SPACE ECONOMY & PUBLIC POLICY

Supporting Space Economic Growth

Kandasri Limpakom

May 4, 2023

Geospatial World Forum 2023

Postillion Hotel & Convention Centre WTC, Rotterdam, The Netherlands

สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน)
Geo-Informatics and Space Technology Development Agency (Public Organization)

GISTDA: National Space Agency

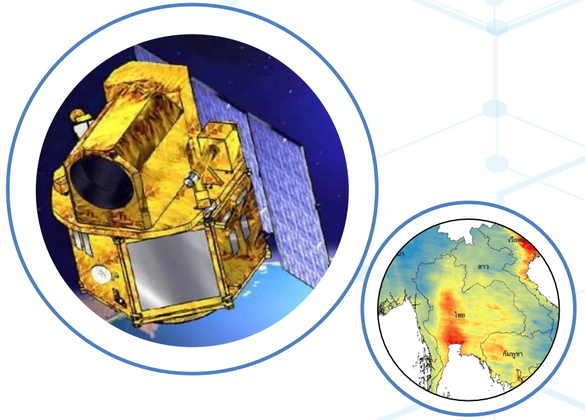
Vision: To be an organization that brings together the values of space technology and geo-informatics for the greatest benefit of humanity.

Upstream

Space Technology Development

- Earth observation satellite operation
- Ground equipment and services
- Satellite Development

Enhancement of
Space and GI manpower



Downstream

Geo-Informatics Technology Development

- Satellite data services
- Applications & solutions development

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Policy

Current Status of Policy on Space & Geospatial Technology in THAILAND

The National Geo-Informatics Committee

The National Geospatial Master Plan 2023-2027 (5 Years)

Submission to the National Geo-Informatics Committee and then the Cabinet for Consideration

The National Space Policy Committee

Development of the National Space Law

The National Space Master Plan 2023-2037 (15 Years)

Submission to the Cabinet for Consideration

The National Space Law

1. New Space Economy
2. Space Security
3. International Standard Operating Procedure
4. One Stop Service Coordinator
5. Space Education
6. Support Space Ecosystem

National Space Master Plan 2023-2037 (15 Years)

Strategy 8: Driving Mechanism for the Master Plan
Enforce laws and regulations that assist Thai space actors (gov. & non-gov.) for conducting space activities

Strategy 1: Space Affairs for National Security
Start the space industrial basis that supports Thailand national security

Strategy 2: Space Affairs for Sustainability
Demonstrate applications of space science and technology for achieving the Sustainable Development Goals

Strategy 7: International Collaboration
Seek new productive cooperation on commercialization of space activities

Strategy 3: Space Economy Development
Increase the growth of the commercial space sector in Thailand

Strategy 6: Human Development
Develop and strengthen the skills and abilities that Thailand needs to adapt in a fast-changing technology

Strategy 4: Infrastructure Management
Create an enabling environment to ensure that space technologies and space-based solutions are quickly and easily transformed into tangible products and solutions

Strategy 5: Research and Innovation
Encourage research community and private sector to intensify their efforts in the space sector

National Geospatial Master Plan 2023-2027 (5 Years)

Vision: Every sectors gain competitive advantage and Thai people have a good quality of life using geospatial technology

Objectives

1. Thai economy gains competitive advantage with geospatial technology
2. All sectors trust in national central geographic information systems

Strategies

1. Drive Thailand Economy with Geospatial Technology
2. Develop the national geospatial data sets which are essential for various uses and mission especially for economic growth.
3. Develop geospatial open platforms and promote geospatial open data
4. Building HR capacity and a mechanism to drive geospatial innovation

Technology & Infrastructure Development

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Geo-Informatics and Space Technology Development Agency (Public Organization)

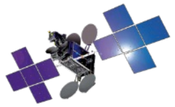
THAICOM

GSO

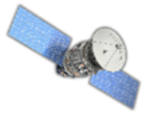
ThaiCOM-1

ThaiCOM-2

ThaiCOM-3



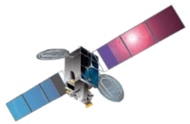
ThaiCOM-4



ThaiCOM-5

ThaiCOM-6

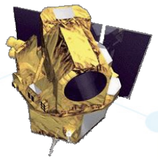
ThaiCOM-8



ThaiCOM-7

1993 1994 1997 1998 2003 2005 2006 2007 2014 2016 2018 2019 2020 2021 2023

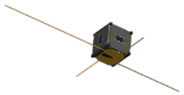
Thaipat 1 & 2



Thaichote

GISTDA

NGSO

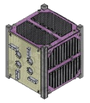


KnackSat
1U-CubeSat

KNACKSAT

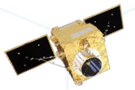
JaiSat-1

Napa-1

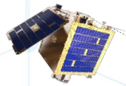


BCCSat-1

Napa-2



THEOS-2



THEOS-2A

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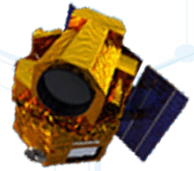
Earth Observation Satellite Operation



THEOS or Thaichote:
Thailand's 1st Earth Observation satellite

- **Altitude:** 822 km
- **Mass:** 715 kg
- **Resolution:** MS (R, G, B) 15 m. / PAN 2 m.
- **Revisit:** 3-5 days
- **Swath:** 90 km
- **Design Lifetime:** 5 years

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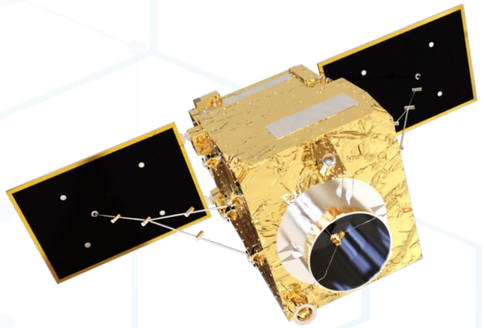
Earth Observation Program



Coming Up in 2023

THEOS-2: a very-high-resolution Earth Observation satellite

- **Altitude:** 621 km
- **Mass:** 425 kg
- **Resolution:** MS (R, G, B, NIR) 2 m. / PAN 0.5 m.
- **Revisit:** 4 days
- **Swath:** 10.3 km
- **Design Lifetime:** 10 years

THEOS-2A: a small Earth Observation satellite, building the satellite development capacity in Thailand

- **Altitude :** 500 km
- **Mass :** 101.5 kg
- **Resolution :** Bayer filtered (native) MS 1.07 m.
- **Revisit :** 2 days
- **Swath :** 5.48 km
- **Design Lifetime :** 3 years
- **Additional Capabilities:** 3 VDO modes / AIS & ADS-B for ship and aerial monitoring/surveying

Ground Equipment and Services

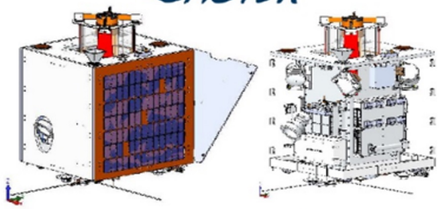
Complete Cycle for Ground Segment Development in Thailand

FDI from Sweden in EEC area

National Infrastructure for Satellite Development

GISTDA

AIRBUS



SURREY

CORBONITE SATELLITE

MECHANICAL PARTS

Triumph Group Aerospace Structures
JINPAO
Ducommun
AEROWORKES
C.C.S. Group
senior Aerospace
COBRA
Micromatics

TIER-1 THAI SUPPLIERS

ELECTRICAL PARTS

SYNERGY
Cherrytech Group
GRAVITECH HOME OF MAKER

SUPPLY CHAIN DEVELOPMENT

AIT – Assembly Integration & Test Facility

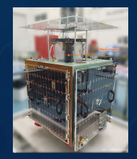
Satellite Roadmap: National Constellation

THEOS-1
(Passive Payload)

2008

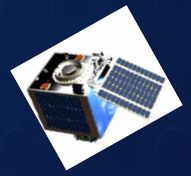
THEOS-2&2A
(Passive Payload)

2023

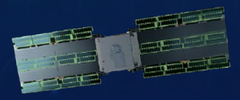


THEOS-3
(Passive Payload)

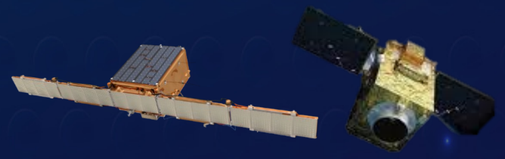
2026



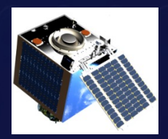
2029

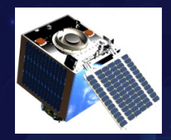


2034



2038





THEOS-4&5
(Active & Passive Payload)

THEOS-6&7
(Active & Passive Payload)

THEOS-8A,8B,8C
(Passive Payload)

