Shaping Thailand’s Space Future through the Digital Transformation



POLICY, PEOPLE, AND PARTNERSHIPS FOR SUSTAINABLE GROWTH

Harnessing Digital Innovations for Space: Experiences and Insight
Session: National Space Policy and Capacity Building - Opportunities and Challenges

Dr. Tanita Suepa
Director of Strategic Alliance Office
Geo-Informatics and Space Technology Development Agency (Public Organization)



Thailand's Space Vision

Leveraging Digital Innovations for the Future

Thailand's **space vision** aims to harness digital innovations, fostering growth in various sectors.
By integrating satellite technology and digital networks, the country is positioned to enhance its capabilities, ensuring sustainable development and improved quality of life for its citizens.

The policy aims to enhance **national capabilities** in space technology and promote sustainable development through digital innovations.

Thailand’s Space Policy Landscape

Thailand's Cabinet Directive

National Space Policy Committee

Royal Decree (B.E. 2552)

Prime Minister

Deputy Prime Minister

Ministers

Experts

Permanent Secretary of Ministry of Digital Economy and Society

Committee Member and Secretary

Assistant Secretary

National Geo-Informatics Board

Royal Decree (B.E. 2546)

Prime Minister Or Deputy Prime Minister

Ministers

Permanent Secretaries

Experts

Permanent Secretary of Ministry of Higher Education, Science, Research and Innovation

Board Member and Secretary

Board Member & Assistant Secretary

Domestic Law

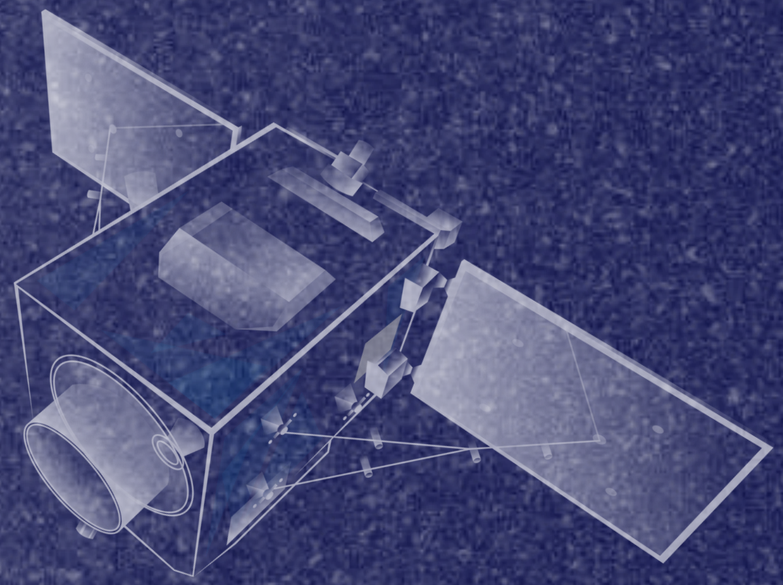
National Space Law

National Master Plan and Strategy

National Space Master Plan

Master Plan of the National Geo-informatics System

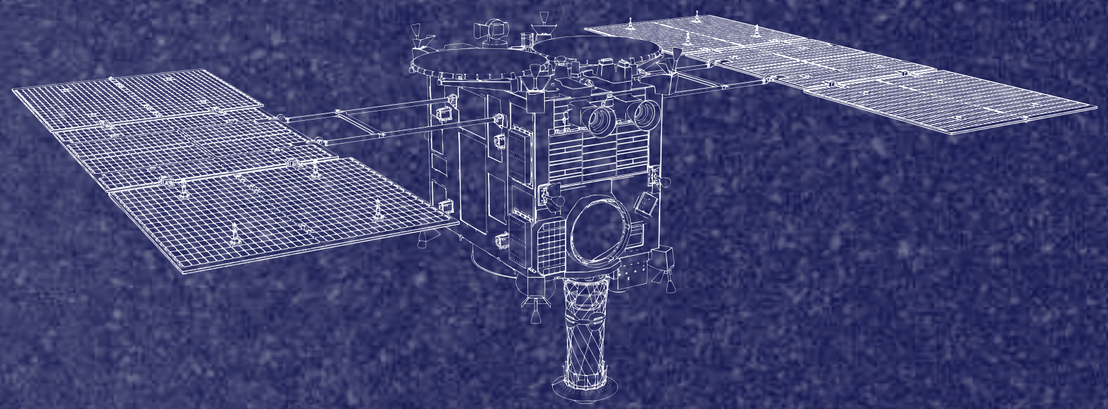
(Draft) Thailand Space Act



Principles and Justification

- **Economic Growth and Global Competitiveness**
- **International Treaty Compliance**
- **Protection of National Interests**
- **Domestic Space Governance**

(Draft) National Space Master Plan 2023-2037



Key Strategies

Strategy 1: Development of space technology and promotion of the utilization of space for sustainable development

Strategy 2: Development of the Space Economy

Strategy 3: Management of space infrastructure to promote the space industry

Strategy 4: Development of high-quality and specialized personnel in space technology

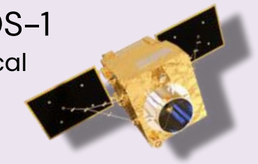
Thailand's Earth Observation Satellites Development Program

GISTDA

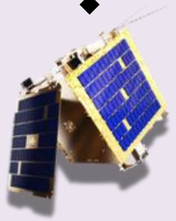
2008 2023 2025 2028 (6 YEARS)



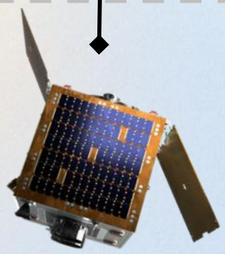
THEOS-1
Optical



THEOS-2
Optical
Very High Resolution



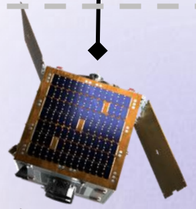
THEOS-2A
Optical
Very High Resolution
Video



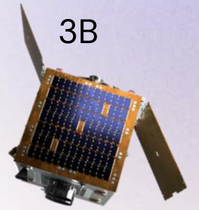
THEOS-3A
Optical
Medium Resolution
VNIR, SWIR

THEOS-3
- **Payload: VNIR and SWIR**
- **Resolution: ≤ 10 meters**
- **Swath Width: > 20 kilometers**
- **Revisit Time: 3–5 days**

