SAR Imagery*
- *Sentinel-1A, 1B*

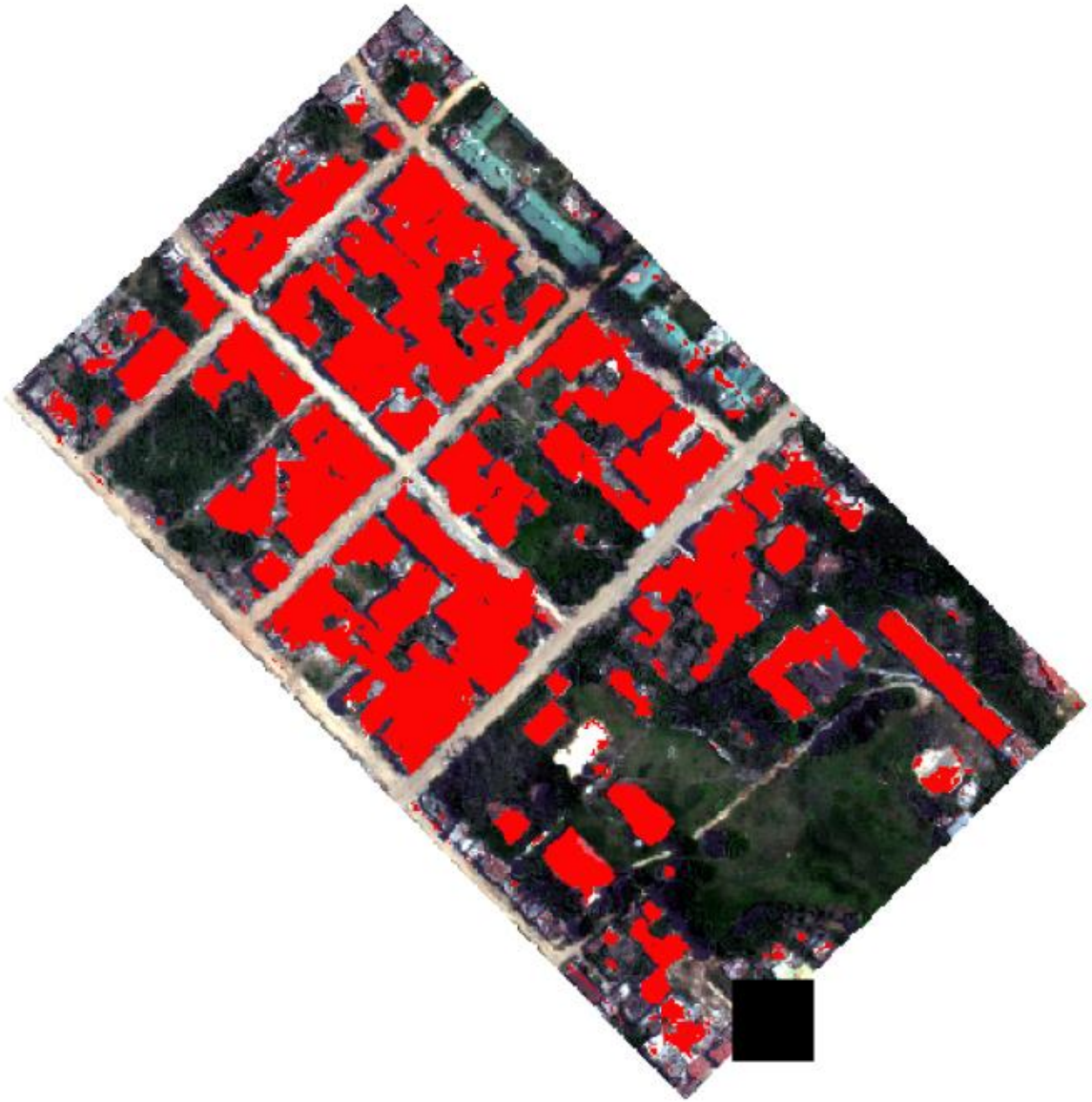


APPLICATIONS

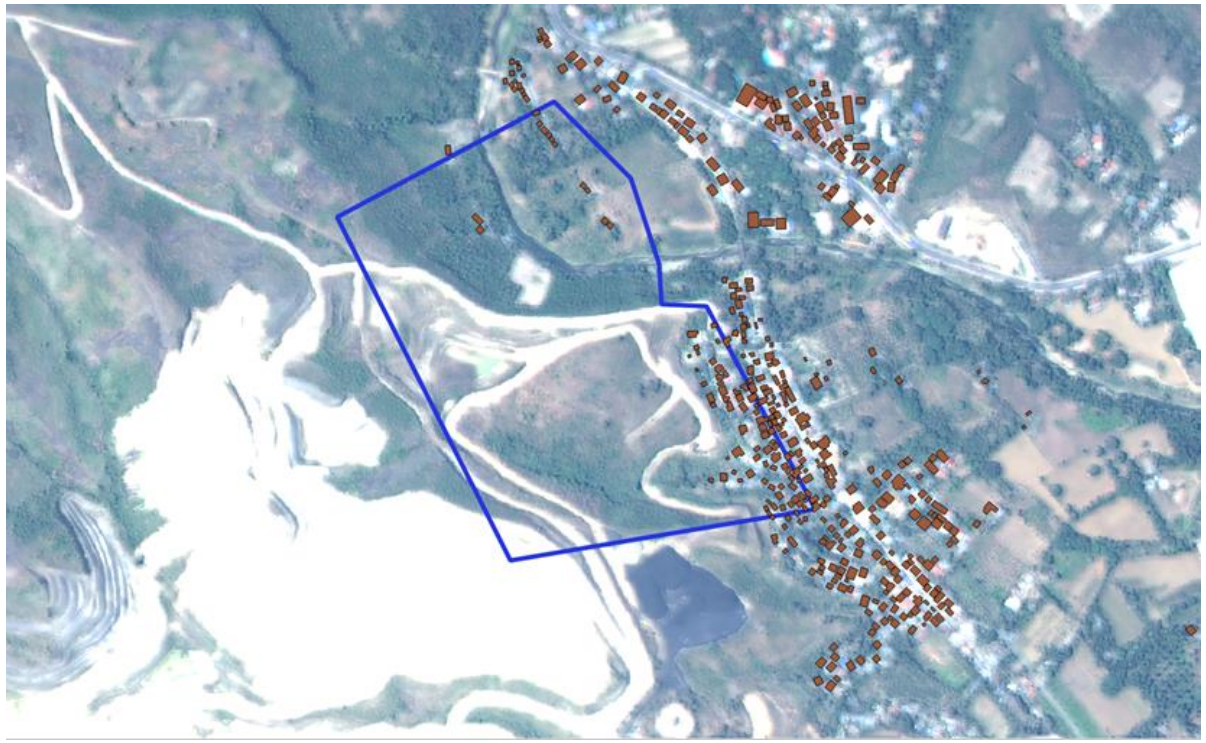
Disaster Mapping

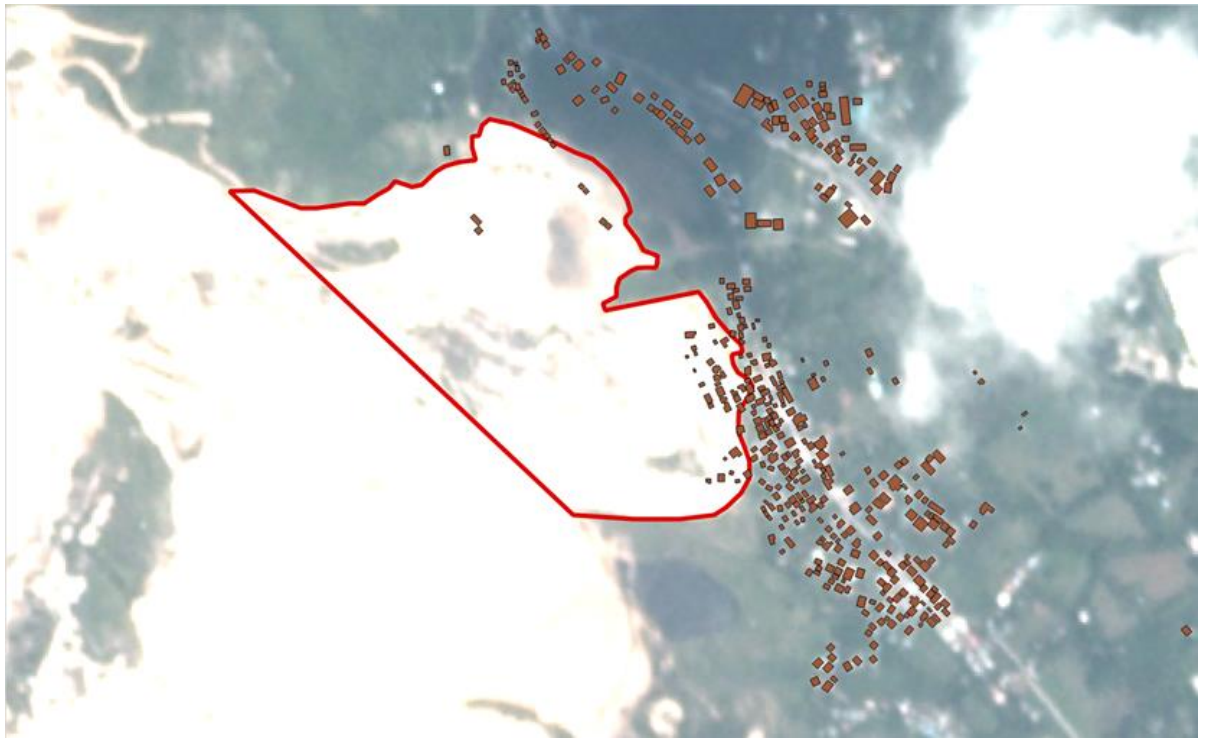
Damage Detection

- *VHR Optical Imagery*



Disaster Mapping





Images from the PEDRO Center were also used to assist rescue teams after the Naga landslide.