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Geo-Informatics and Space Technology Development Agency (Public Organization)

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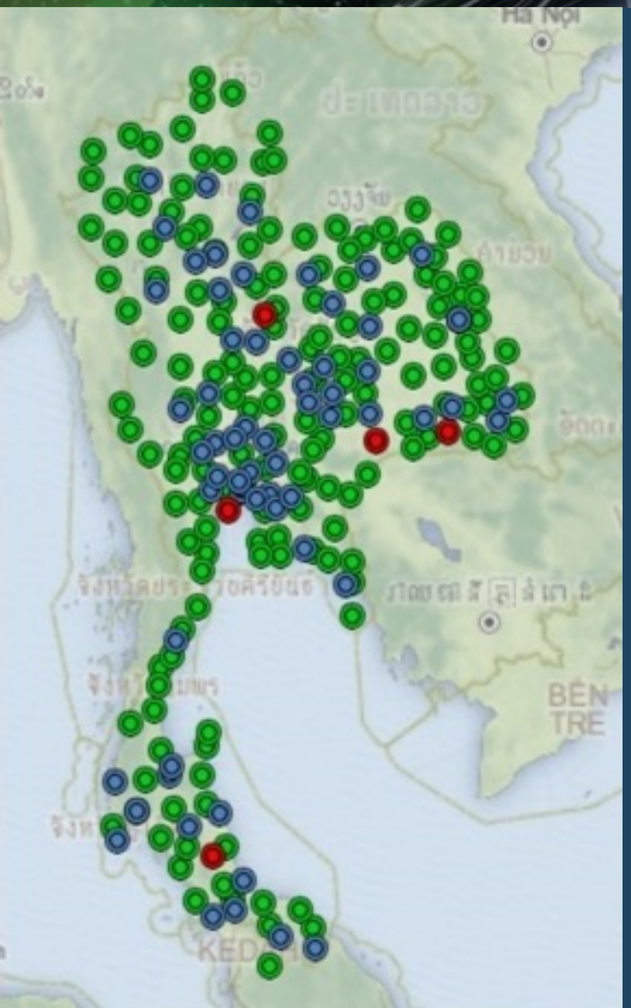
ศูนย์ข้อมูลค่าอ้างอิงพิกัดแบบต่อเนื่องแห่งชาติ

(National CORS Data Center)



By integrating data from CORS (Continuously Operating Reference Stations) of various government agencies across the country, the National CORS Data Center can provide unified high-accuracy coordinates to government agencies, private sector and general public.

The service includes:

1. Network Real Time Kinematics (Network Real Time Kinematics) surveying service
2. Satellite data service for continuous navigation of the coordinate reference station. (Continuously Operating Reference Stations; CORS) in RINEX file format.
3. Post processing service

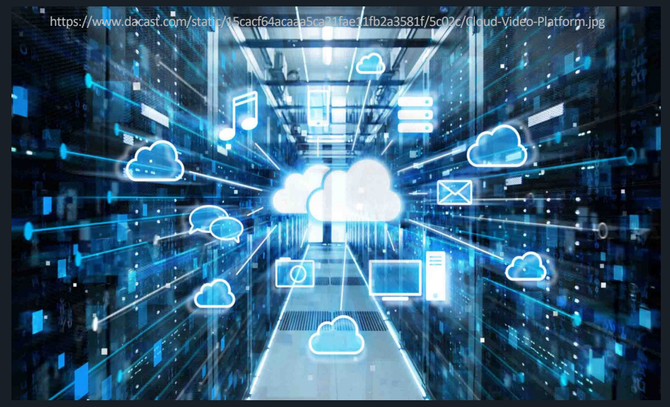
Service from the National CORS Data Center will make survey from GNSS most reliable, providing high-accuracy coordinates. In addition, the service is useful in a variety of fields such as

- Survey work for mapping and geo-informatics
- Land surveying and surveying
- Engineering and construction work (i-Construction)
- Transportation and driverless vehicles
- Smart Farming

Data from more than 200 CORS Nation Wide

In a nutshell …

- A cloud-based platform providing shared and trusted geospatial data, services, and applications for use by the public and by government agencies and partners to meet their mission needs.
- A national strategic plan: Open Government, Open Data and Digital Government strategies to enhance transparency, collaboration and participation.
- New space economy
- FAIR Principle:
  - *Findable*
  - *Accessible*
  - *Interoperable*
  - *Reusable*
- Open-source framework



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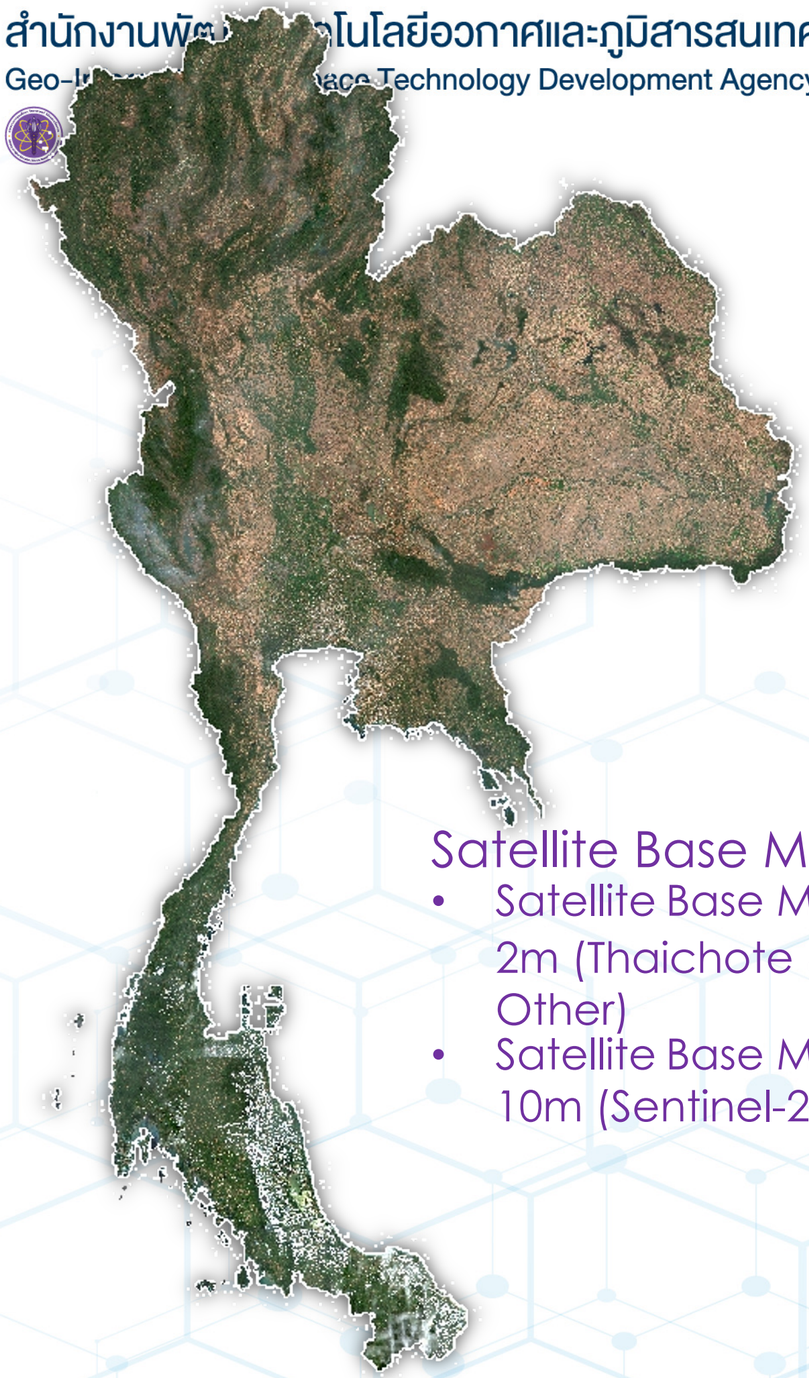
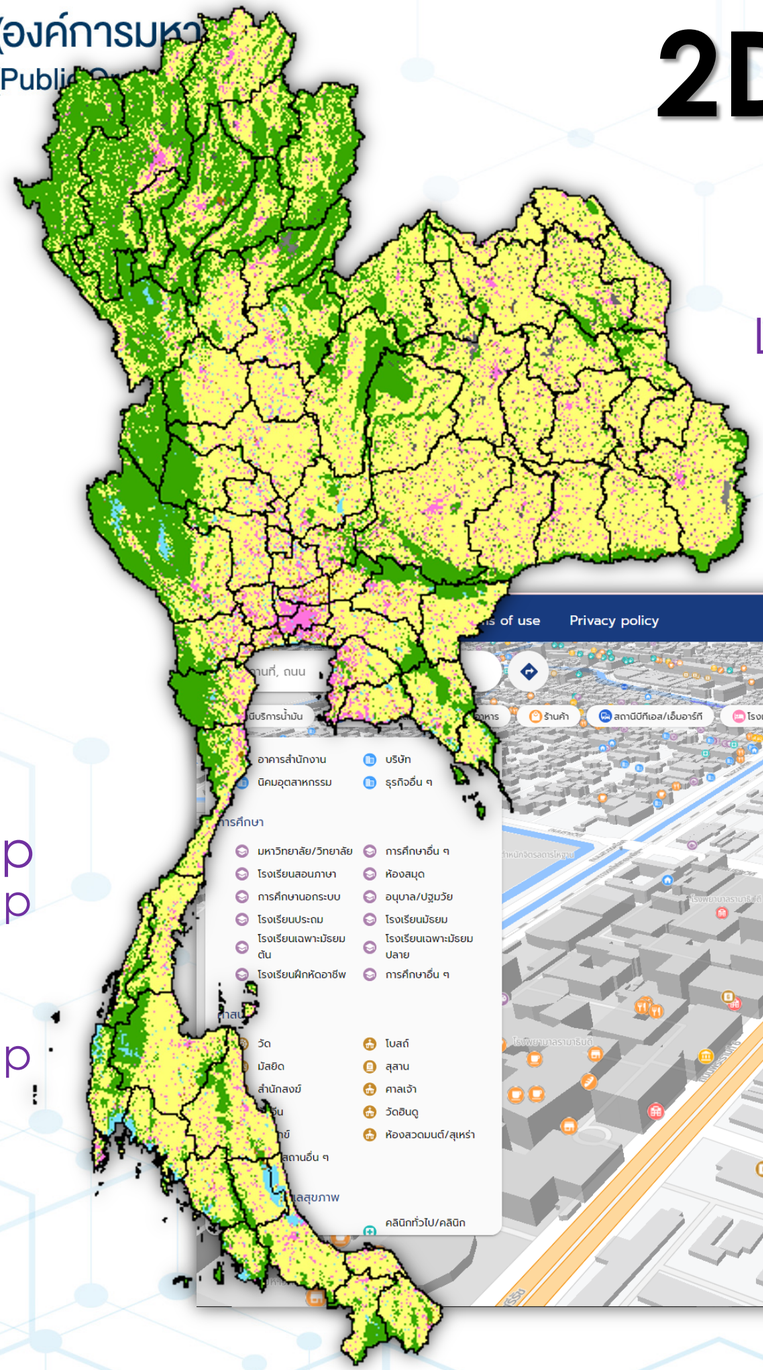
Geo-I ace Technology Development Agency (Publi