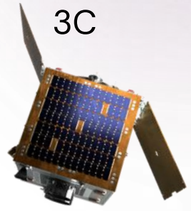
VNIR & SWIR



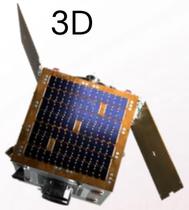
3B



3C



3D



3E

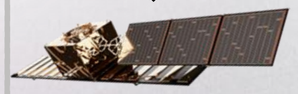


THEOS-4A

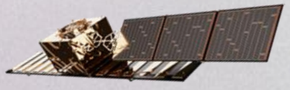


4B
Optical
Medium Resolution
(MWIR)

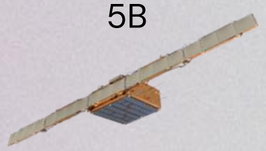
THEOS-4
- **Payload: MWIR (Mid-Wave Infrared)**
- **Resolution: ≤ 4 meters**
- **Swath Width: > 4 kilometers**
- **Orbit: 500–600 km altitude; Sun-Synchronous Orbit (SSO)**



THEOS-5A
C - Band



5B



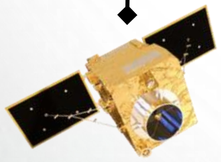
THEOS-5C
X - Band



5D



THEOS-5E
L- Band



THEOS-6
Very High Resolution

THEOS-6
- **Payload: Panchromatic and VNIR**
- **Resolution: ≤ 0.5 meters**
- **Swath Width: > 10 kilometers**
- **Revisit Time: Average of 5 days**
- **Orbit: 550–650 km altitude; Sun-Synchronous Orbit (SSO)**

Synthetic Aperture Radar (SAR)

THEOS-5A / 5B / 5C / 5D
- **Payload: Synthetic Aperture Radar (SAR)**
  - **C-Band SAR and X-Band SAR**
- **Resolution: Approximately 0.5–10 meters**
- **Swath Width: > 100 kilometers**
- **Revisit Time: Average of 1 day**
- **Orbit: 600–700 km altitude; Near Equatorial Orbit**

THEOS-5E
- **Payload: Synthetic Aperture Radar (SAR)**
  - **L-Band SAR**
- **Resolution: Approximately 7–100 meters**
- **Swath Width: 40–350 kilometers (depending on operation mode)**
- **Revisit Time: Average of 2–4 days**
- **Orbit: 600–700 km altitude; Near Equatorial Orbit**

Reference: C - Band from Dragonfly-C - Dragonfly Aerospace, X-band from ICEYE X1

National Space Policy Overview

Thailand leverages digital innovations like AI and IoT
to enhance sustainable development through GISTDA's strategic mandate.

Policy Framework

Establishing guidelines for space development and utilization

The framework outlines **strategic priorities** for national space initiatives.

GISTDA's Role

Leading Thailand's space technology and innovation efforts

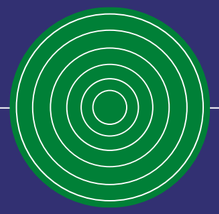
GISTDA plays a crucial role in drafting and implementing national space policies.

Digital Economy Integration

Bridging space technology with digital transformation objectives

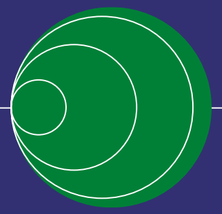
Integration fosters innovation and supports **economic growth** in Thailand.

Thailand's Space Policy



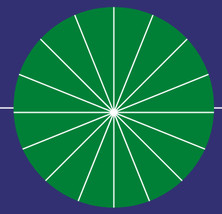
Launch

The **initial framework** for space policy was established.



Development

Focus on **capacity building** and digital innovations began.



Implementation

Full-scale adoption of space applications was achieved.

GISTDA's Role in Space Development

01 Satellite Data Utilization: Enhancing Decision-Making

GISTDA provides crucial data for geospatial solution.

02 Digital Platform Development: Increasing Accessibility

Innovative platforms democratize access to space data.

03 International Collaboration: Building Global Partnerships

GISTDA fosters strong ties with international entities.

GISTDA's Contributions



Satellite Operations

GISTDA manages **satellite operations** for national needs.



Earth Observation Application

Utilizing satellites to gather **critical solutions**.



Data Dissemination

Ensuring **accessible data** for research and development and decision making.

Harnessing Digital Innovations



Agriculture/ Dragonfly

Revolutionizing data analysis for agriculture

GeoAI enhances decision-making through **real-time insights** for crop management.

Digital Twin

Creating virtual models of real-world systems

Digital Twins simulate environments, enabling **efficient urban planning** and resource management.

Sphere & Open Platform

Collaborative tools for data sharing

Sphere facilitates **integrated solutions**, promoting innovation in space technology applications.