Disaster Mapping

Landslides

Itogon Benguet

Dataset:
Planet (Dove Constellation)

Processing Time
~ 2 minutes

Released to:
- Office of Civil Defense
- DOST Regional Offices
- Social Media
- Others

Natural Color of Planet Image (RGB: 321)
As of June 4, 2018

APPLICATIONS

Disaster Mapping

Landslides

Itogon Benguet

Dataset:
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Processing Time
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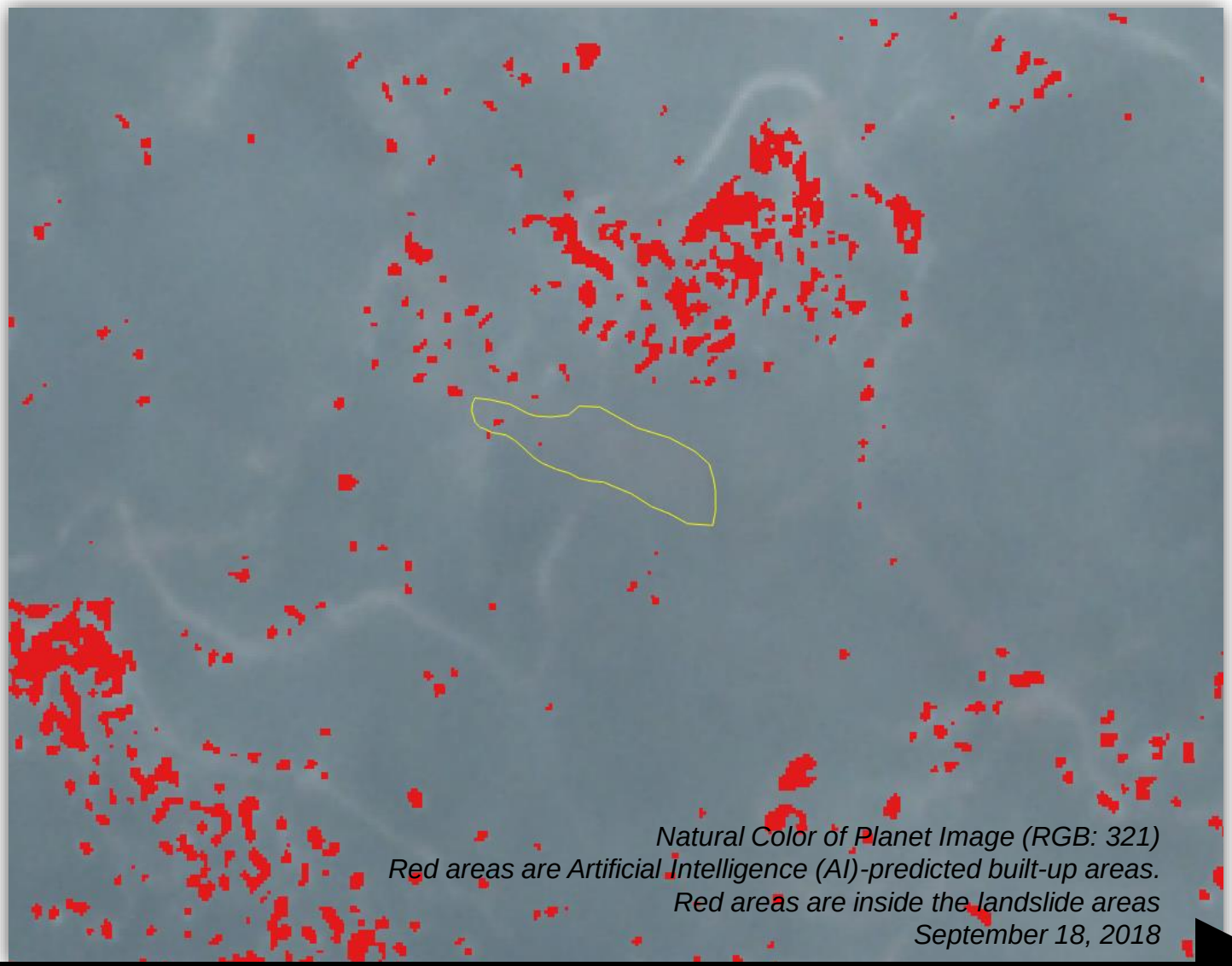


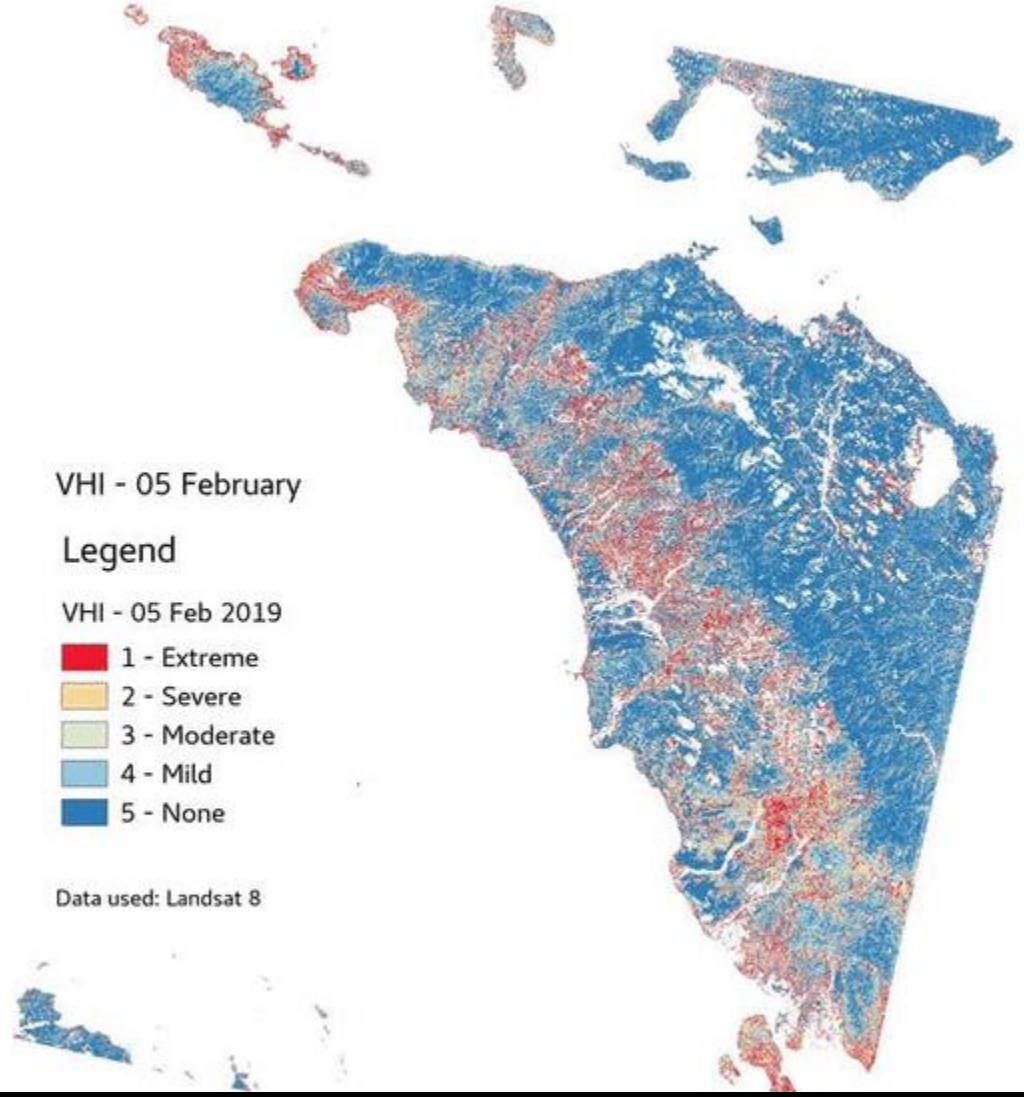
Natural Color of Planet Image (RGB: 321)
Red areas are Artificial Intelligence (AI)-predicted built-up areas.
Red areas are inside the landslide areas
September 18, 2018