2D & 3D Data Set



Satellite Base Map

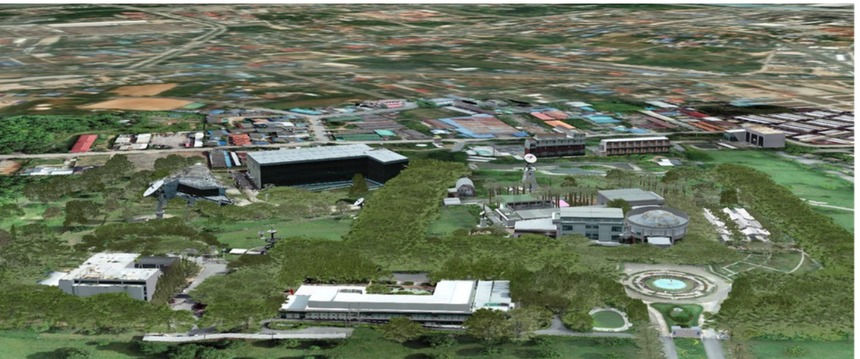
- Satellite Base Map 2m (Thaichote & Other)
- Satellite Base Map 10m (Sentinel-2)

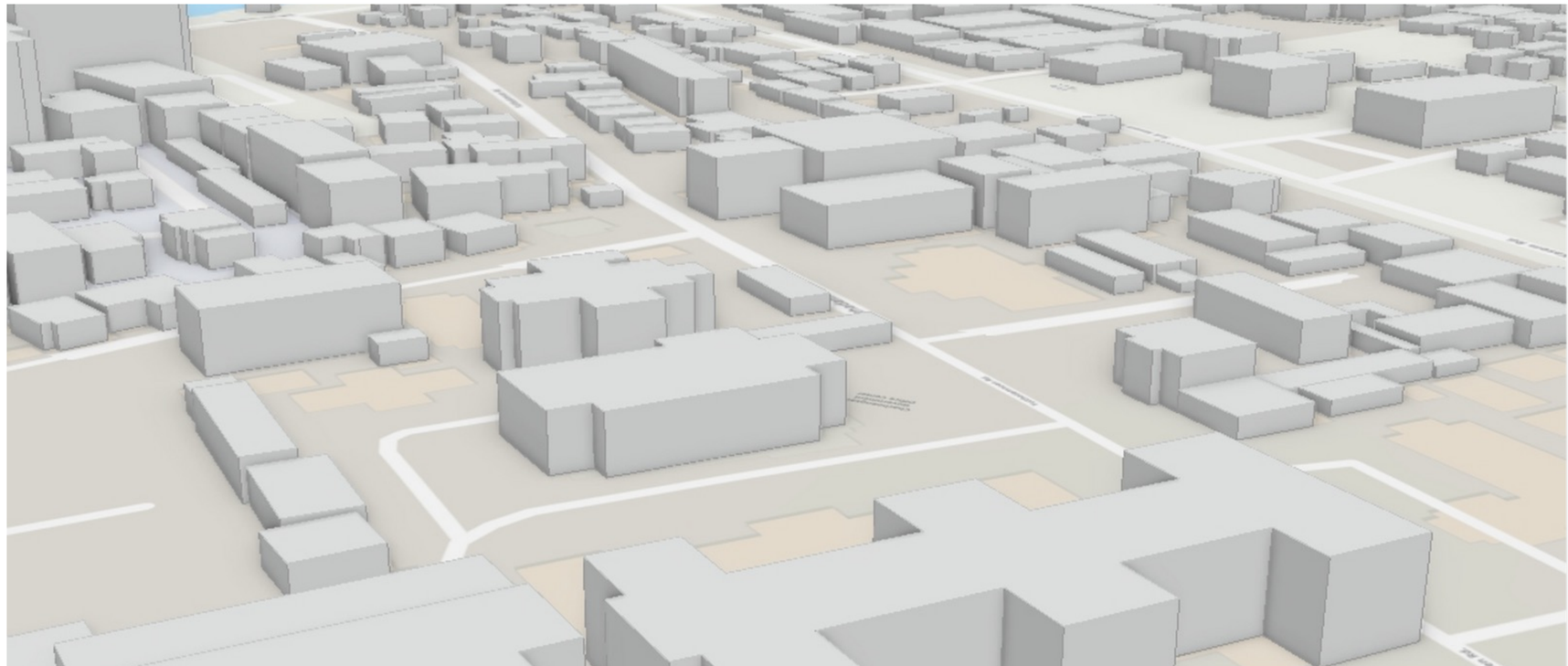


Landuse 1990 - 2022

- POI 1.1M
- Building Footprint 33M
- Building 3D 2M

3D MAP





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Applications & Solutions Development

GI for ALL: Policy Makers, Operators at National & Local Levels and Thai People

FarmSpace – Roadmap

Target Users

Smart Farmers

สมาคมประกันวินาศภัยไทย
Thai General Insurance Association

Banks

Timeline

Release 1
30 Sep 2023

Release 2
30 Sep 2024

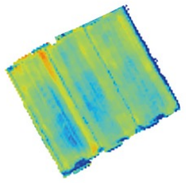
Release 3
30 Sep 2025

2023 | 2024 | 2025 | 2026

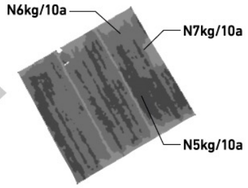
Deliverables

Product/Service
Crop growth status
Weather forecast
Fertilizer recommendation

Crop Growth Map



Fertilization Map



Product/Service
Yield estimation
Crop insurance
Carbon credit

Product/Service
Credit score
Crop calendar

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Near-Real Time Monitoring on the Major Environmental Issues in Thailand

Sea Level Rise
Environmental Disasters
Pollution
Oil Spills
Ocean Acidification
Extinction of Animals
Climate Change
Deforestation
Loss of Biodiversity
Ozone Layer Depletion
Waste
Habitat Loss
Desertification
Land Degradation
Natural Resource Depletion
Energy Crisis