Carbon/ Carbon Atlas

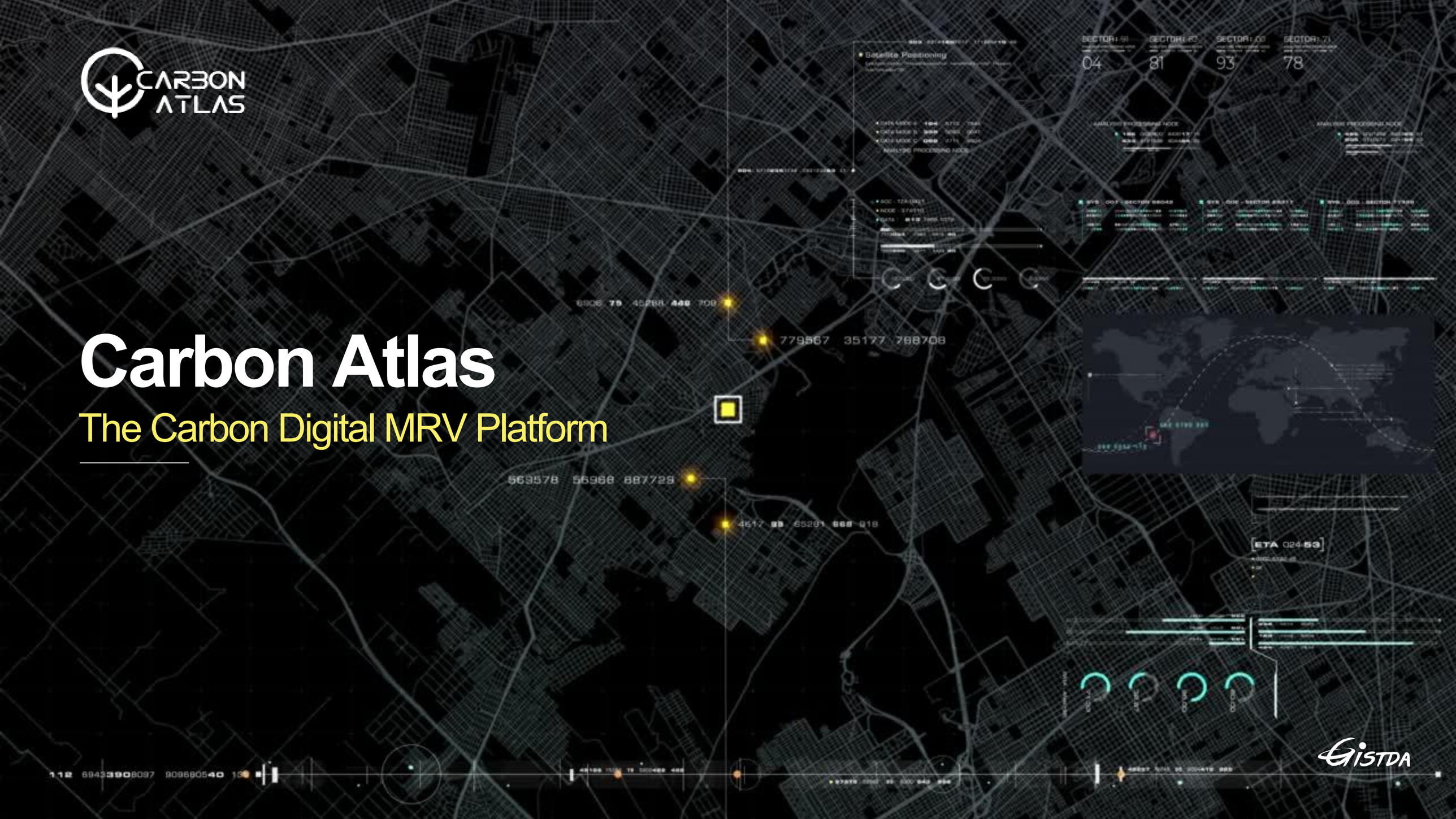
Empowering communities with carbon credit from space

The ‘Carbon Atlas' provides users with **current and updates** on carbon credit management.

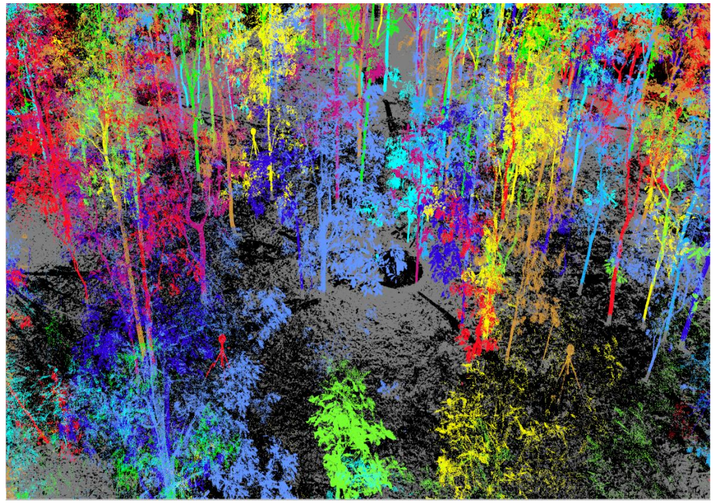
Future Innovations

Expanding the horizons of digital technology

Continuous advancements promise to drive **sustainable development** in the space sector.


CARBON ATLAS
Carbon Atlas
The Carbon Digital MRV Platform
GISTDA





Welcome to innovative remote sensing & AI-based carbon DMRV service.

With cutting-edge technology and expertise, we offer accurate and efficient solutions for unlocking your green and carbon economy.

Key Benefits:

- **Approved Methodology:** Officially approved by TGO under the T-VER framework.
- **High Accuracy:** Built using **> 1,000 field plots** collected with 3D terrestrial laser scanning, ensuring robust biomass and carbon modeling with validated accuracy.
- **Lower Costs:** Cut MRV expenses by up to 70% through satellite-based remote sensing and automation.
- **Scalability:** Suitable for any project size—from a few rai to millions of hectares—enabling both smallholder and National-level initiatives..

Applications:

- **Carbon Credit:** Generate field-scale carbon data aligned with TGO-approved methodologies for T-VER credits.
- **REDD+ and Forest Carbon:** Monitor and quantify forest carbon changes for conservation and restoration initiatives.
- **Insurance & Finance:** Provide insurers and financiers with trusted carbon data to underwrite or invest in green assets.
- **Government & Corporate:** Power national inventories and regional climate action plans with accurate, scalable carbon intelligence.



This document is not contractual. Subject to change without notice.
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Carbon Atlas

Key Features:

- **Digital MRV System:** Advance satellite analytics and AI – powered remote sensing for fully automated carbon stock estimation.
- **Field Scale Carbon Estimation:** Accurate at the plot level for forests, farms, and agroforestry lands.
- **T-VER Ready Reports:** Outputs meet criteria and are ready for submission to the T-VER registry.
- **Smart Dashboard:** Track carbon removal, sequestration, and project performance in real time.
- **Open APIs:** Access MRV services and data directly via secure RESTful API.

Key Areas:

Hill Evergreen Forest | *Mixed deciduous Forest* | *Dry dipterocarp Forest* | *Mangrove Forest* | *Para Rubber Plantation*

How It Works:

- **Define Land Parcel:** Upload field boundary or use interactive map to select area, then automatically check geolocation criteria.
- **Run Models:** Process data and generate carbon estimates with TGO-approved models.
- **Review MRV Report:** Output includes carbon stock, emissions/removals, and credit potential aligned with T-VER.
- **Download or Connect via API:** Get data in report format or integrate via APIs for automated workflows.