APPLICATIONS

Disaster Mapping

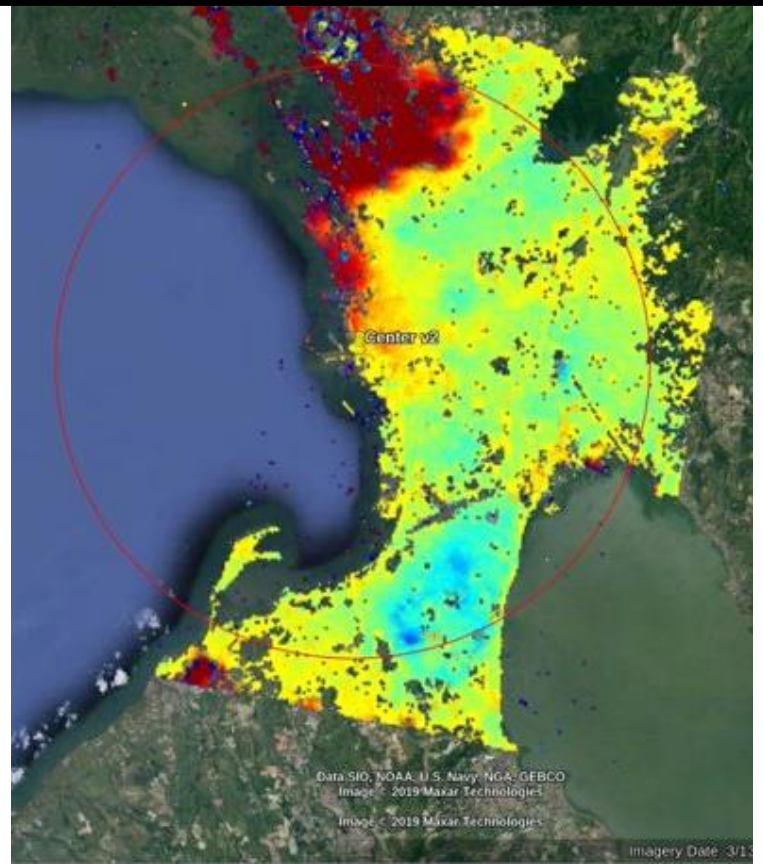
Drought Monitoring

- *Multi-temporal Optical Imagery*
- *Landsat 8*

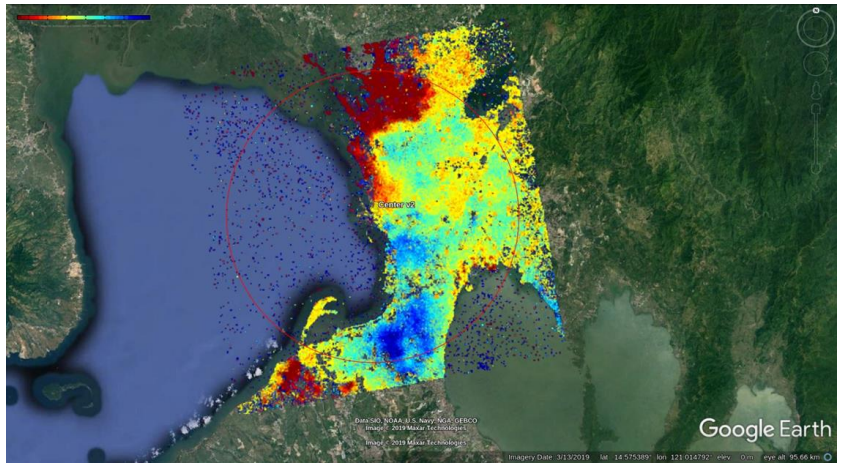


Disaster Mapping

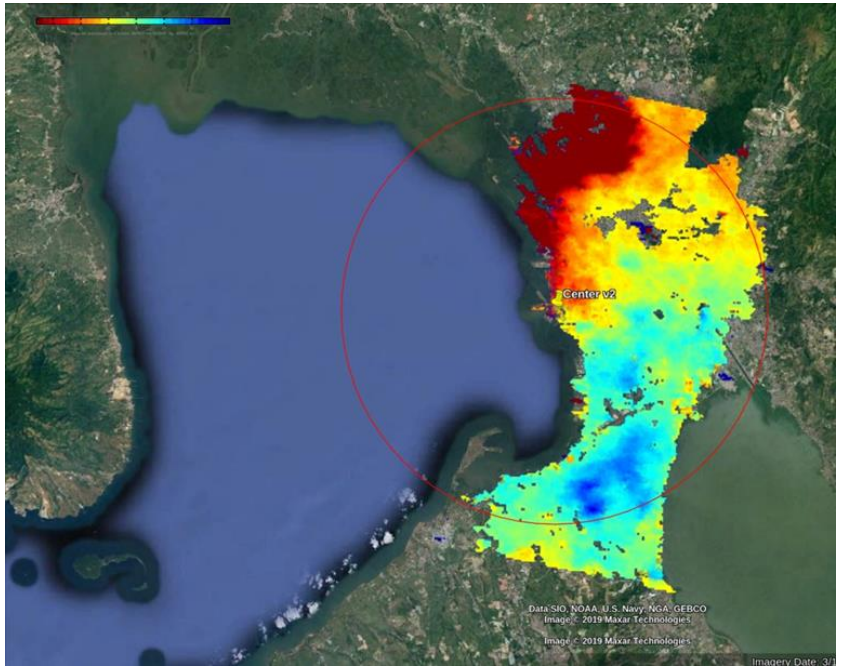
Surface Movements



Dataset: Sentinel 1A (C Band Radar Data)