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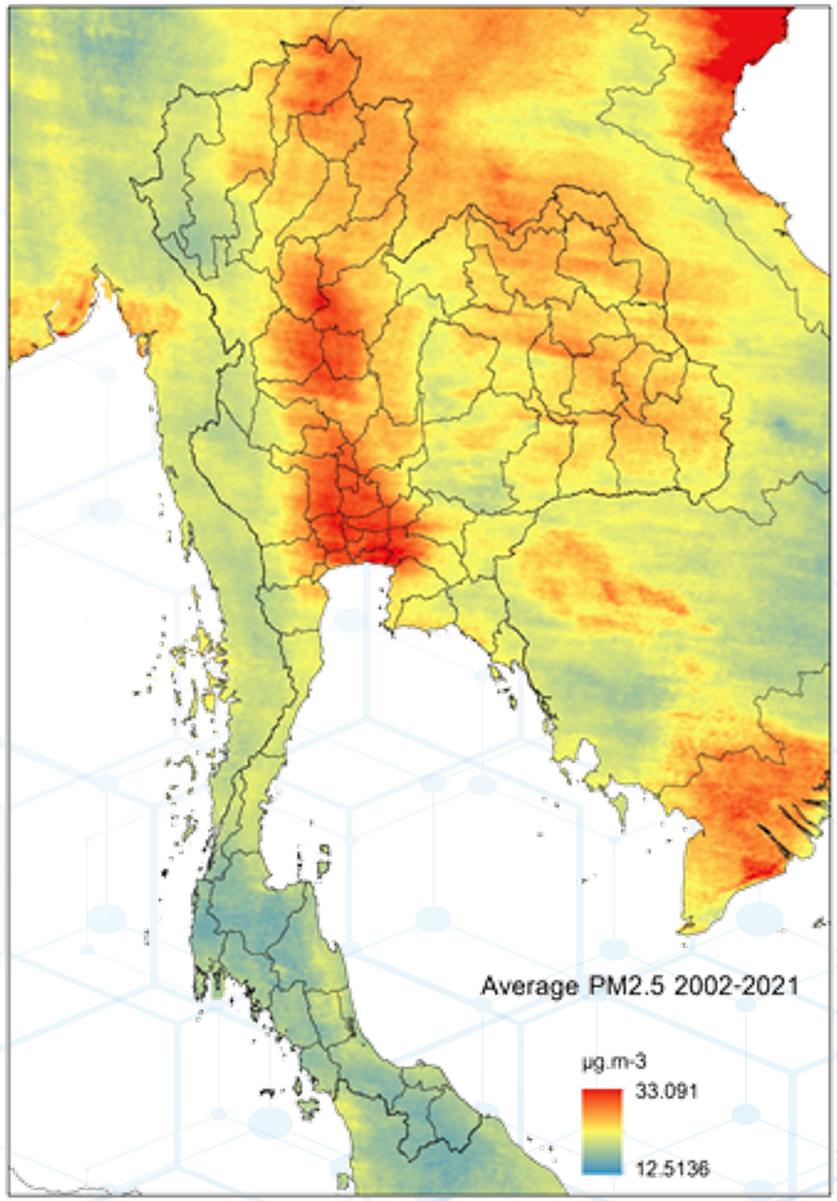
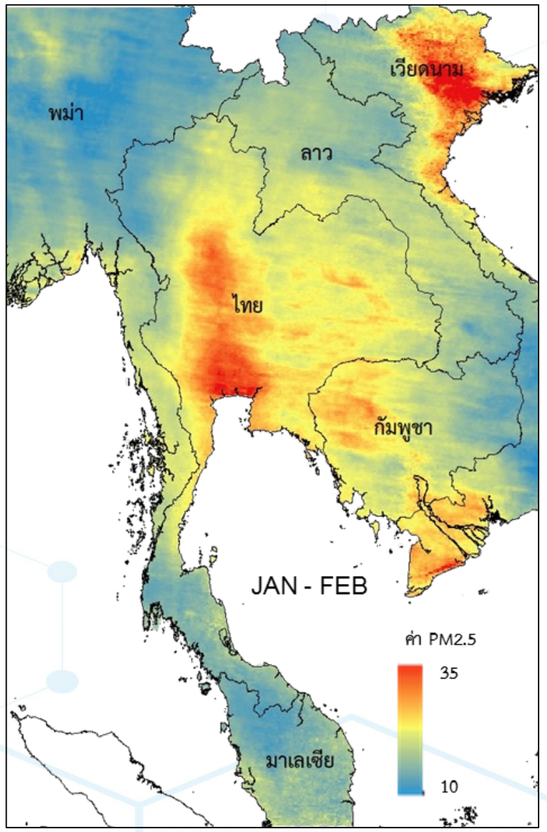
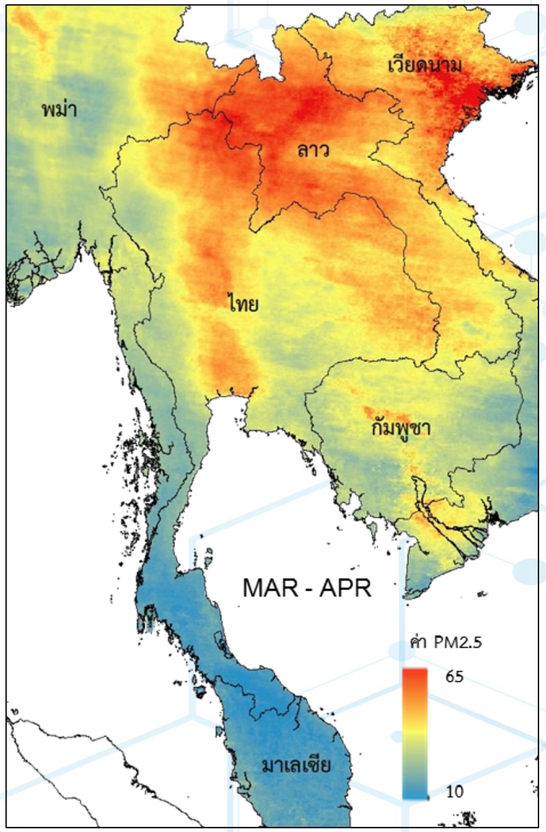
The 20 years average spatial distributions of PM2.5 conditions across the entire countries obtained from the remote sensing data between 2002 and 2021

The areas with high concentration located at the central plain (19.91 µg.m-3) and lower northern (19.11 µg.m-3) region of Thailand. The other regions showed a lower level of PM2.5 concentrations, northeastern (18.92 µg.m-3), eastern (18.76 µg.m-3) and southern (16.16 µg.m-3) region, respectively





Jan – Feb
2002 - 2021



Mar - Apr
2002 - 2021

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Aerosols, Air Pollution

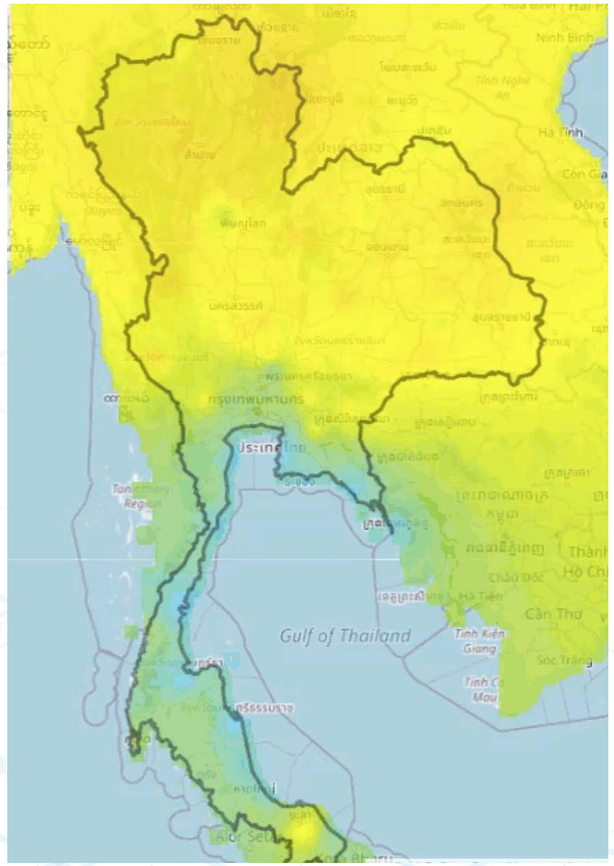
Satellite-Based Estimation of PM2.5 Concentrations