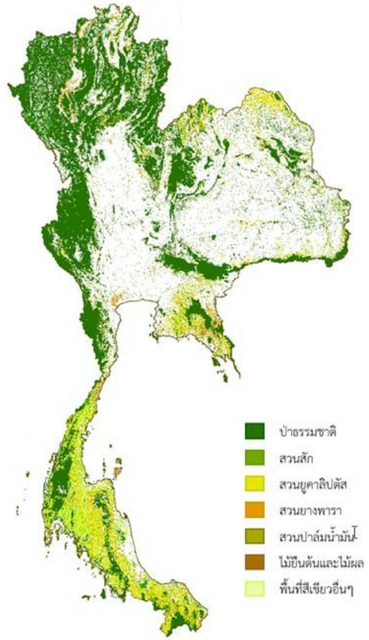
Contact Us:

For inquiries or to learn more about our tree carbon DMRV service, please contact us:

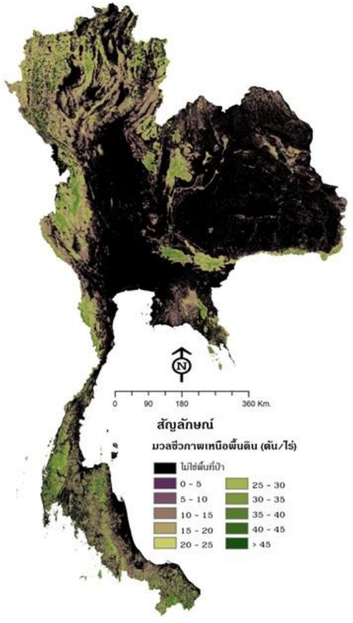
Phone: +66 2141 4444
Email: service@gistda.or.th
Website: www.gistda.or.th

GISTDA

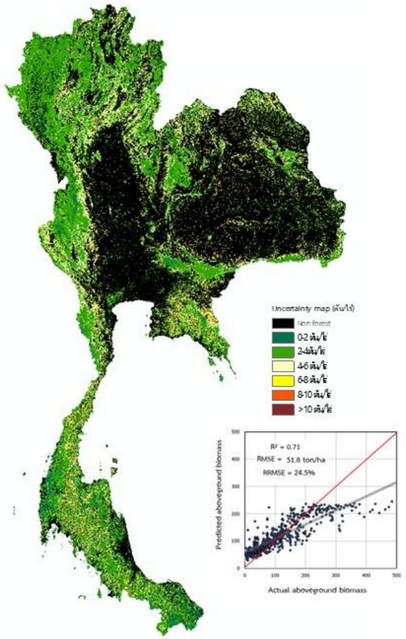
Carbon Atlas



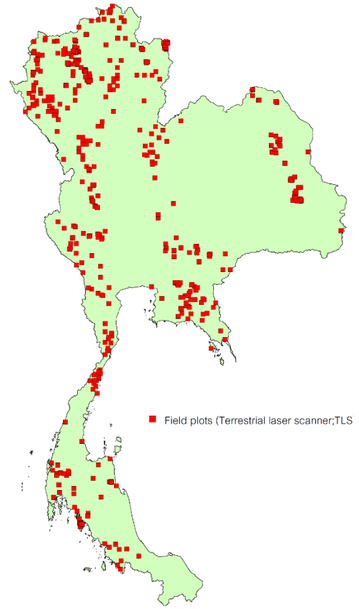
Green Area



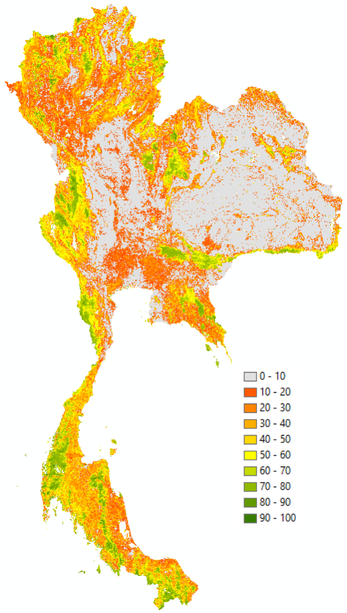
Above Ground Biomass



Uncertainty



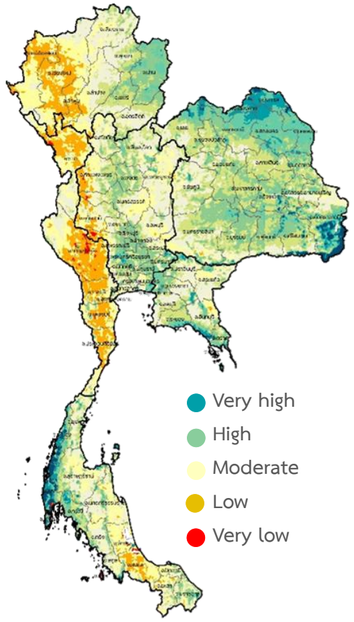
3D Scanning Plots



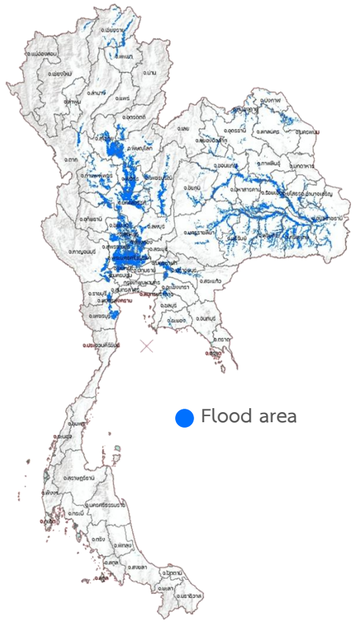
Forest Canopy Density



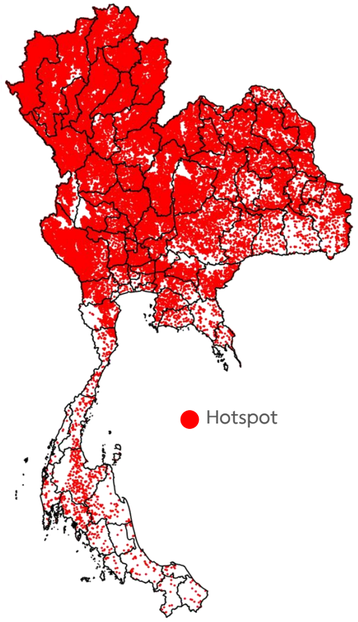
Satellite Basemap (0.5-2m)