Results: ALOS2

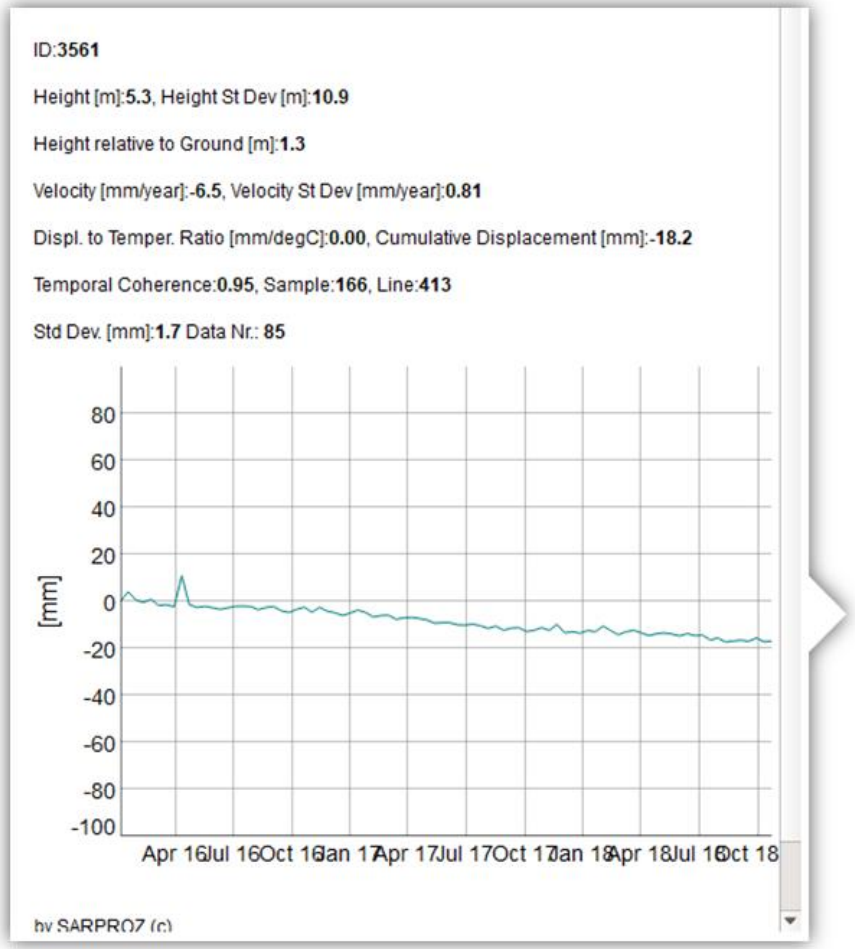


Results: CSK

APPLICATIONS

Disaster Mapping

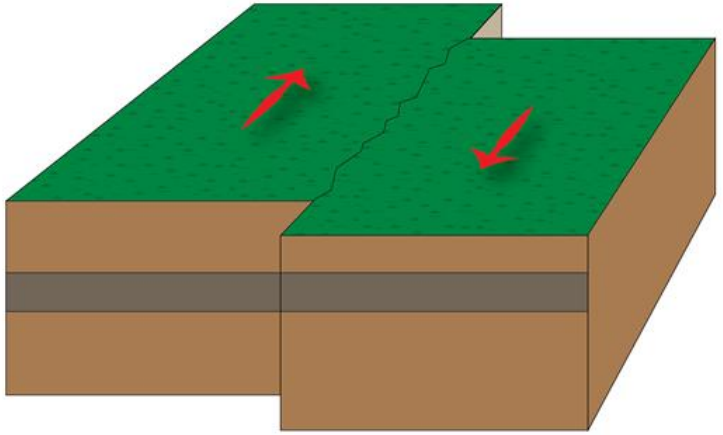
Surface Movements

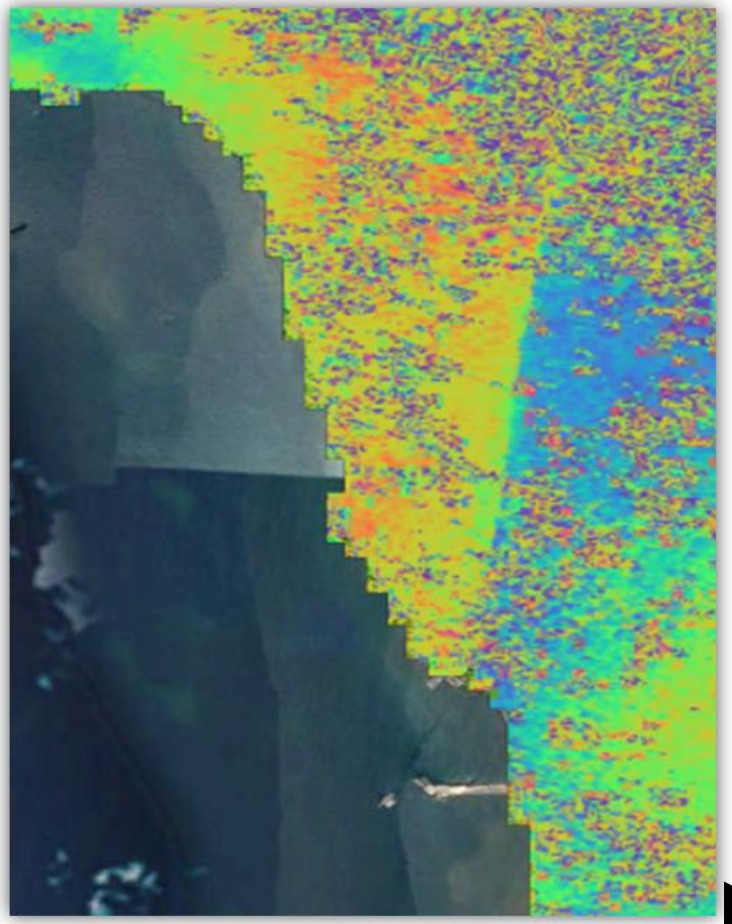


APPLICATIONS

Disaster Mapping

Surface Movements

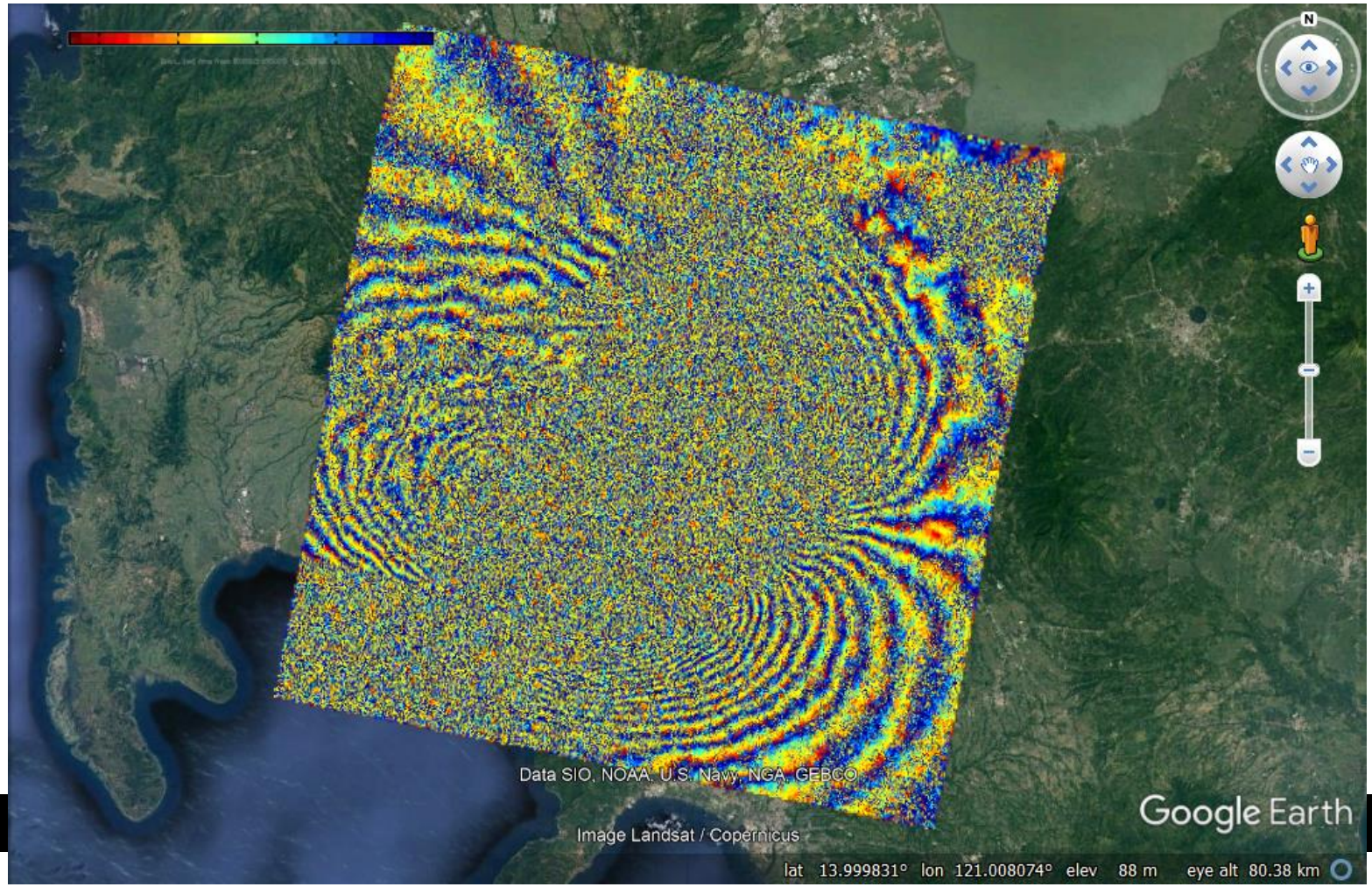




APPLICATIONS

Disaster Mapping

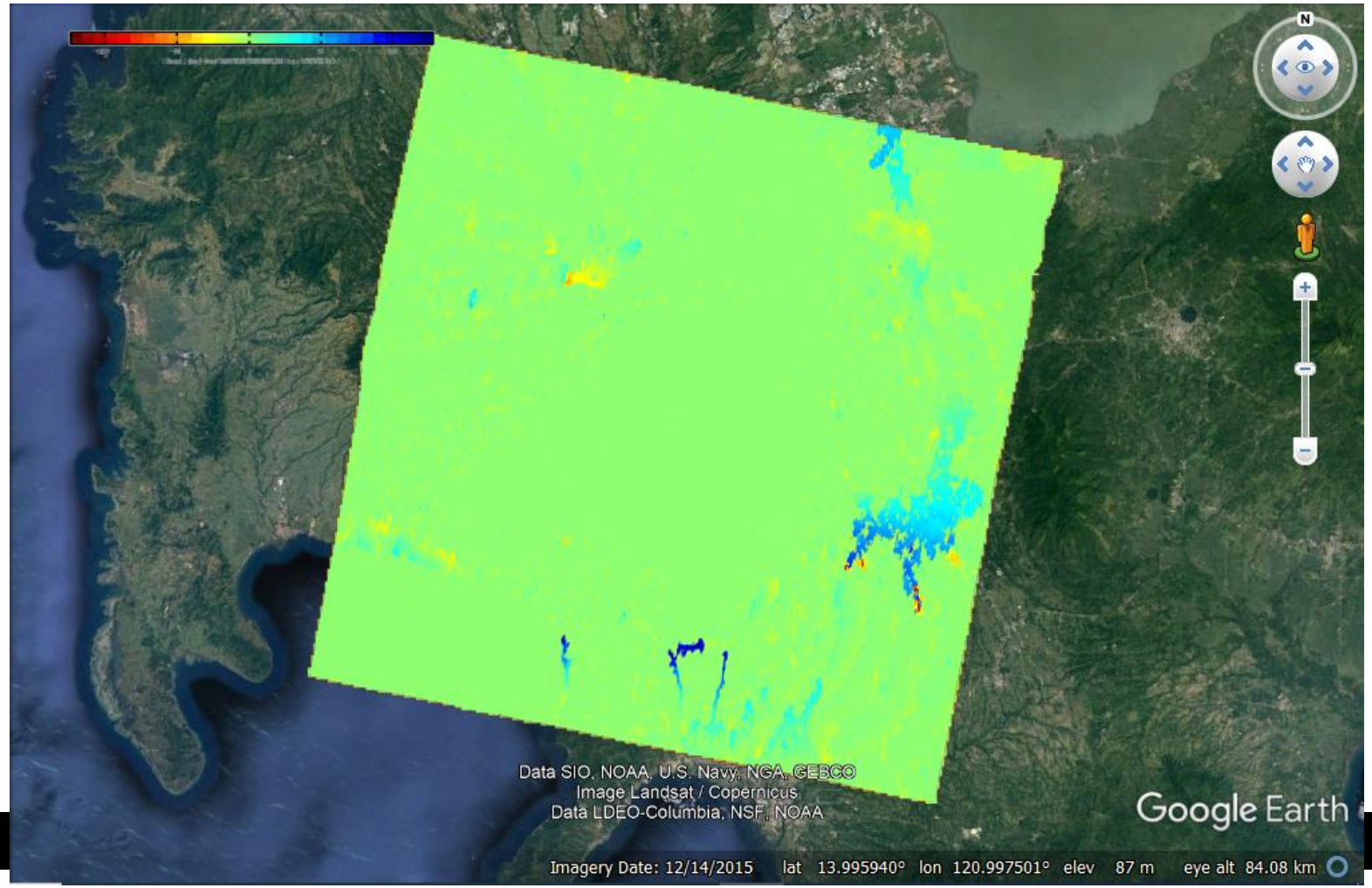