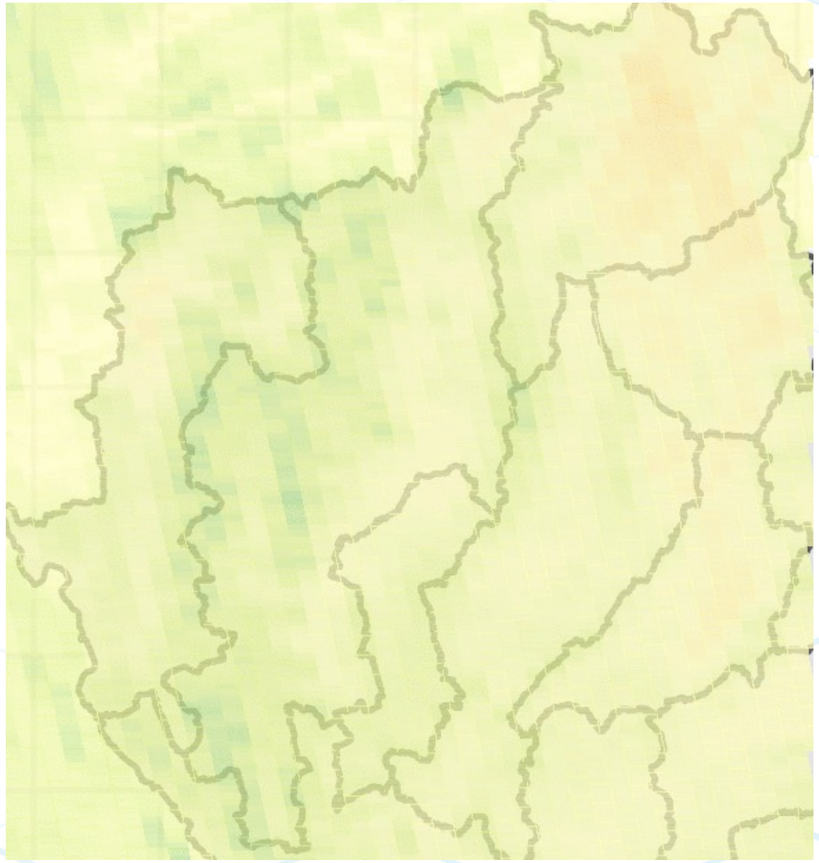
Multi-sensor Integration for Monitoring & Forecasting

- Sensor/PM2.5
- Sensor/PM2.5
- Satellite/PM2.5
- Wind & Humidity

PM2.5 Thailand (Hourly)

Public service





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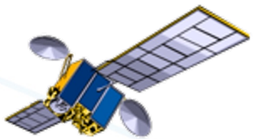
Aerosols, Air Pollution



Satellite Observations

Research Aircraft

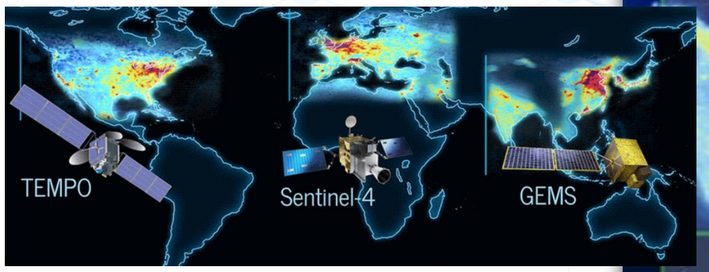
Improved Air Quality Understanding

Pandora, AERONET, …

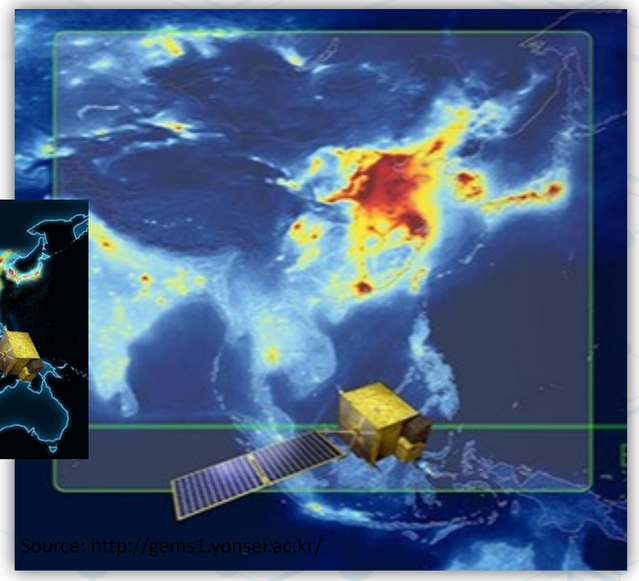
Research
- Satellite validation and detailed mapping,
- Emission evaluation and model,…

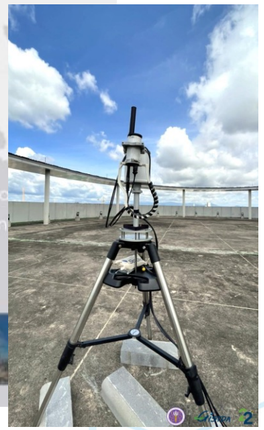
Supporting the ASIA-AQ campaign

Geostationary Environment Monitoring Spectrometer (GEMS)

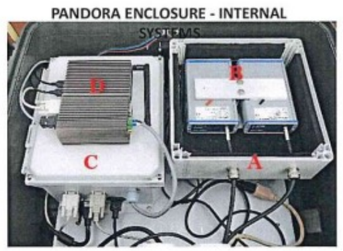


https://www.spiedigitallibrary.org/





PANDORA instrument

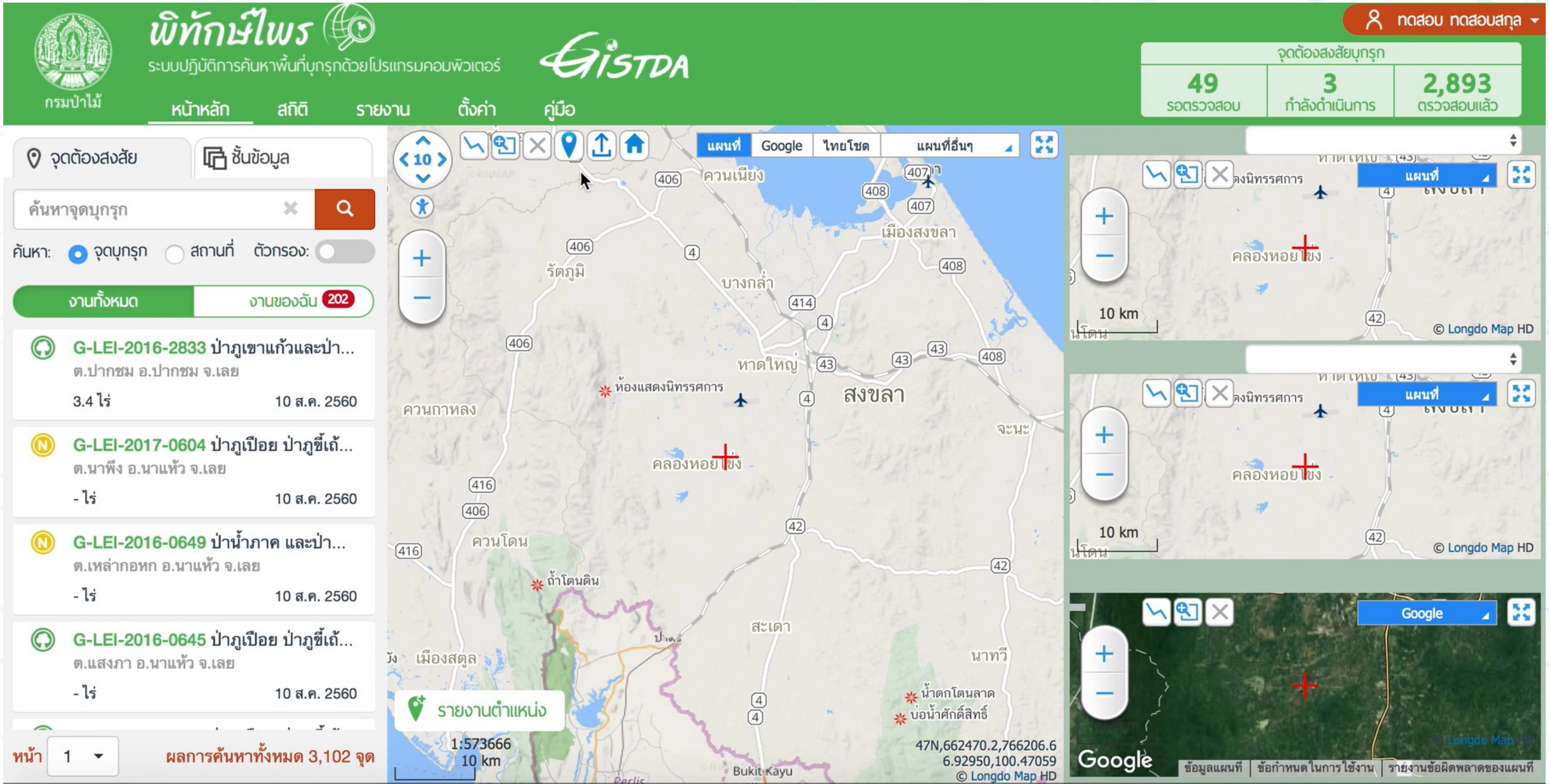


A - Spectrometer box (maintains spectrometer temperature)
B - Spectrometer(s) (measure spectra)
C - Electronics box (power and electronics)
D - Control computer (runs control software)

สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน)
Geo-Informatics and Space Technology Development Agency (Public Organization)

Natural Resource Monitoring

Forest and green area monitoring using satellite and social media information

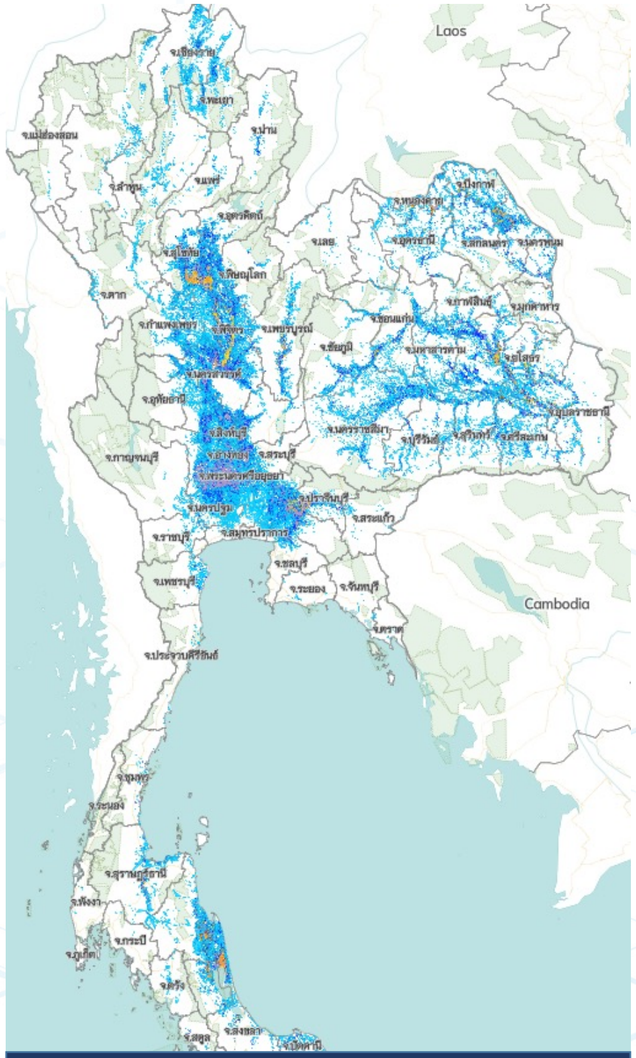


สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน)

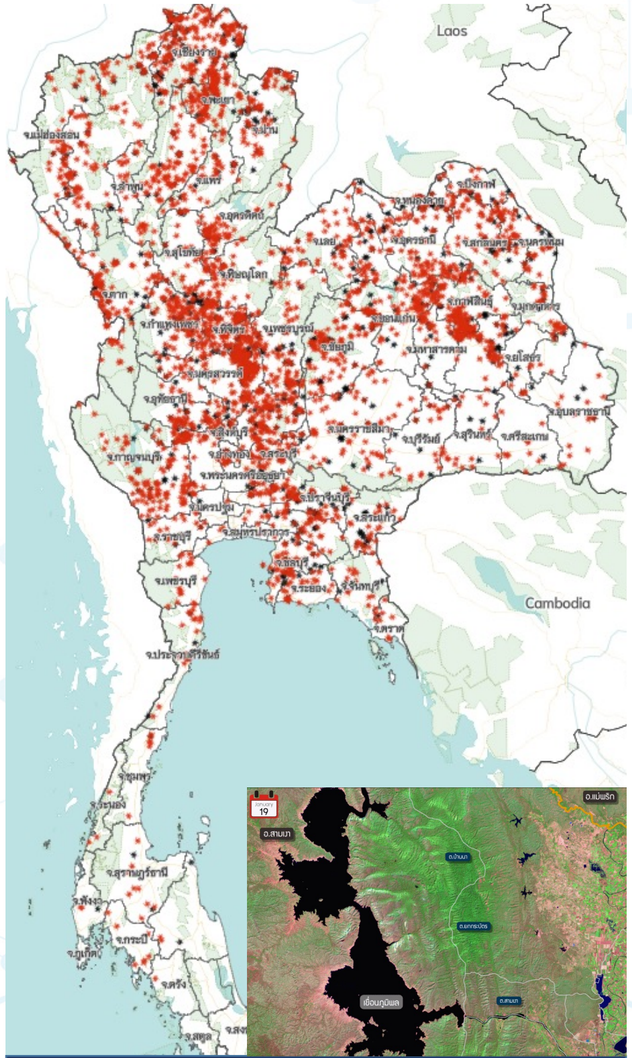
Geo-Informatics and Space Technology Development Agency (Public Organization)