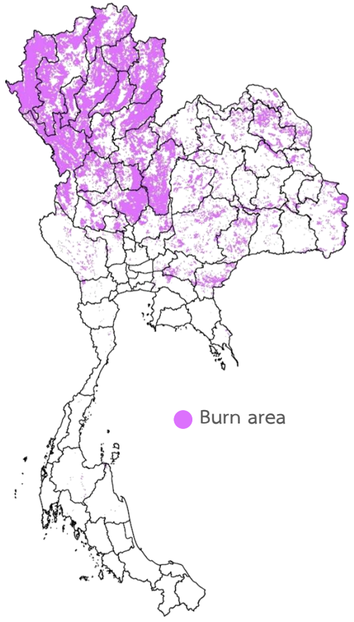
Soil moisture



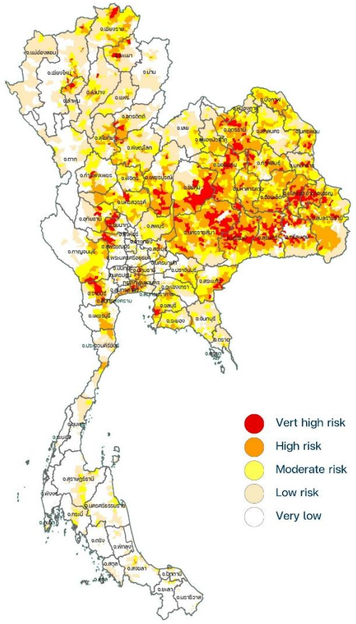
Floods



Hotspot

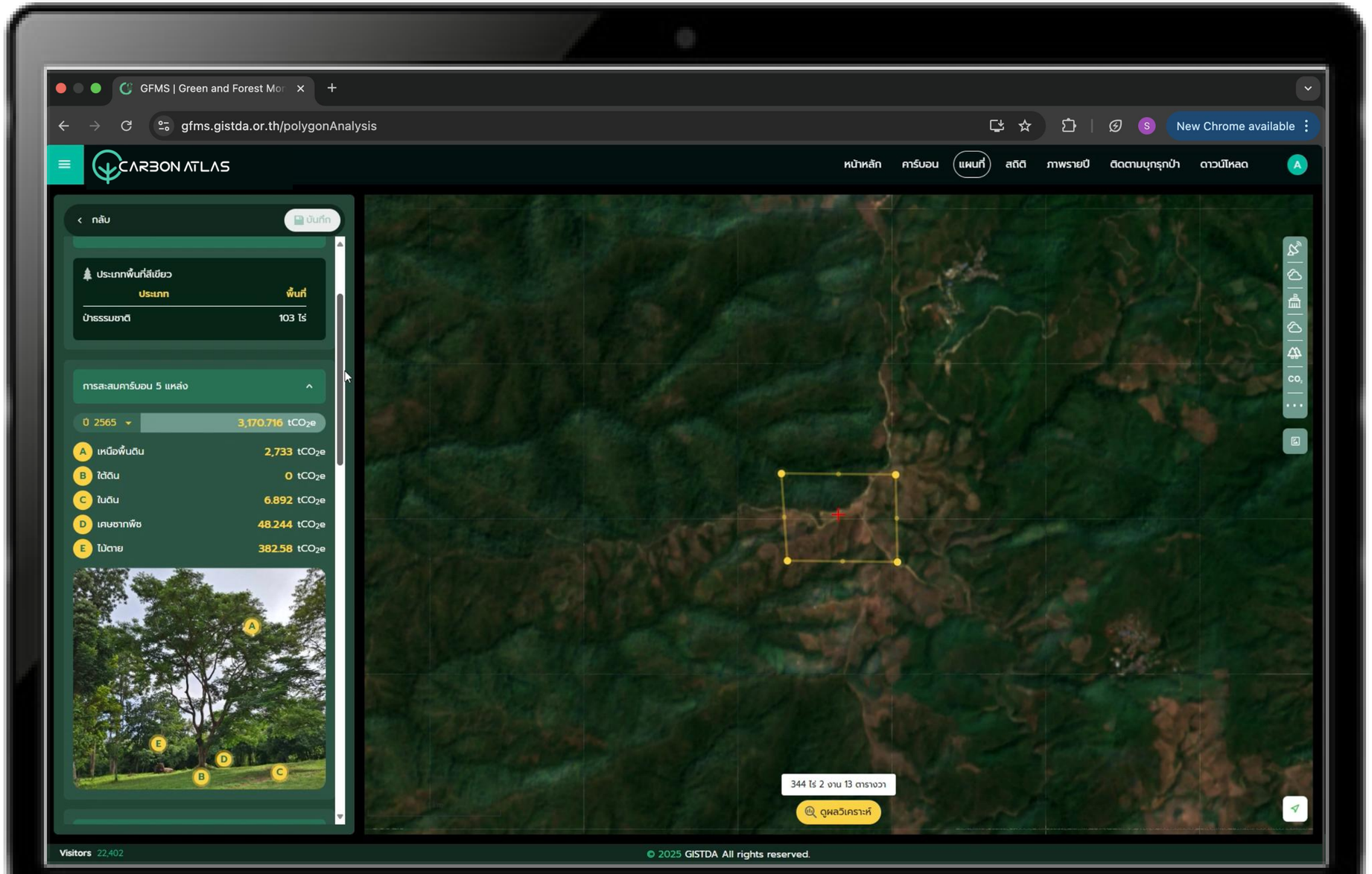


Burn area



Drought





CARBON ATLAS
National Carbon Maps

The satellite-powered platform for estimating carbon storage to support climate action and sustainable management.

Carbon dMRV service

Use advance satellite analytics and AI – powered remote sensing to automatically estimate carbon stock.

Carbon credit at field-scale

Calculate carbon credits at the plot level to support verification and participation in carbon markets.

MRV Open APIs

Access MRV services and data directly via secure RESTful API.

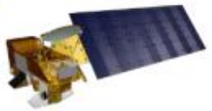
Contact Us:

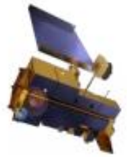
For inquiries or to learn more about platform, please contact us:

Phone: +66 2141 4444
Email: service@gistda.or.th
Website: www.gistda.or.th

Satellite-based observations for active fire hotspots

Terra-MODIS





Aqua-MODIS

- spatial resolution : 1,000 m.
- swath width : 2,330 km
- Revisit : 4 times a day
  - Early morning
  - Morning
  - Afternoon
  - Evening-night

Suomi NPP-VIIRS



- spatial resolution : 375 m.
- swath width : 3,060 km
- Revisit : 2 times a day
  - morning to afternoon
  - night to early morning