Taal Volcano Eruption Monitoring: IFG



APPLICATIONS

Disaster Mapping

Taal Volcano Eruption Monitoring: UW IFG



APPLICATIONS

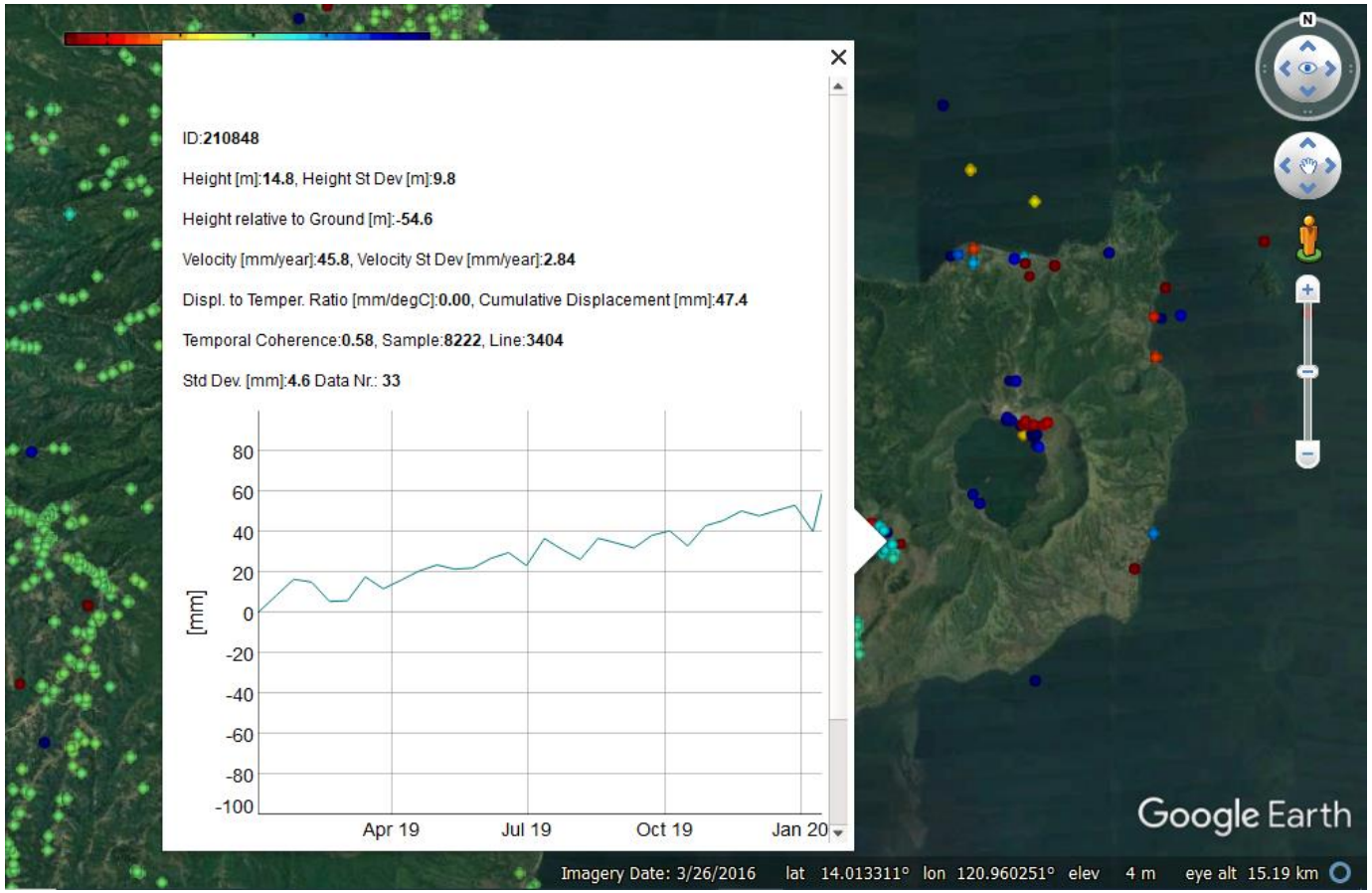
Disaster Mapping

Taal Volcano Eruption Monitoring: PSInSAR

APPLICATIONS

Disaster Mapping

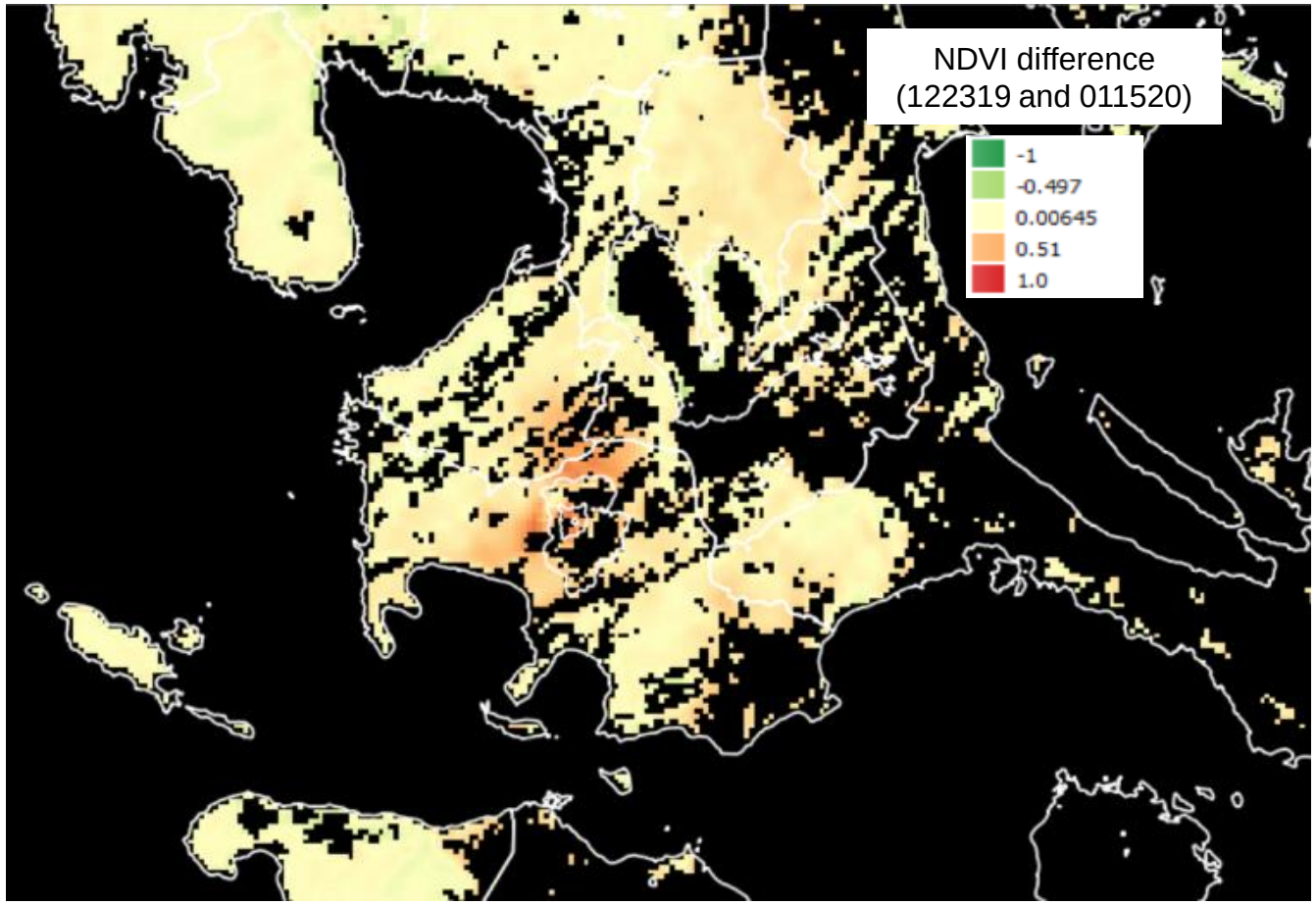
Taal Volcano Eruption Monitoring: PSInSAR