Disaster Monitoring

Decision Support System for Disaster Management



Repeated Flood



Active Fire

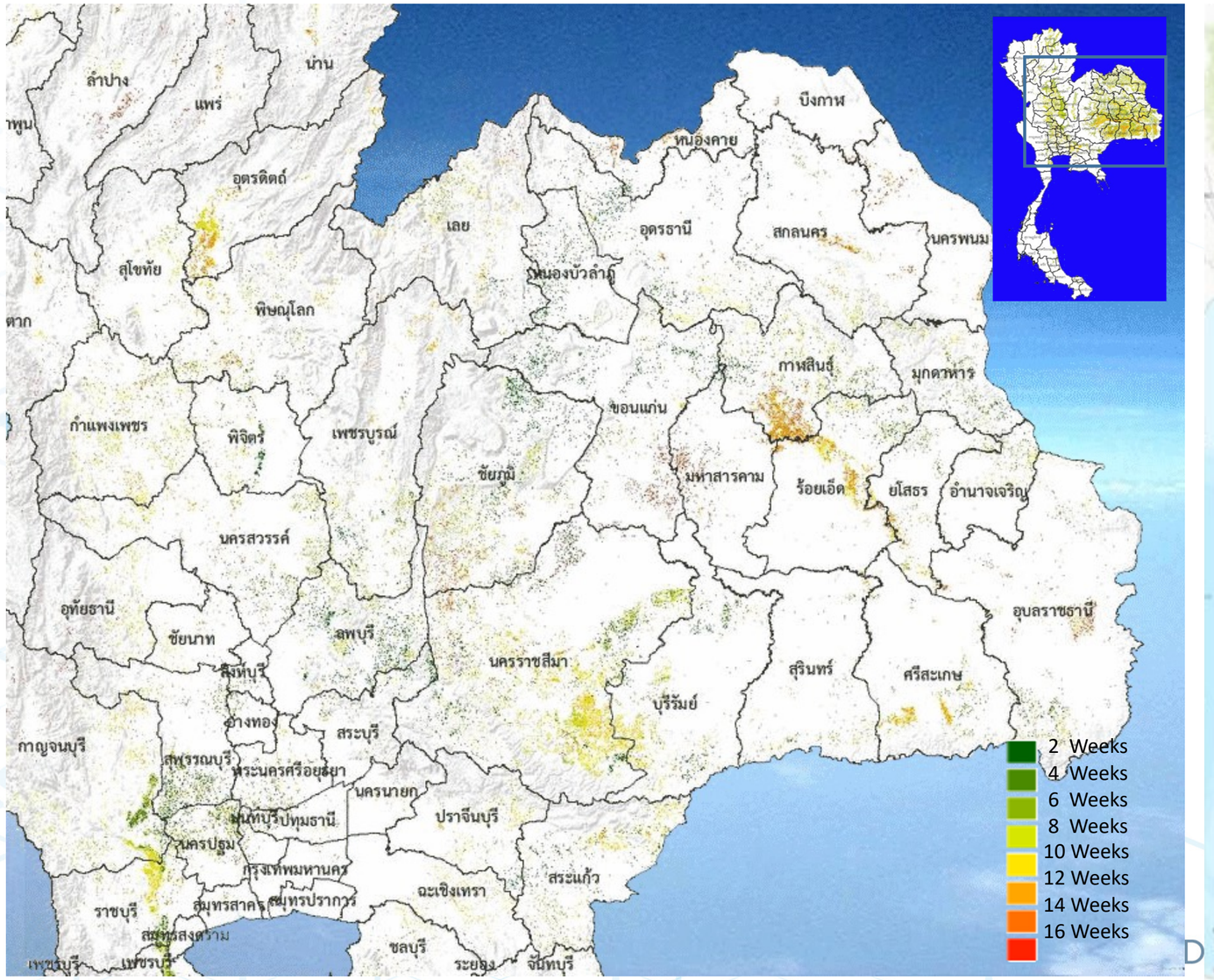
R.TH

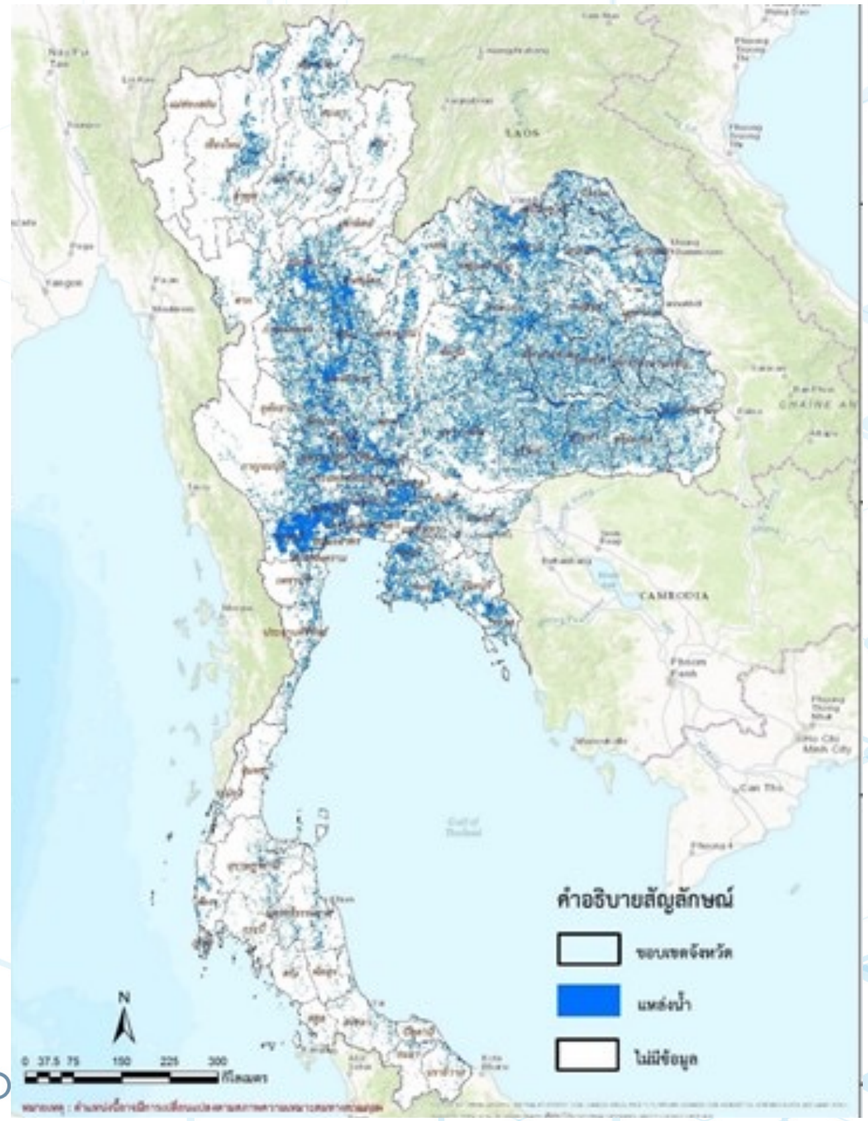
Drought Risk

สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน)
Geo-Informatics and Space Technology Development Agency (Public Organization)

Near Realtime Application

Economic Crops & Water Resource Monitoring





Carbon Atlas – Roadmap

Target Users

Mae Fah Luang Foundation under Royal Patronage

EGAT

Farmers

Investors

Timeline

Release 1
30 Sep 2023

Release 2
30 Sep 2024

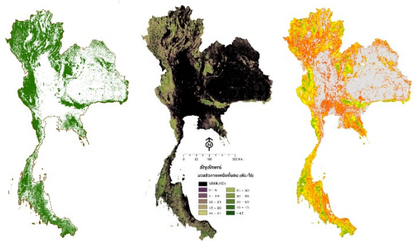
Release 3
30 Sep 2025

2023 | 2024 | 2025 | 2026

Deliverables

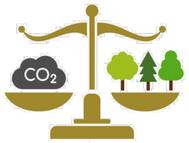
Product/Service

Above Ground Biomass (AGB)
CH4 Map
Net Carbon Map (Capture & Emission)



Product/Service

Carbon Trade Exchange Platform



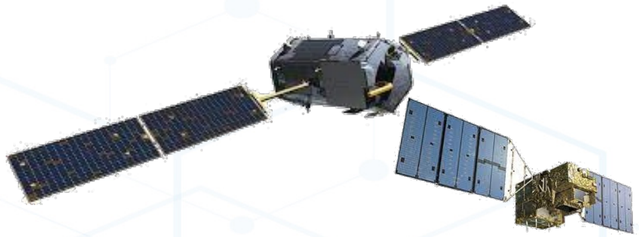
Product/Service

TBD

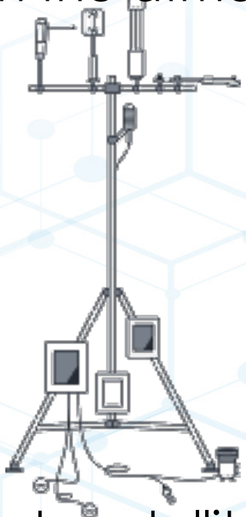
สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน)
Geo-Informatics and Space Technology Development Agency (Public Organization)

GHG Emissions & Removals

Atmospheric GHG Monitoring



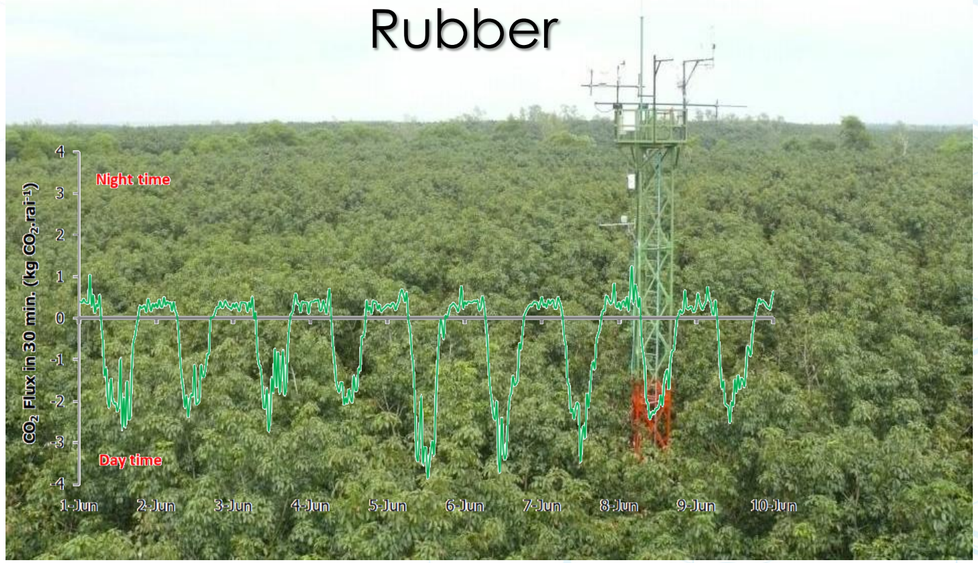
Applying earth observation satellites to monitor CO2 and CH4 in the atmosphere



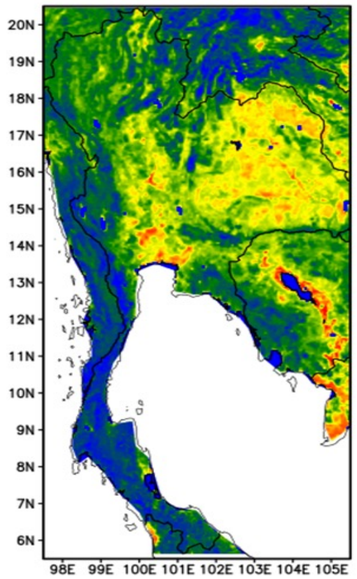
Integrate satellite data and Eddy Covariance method