NOAA-20 - VIIRS



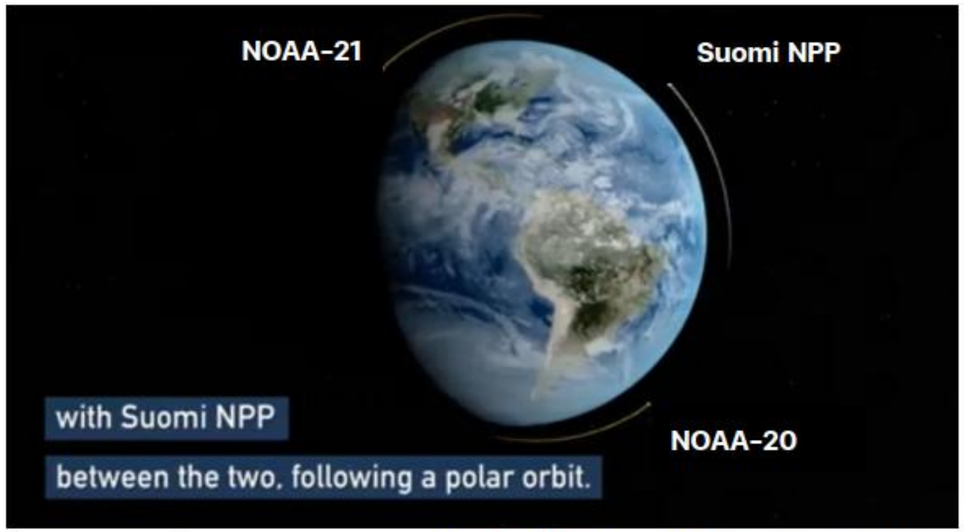
Revisit : 2 times a day

NOAA-21 - VIIRS

Launched in November 2022



Revisit : 2 times a day



Source: https://www.youtube.com/watch?v=Yvo837K89w4&list=PPSV

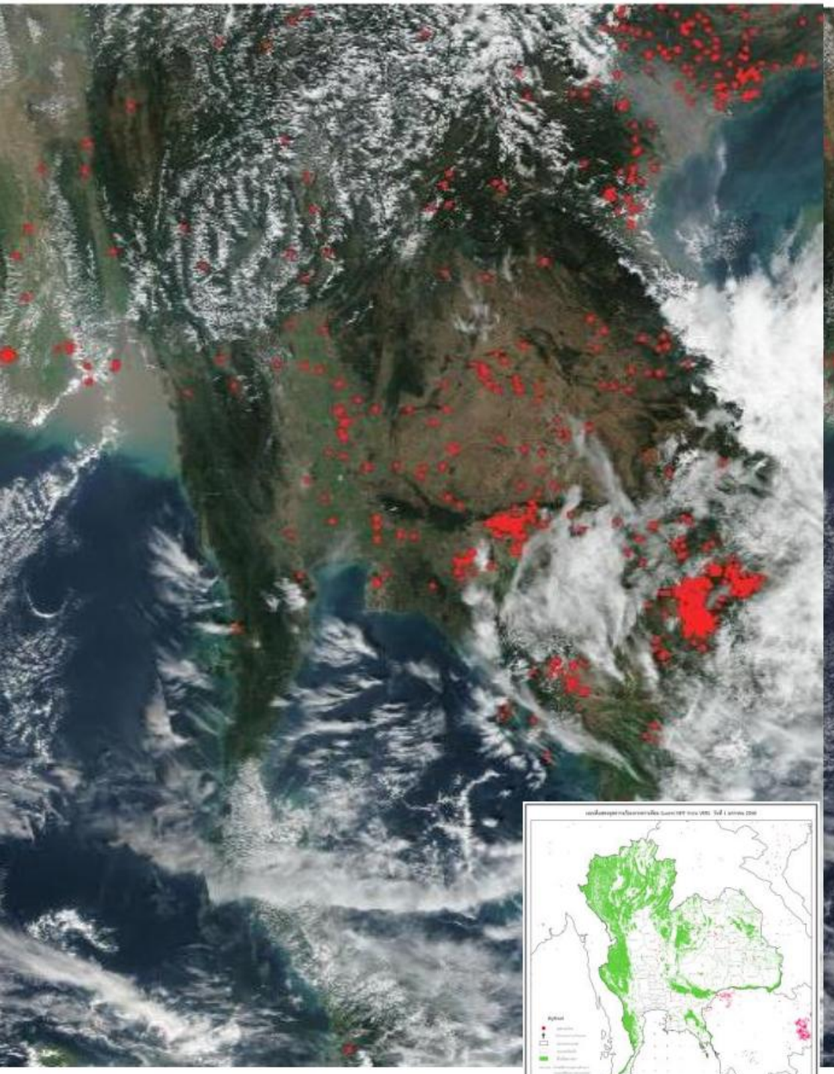
- Same VIIRS sensor as Suomi NPP
- 375 m spatial resolution
- Acquisition time at mid-night & afternoon (2 times a day)
- Same hotspot model with Suomi NPP

FIRMS
Fire Information for Resource Management System

Monitoring	Management
G_Vi1_Tim รับสัญญาณโดยสถานี GISTDA	**G_Vi1_Day** รับสัญญาณโดยสถานี GISTDA
N_Vi1_Tim ดาวเทียม Suomi NPP	**N_Vi1_Day** ดาวเทียม Suomi NPP
N_Vi2_Tim ดาวเทียม NOAA-20	**N_Vi2_Day** ดาวเทียม NOAA-20
N_Vi3_Tim ดาวเทียม NOAA-21	**N_Vi3_Day** ดาวเทียม NOAA-21
N_Mod_Tim ดาวเทียม Terra/Aqua ระบบ MODIS	**N_Mod_Day** ดาวเทียม Terra/Aqua ระบบ MODIS