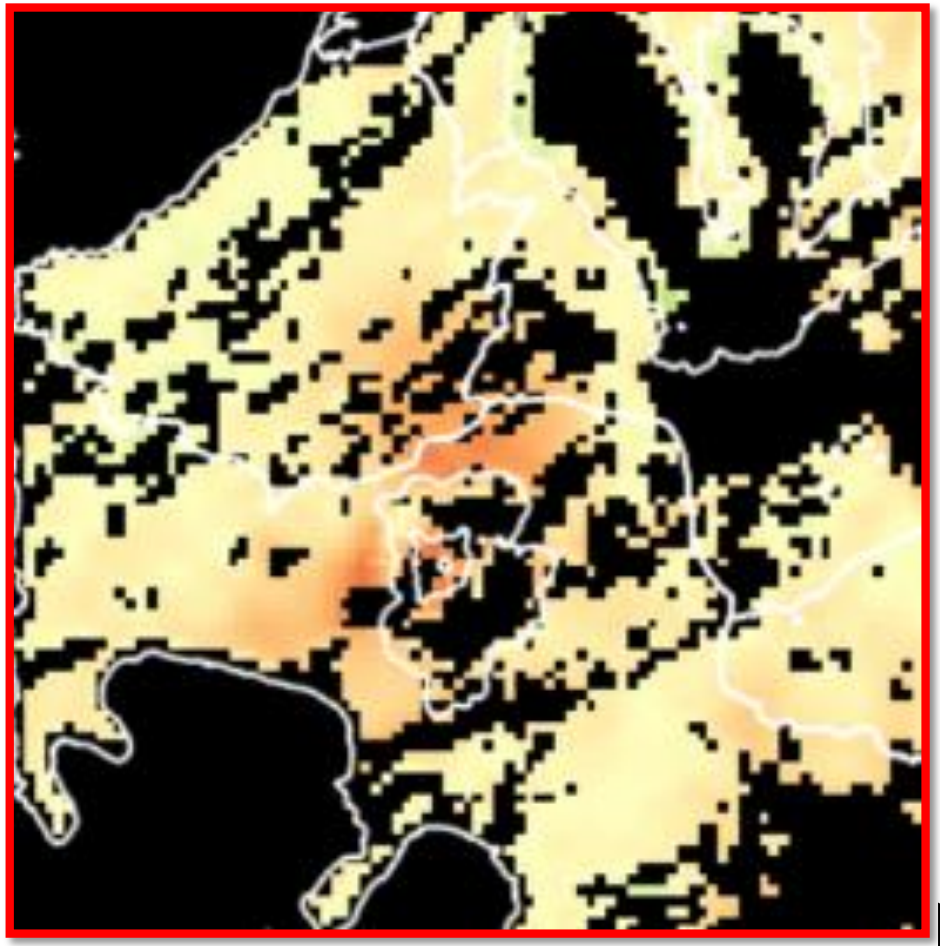


APPLICATIONS

Disaster Mapping

Taal Volcano Eruption Monitoring: NDVI

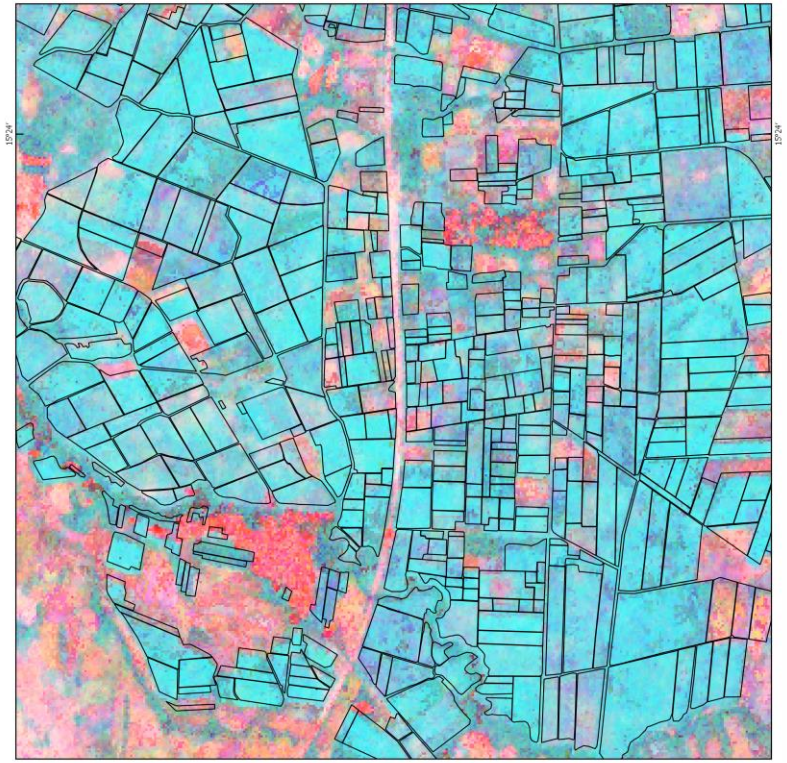


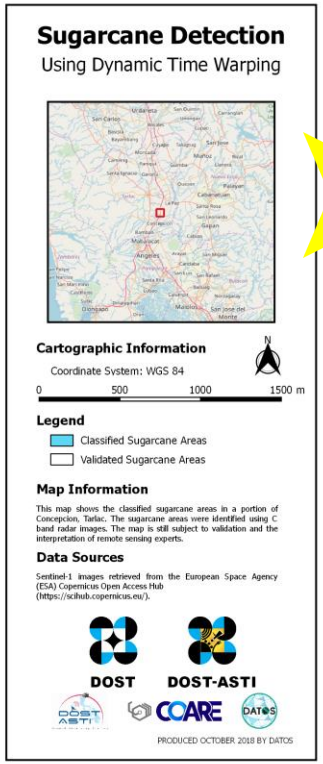


APPLICATIONS

Agriculture

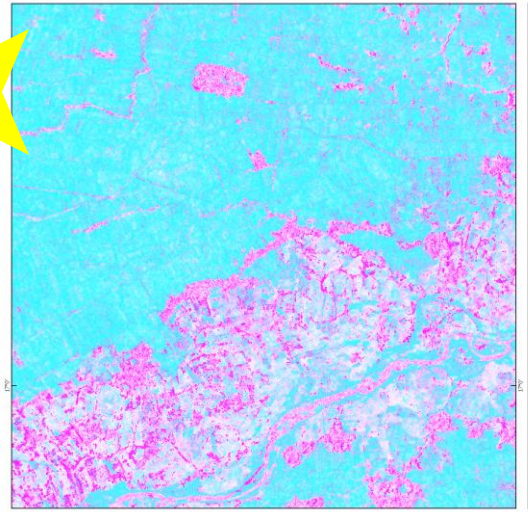
Agriculture

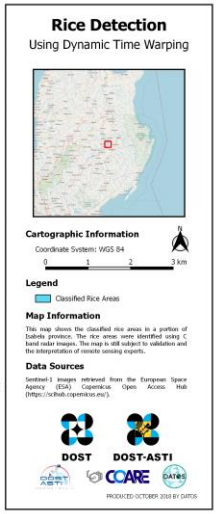


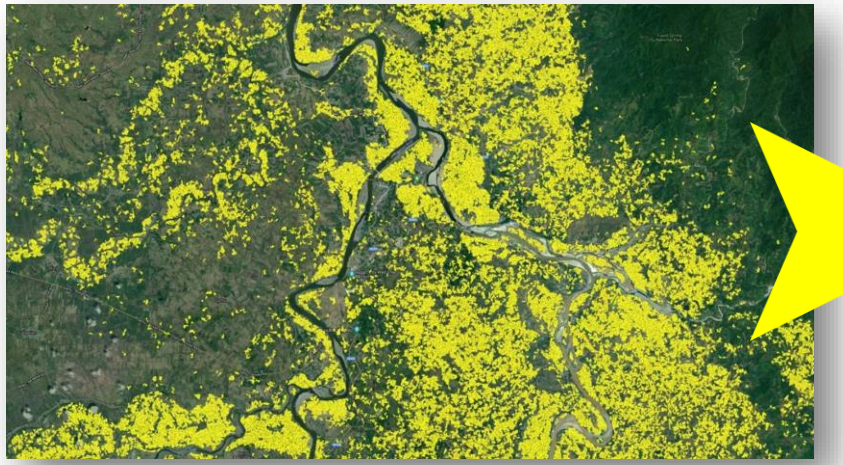


Sugarcane Mapping

Rice Mapping



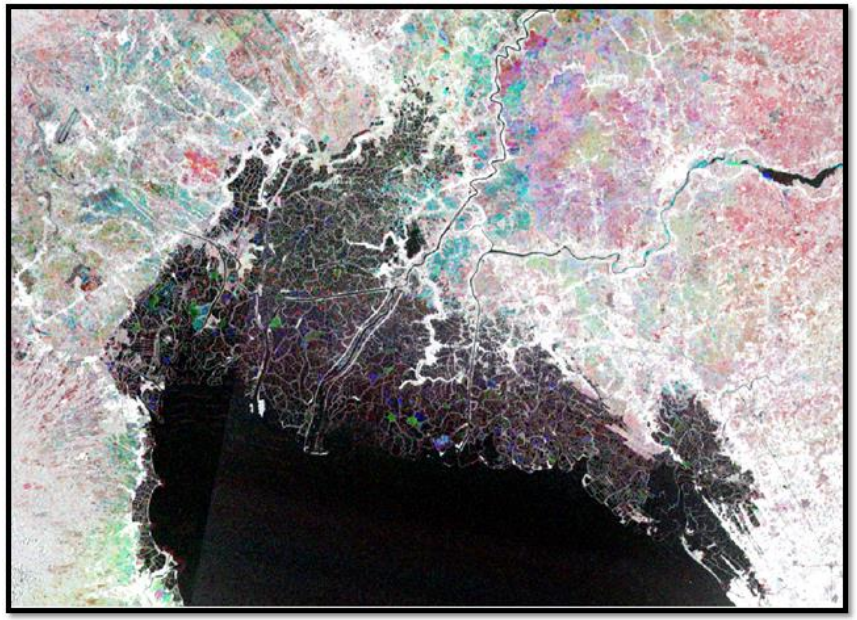




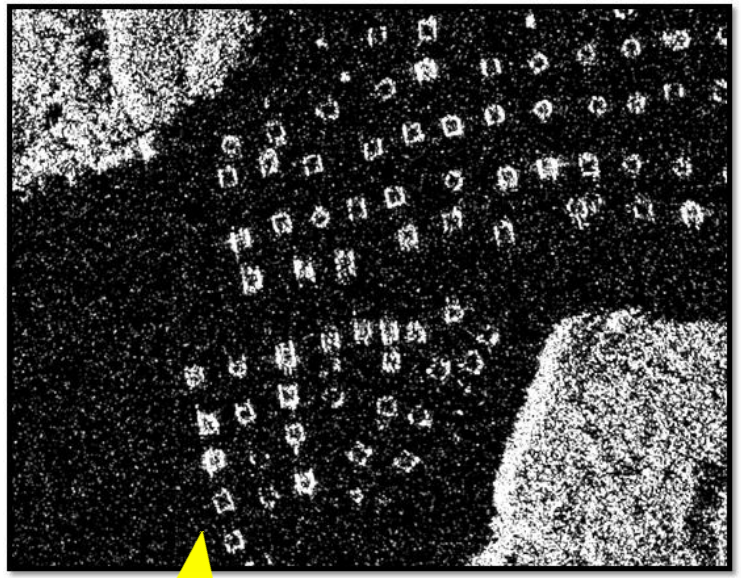
Corn Mapping

APPLICATIONS

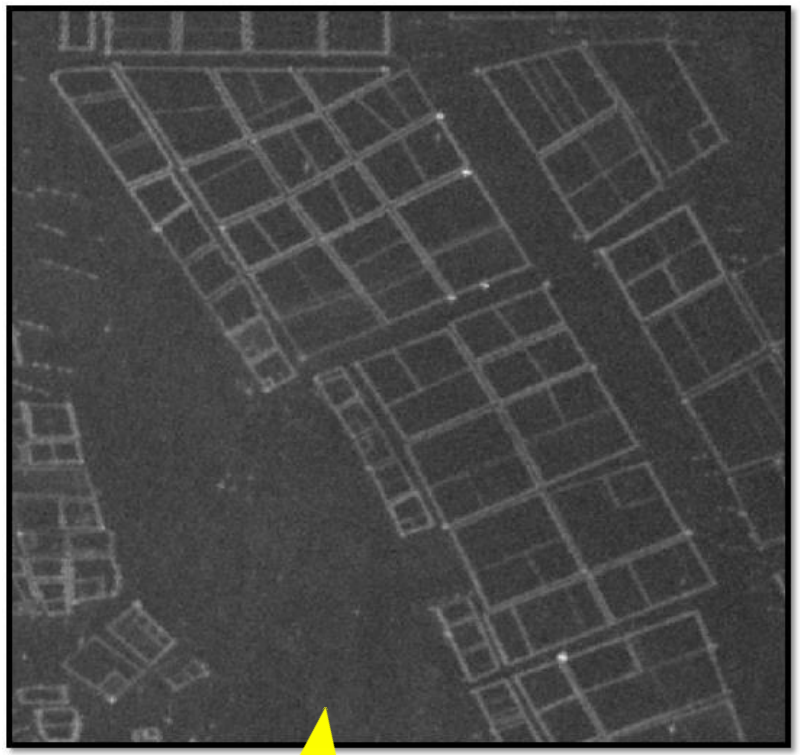
Agriculture



Fishponds



Fish cages



Fish pens