GHG Flux

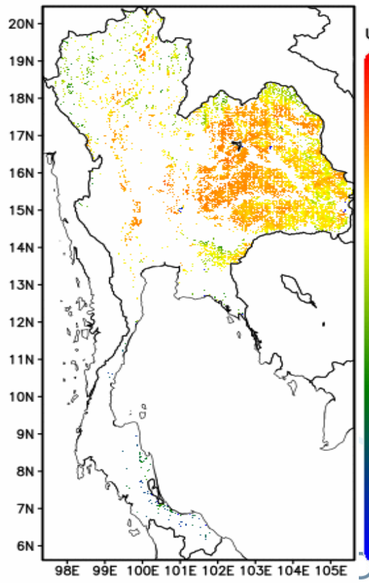
Rubber

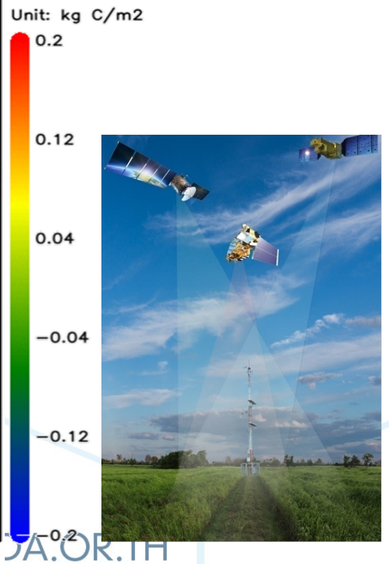


Rubber



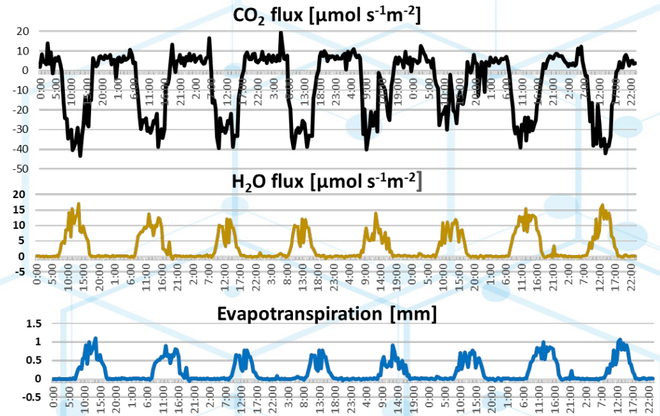
Rice



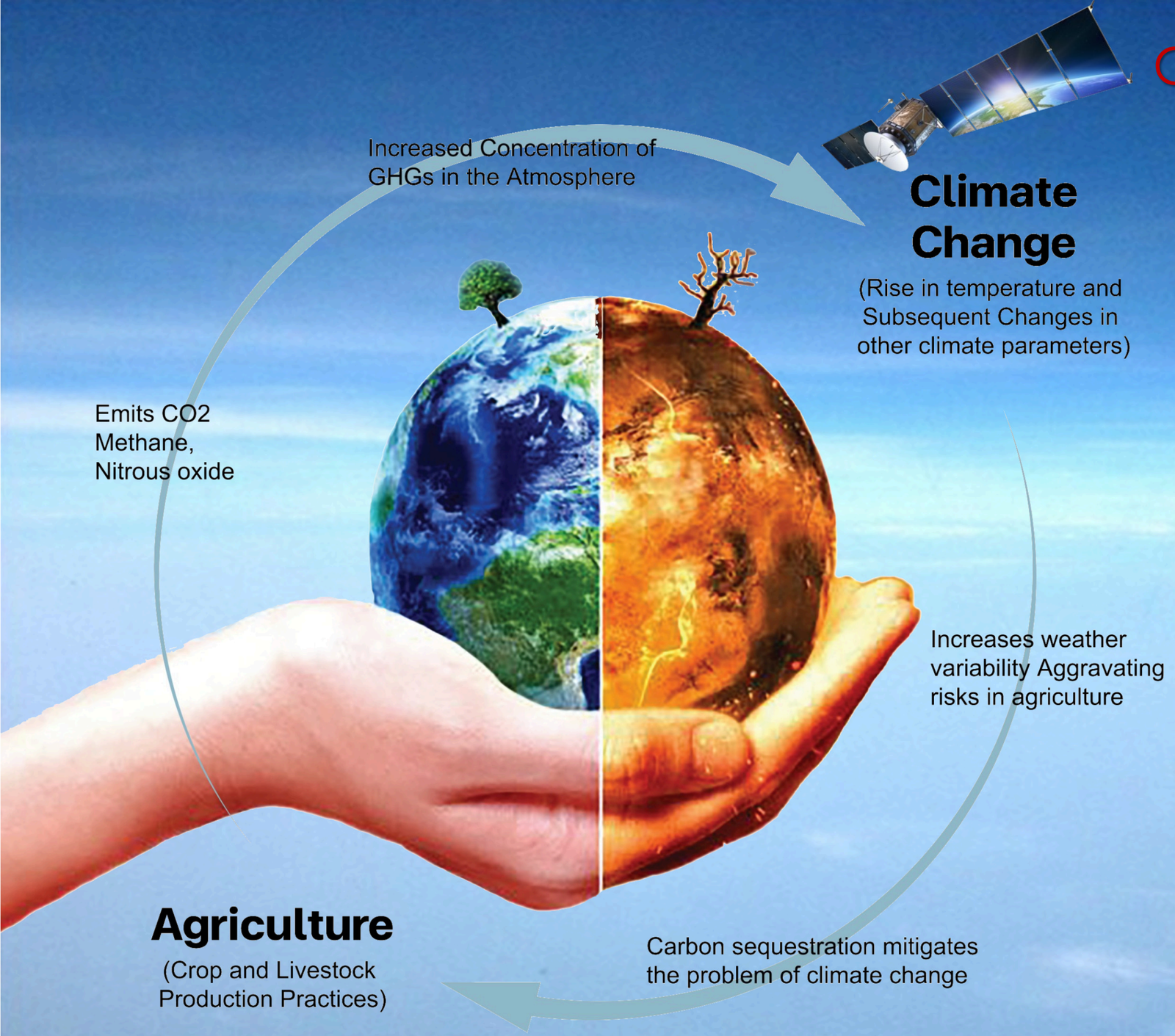


Net Ecosystem Exchange

Rice



Climate-Resilient Agriculture



- Provide tools for decision-makers to visualize policy-impact and assess optimal policy. To design adaptive actions for climate resilient agriculture,
- Explore possible impact of climate-induced events including flood, drought, and slow onset together with different responses from changing crop zoning and calendar.

Capacity Building

KNOWLEDGE ECOSYSTEM

Lifelong Learning

Raise Awareness

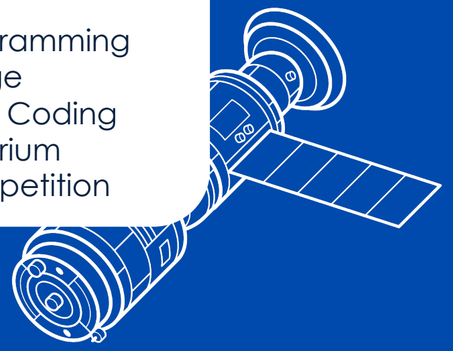
CubeSat
GISTDA Space Camp
APRSAF
Kibo Robot Programming Challenge
STEAM Drone & Coding
Space Inspirium
Contest / Competition

Non-Degree

10 Module Course
Basic Course Training
Advance Course Training

Degree Program

Exchange Program Internship
SCGI Master Program
Master / Ph.D. Program
Research



Executive, Advance, Customized Training Course

Curriculum Year 2023-2027

- Urban Planning Applications and Solutions
- Natural Resources and Environmental Management Solutions
- Agricultural Solutions
- Hazards/Disaster Solutions
- Social Sustainability and Resilience (Wellness) Solutions
- Integrated Water Management and Solutions
- BigData & Intelligent Decision Making
- Application Solutions for Public Health
- Application of GIS for Defense
- Architecture, Engineering and Construction
- Satellite Development

Partners & Networks

Benefits From Space Activities

New Space Economy

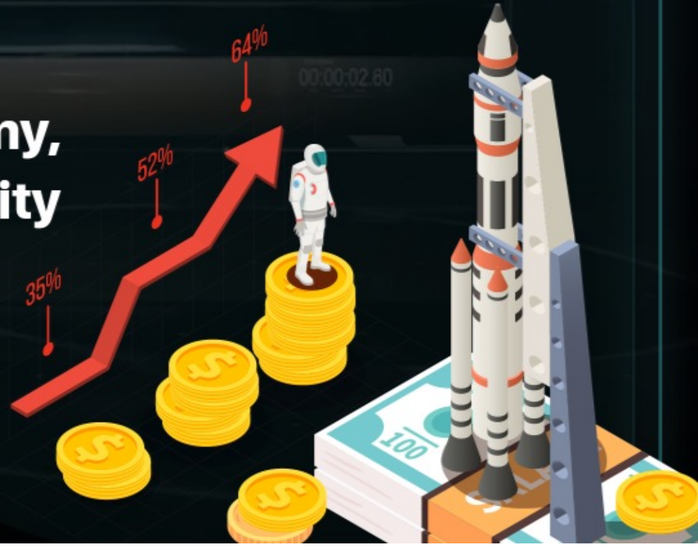
High potential to create new industry in Thailand and region.

Great Investments

Exploration

More Incomes & Employments

Cosmic benefits on Economy, Society, and Security



Elevating
Thai space industry.

THANK YOU