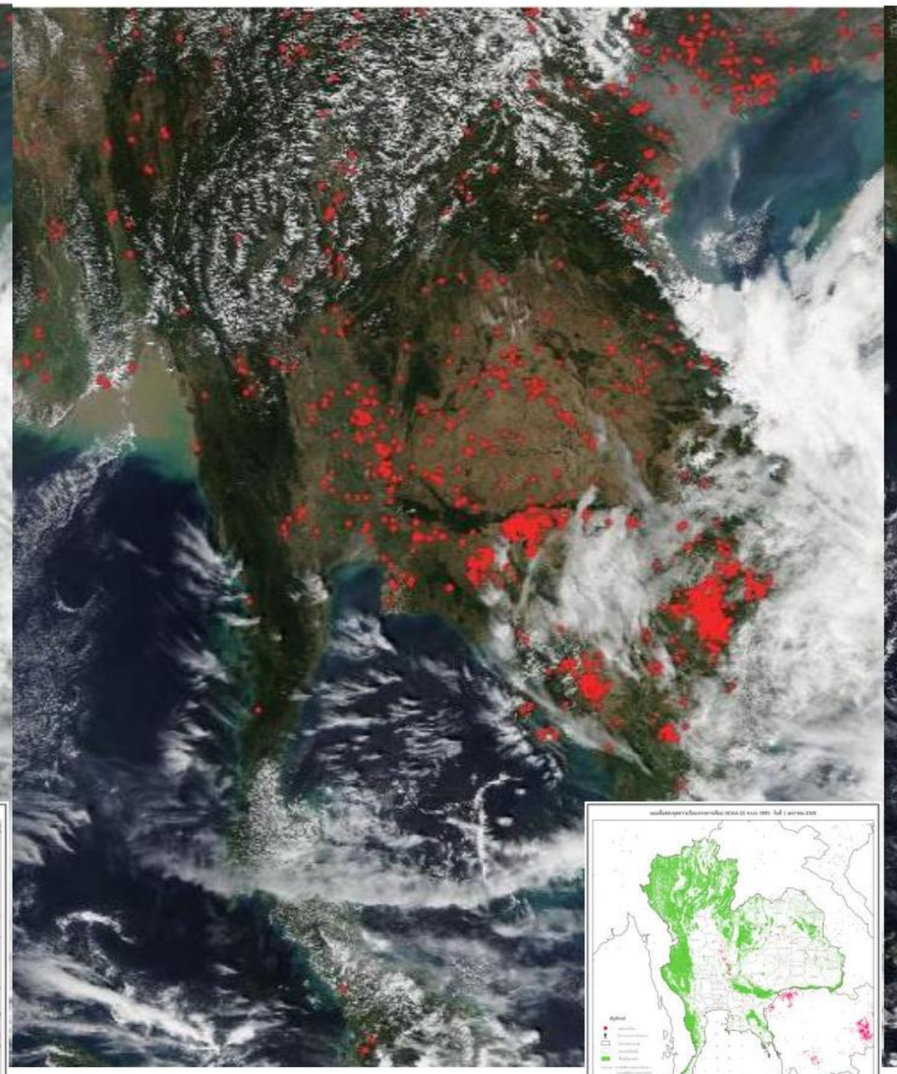
ภาพถ่ายดาวเทียมสีผสมจริงซ้อนทับกับจุดความร้อน (Hotspot) วันที่ 1 มกราคม 2568

Suomi NPP-**VIIRS**



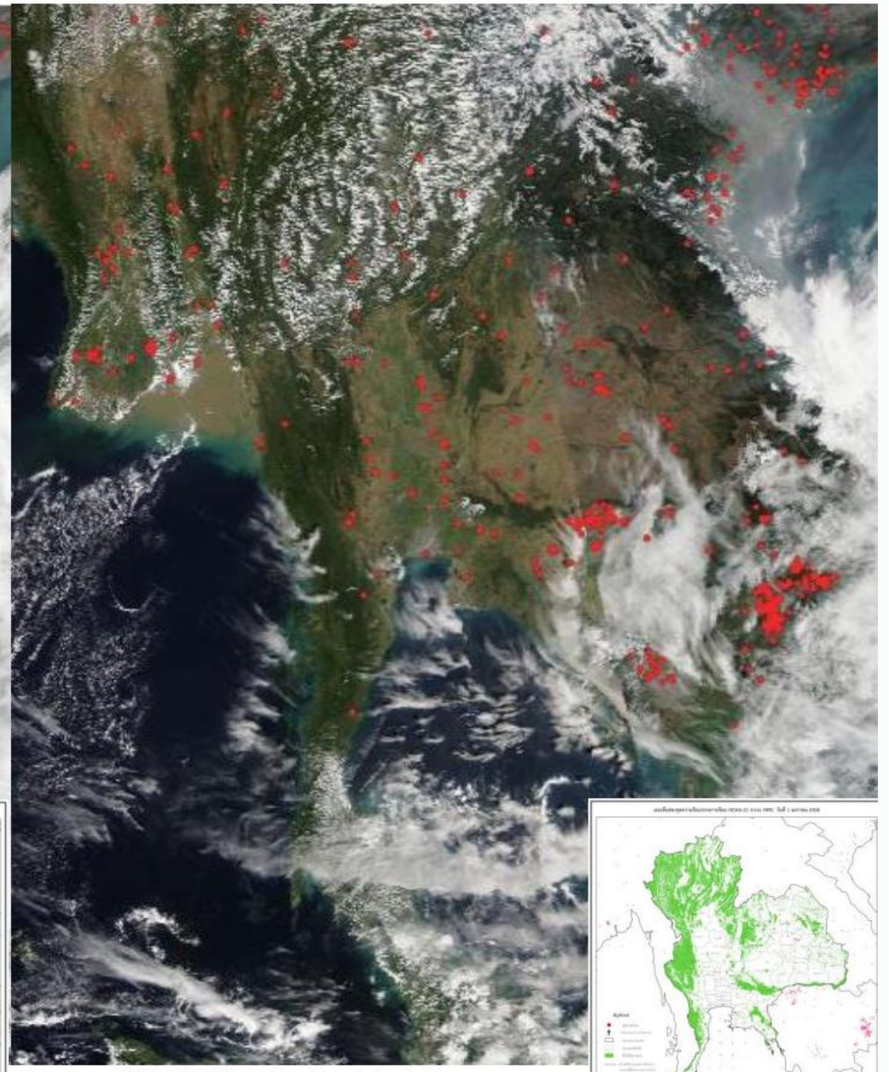
Base Layer: Suomi NPP VIIRS True Color Corrected Reflectance
Overlay Layer(s): VIIRS SNPP Thermal Anomalies 375m Day

NOAA20-**VIIRS**



Base Layer: NOAA-20 VIIRS True Color Corrected Reflectance
Overlay Layer(s): VIIRS NOAA20 Thermal Anomalies 375m Day