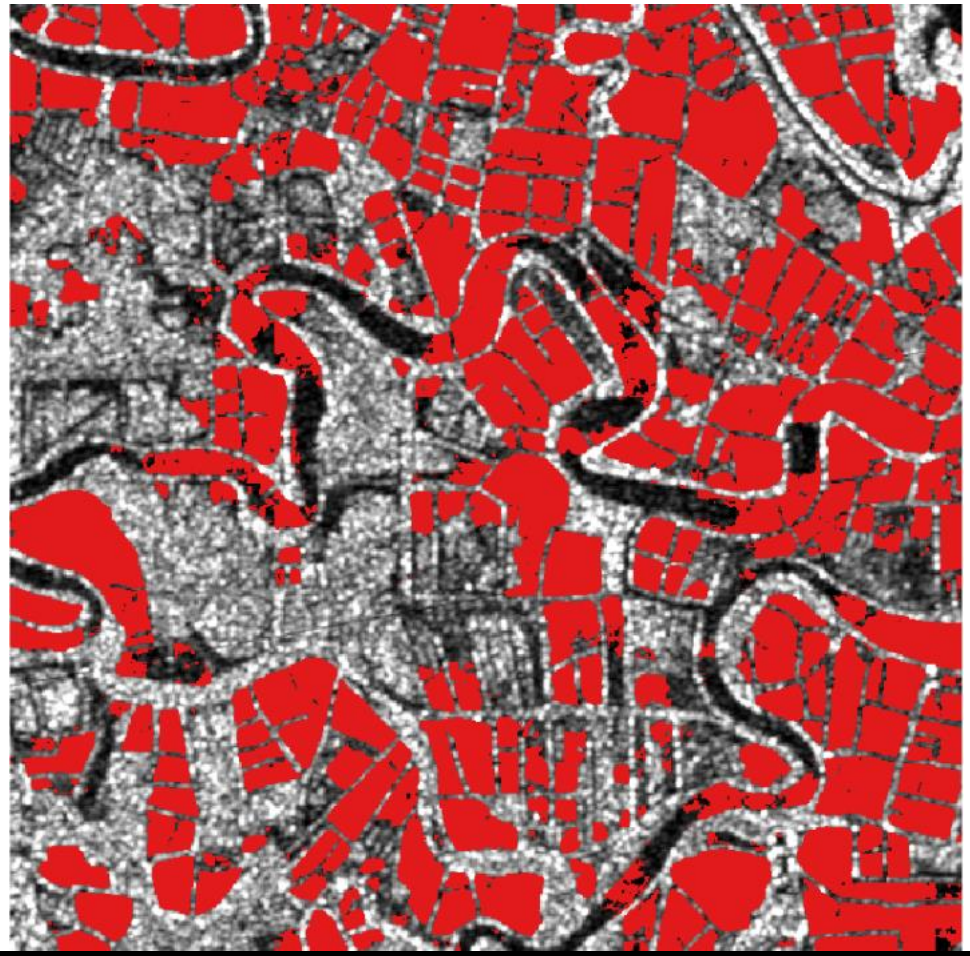
APPLICATIONS

Agriculture

Prediction using the Sentinel 1 AI for Fishpens

Agriculture

Prediction using the KompSAT 5 AI for Fishponds



APPLICATIONS

Agriculture

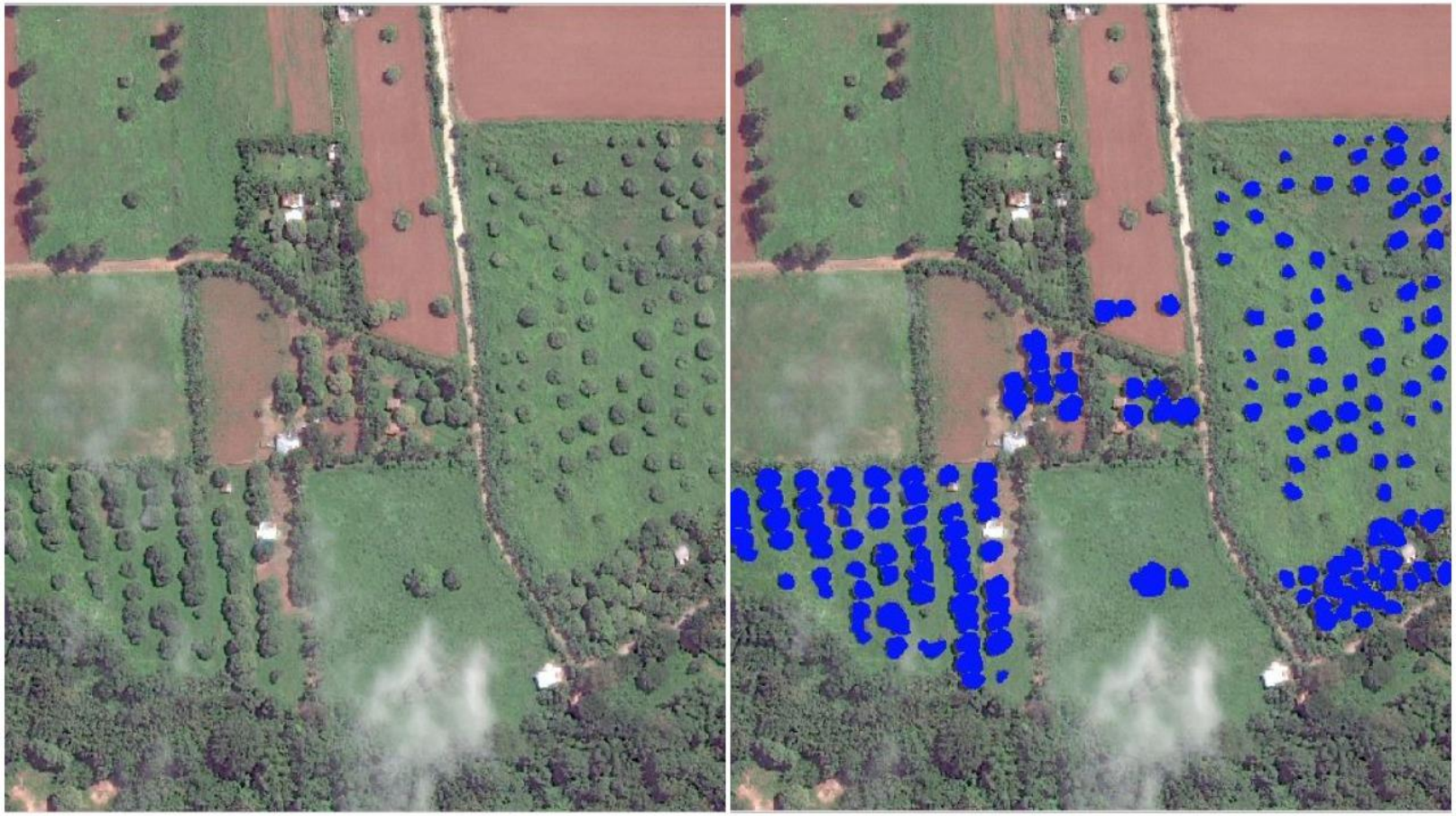
Tree Detection

Coconut Trees

- *VHR Imagery*
- *0.5-meter resolution*

Agriculture

Prediction using the DigitalGlobe AI for Mango Trees



APPLICATIONS

Agriculture

Prediction using the DigitalGlobe AI for Pili Trees

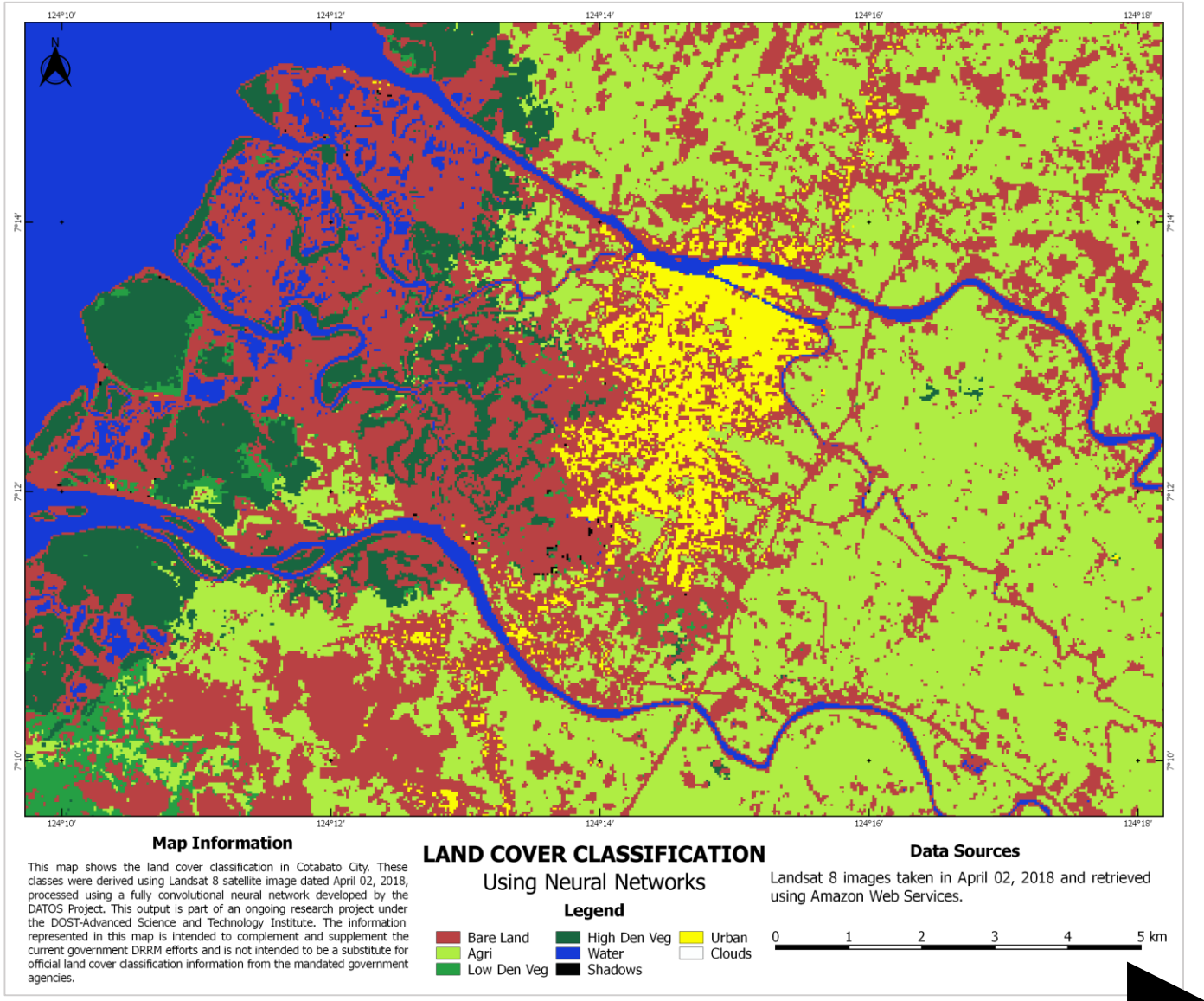
APPLICATIONS

Land Cover/Change Detection

Land Cover/Change Detection

Land Cover Mapping

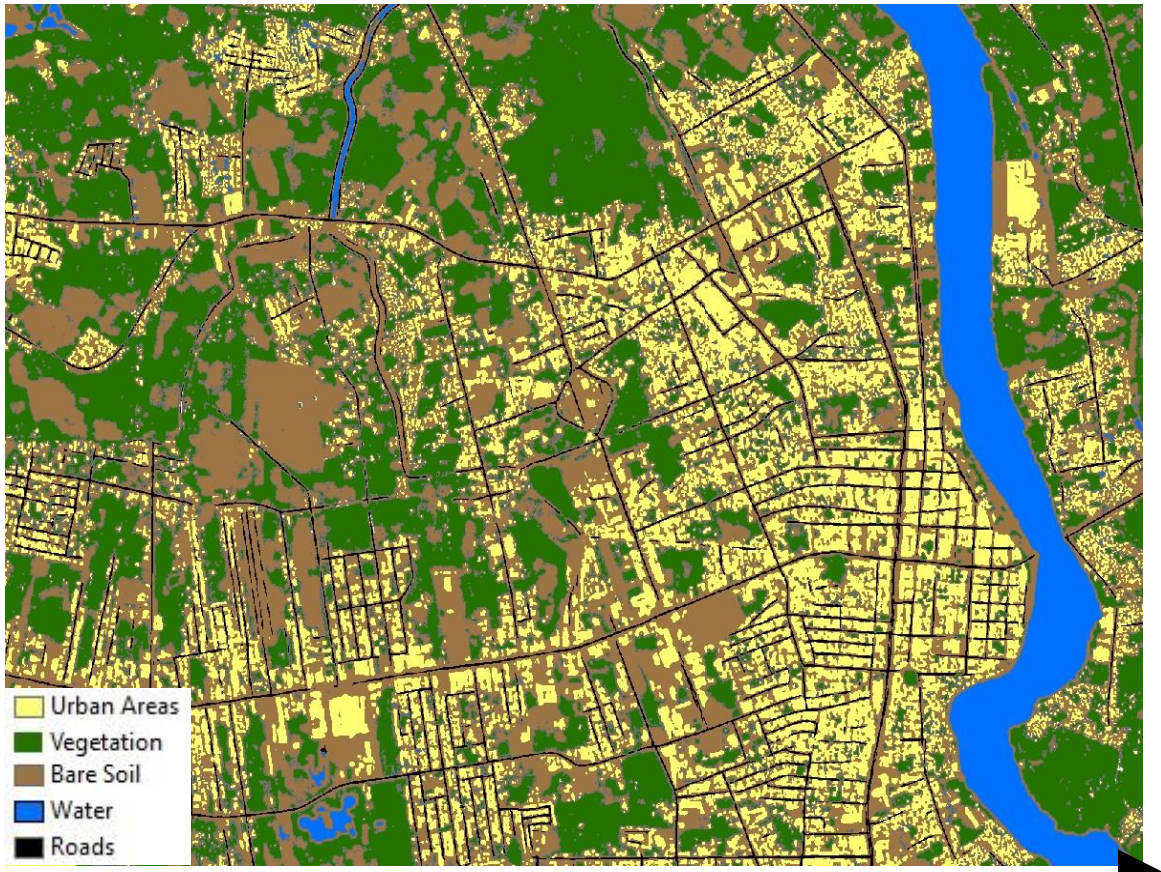
- *Landsat Imagery*



APPLICATIONS

Land Cover/Change Detection

Patched Land Cover Prediction from Individual Planet Land Class AIs

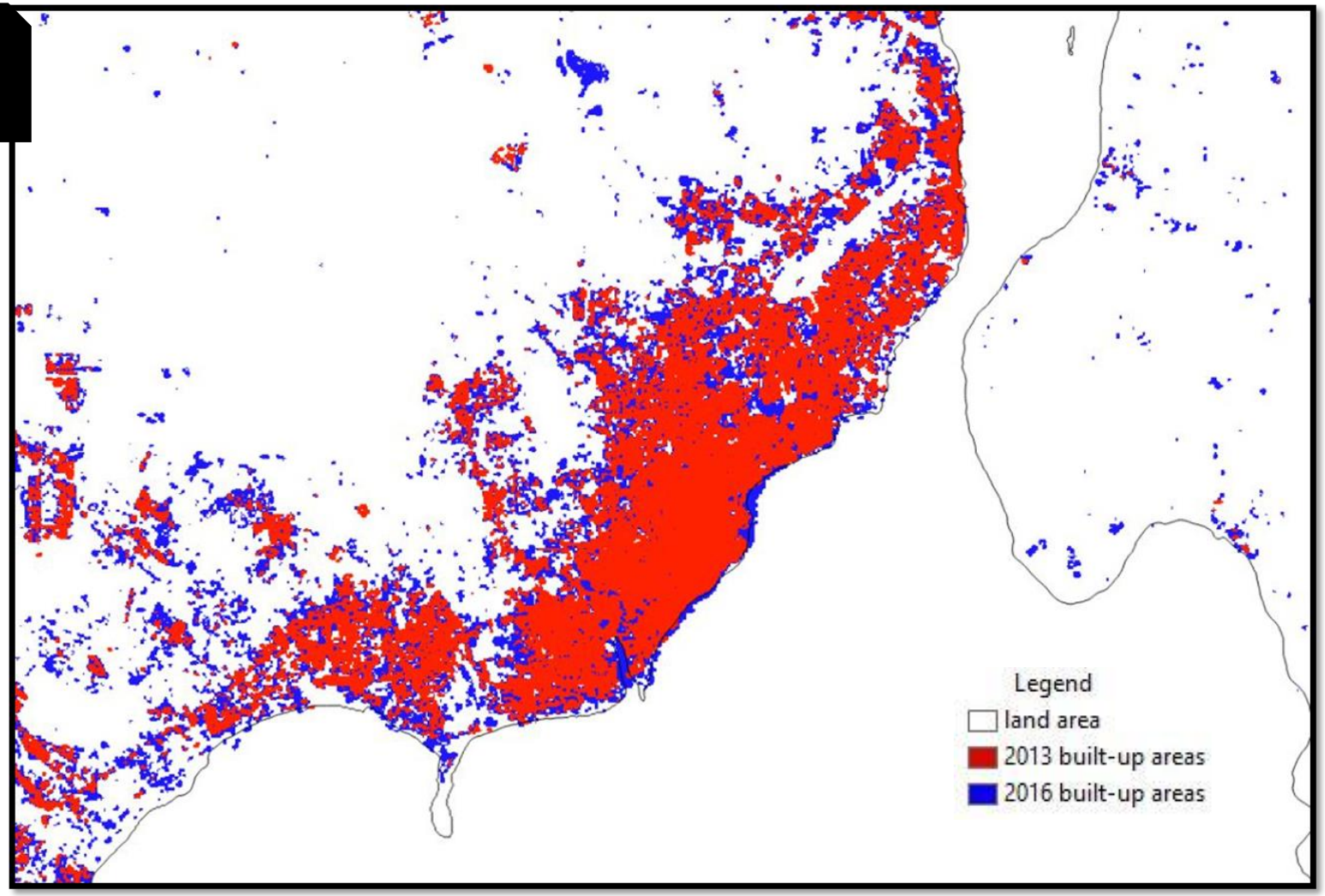


APPLICATIONS

Land Cover/Change Detection

Urban Sprawl

- *Multi-temporal Optical Imagery*
- *Landsat 8*



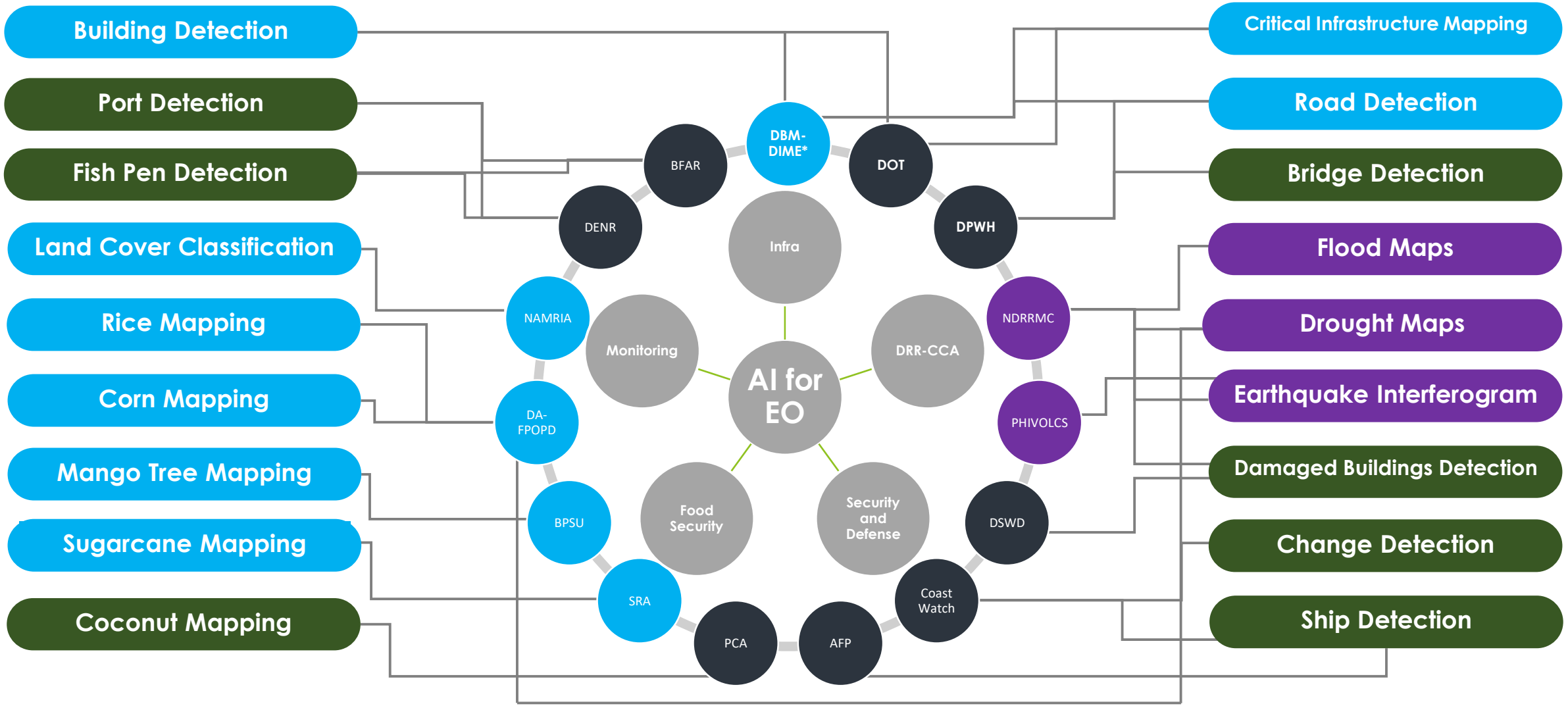
APPLICATIONS

Vision

To accelerate the transition to AI-enabled mapping.

Mission

To impart the knowledge gained to industry leaders.



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*

THANK YOU

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WORKSHOP


MOTIVATION