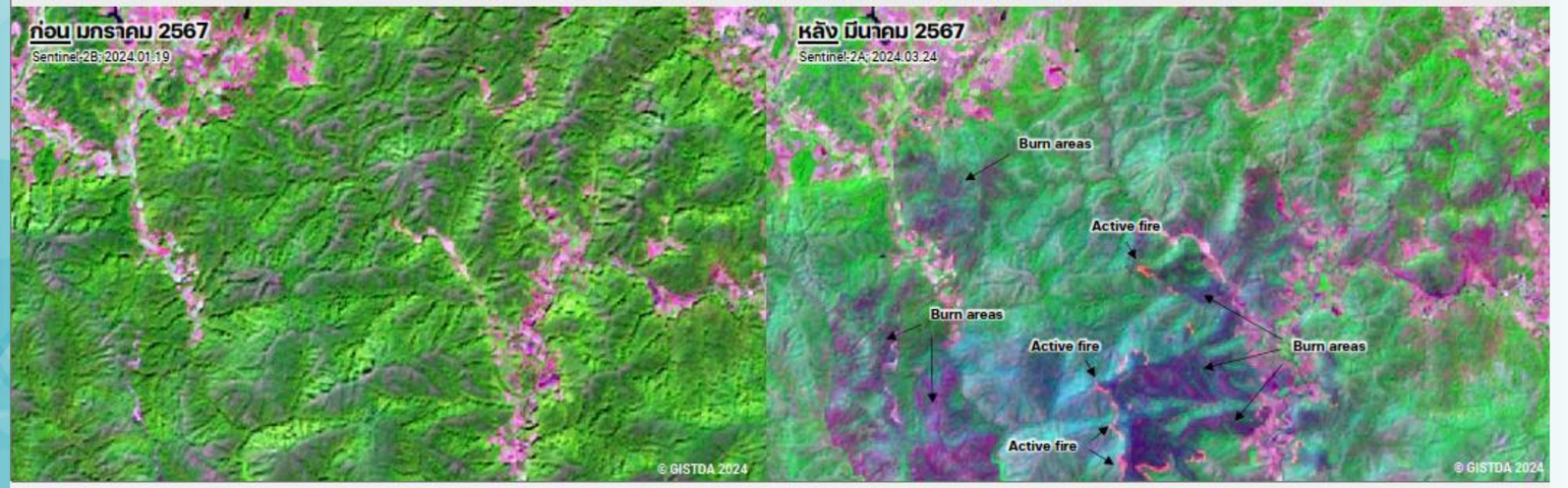
NOAA21-**VIIRS**



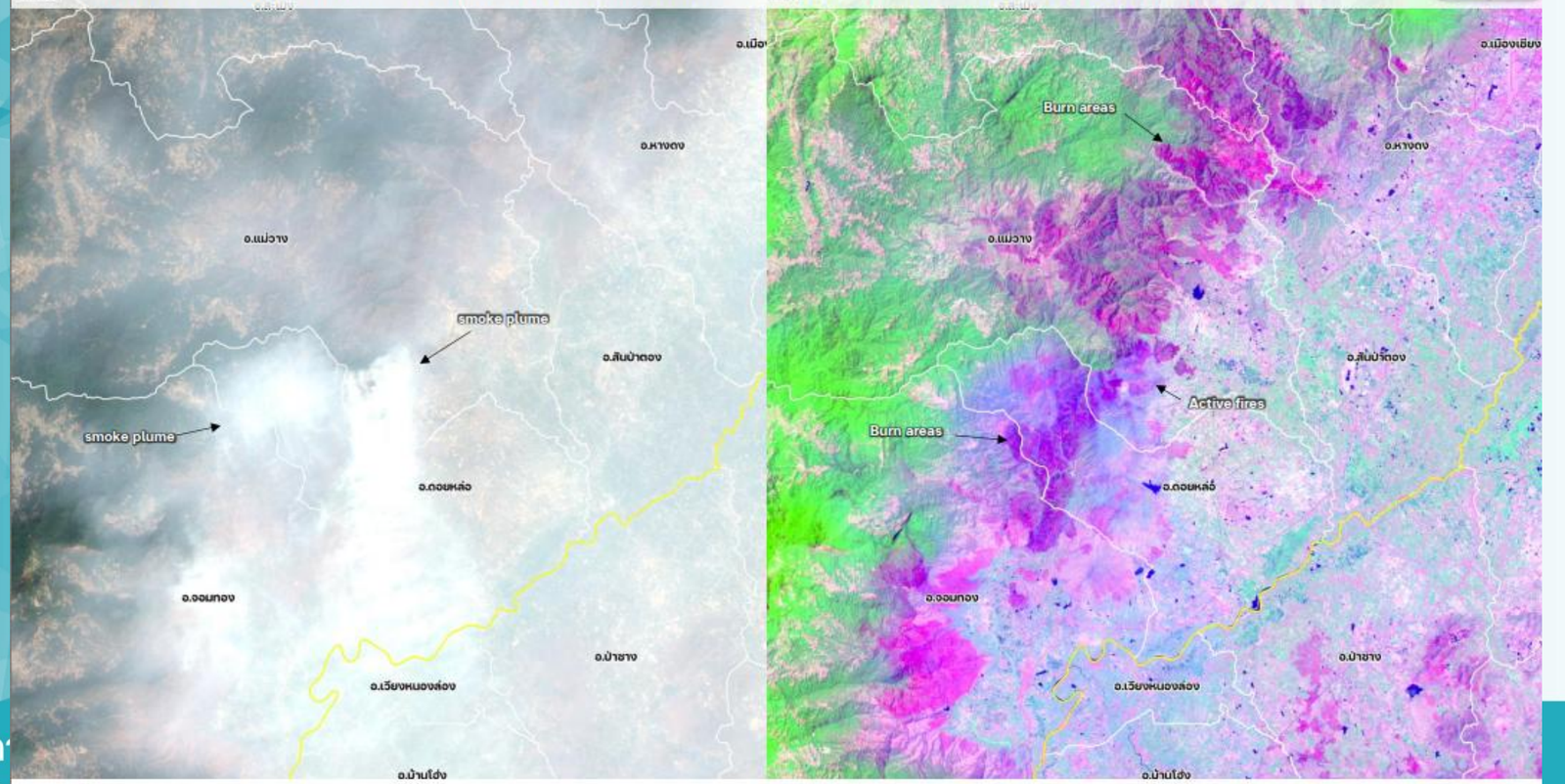
Base Layer: NOAA-21 VIIRS True Color Corrected Reflectance
Overlay Layer(s): VIIRS NOAA20 Thermal Anomalies 375m Day

Source: Worldview Snapshots

เปรียบเทียบภาพถ่ายดาวเทียม Sentinel-2 แสดงพื้นที่เผาไหม้ก่อน-หลัง

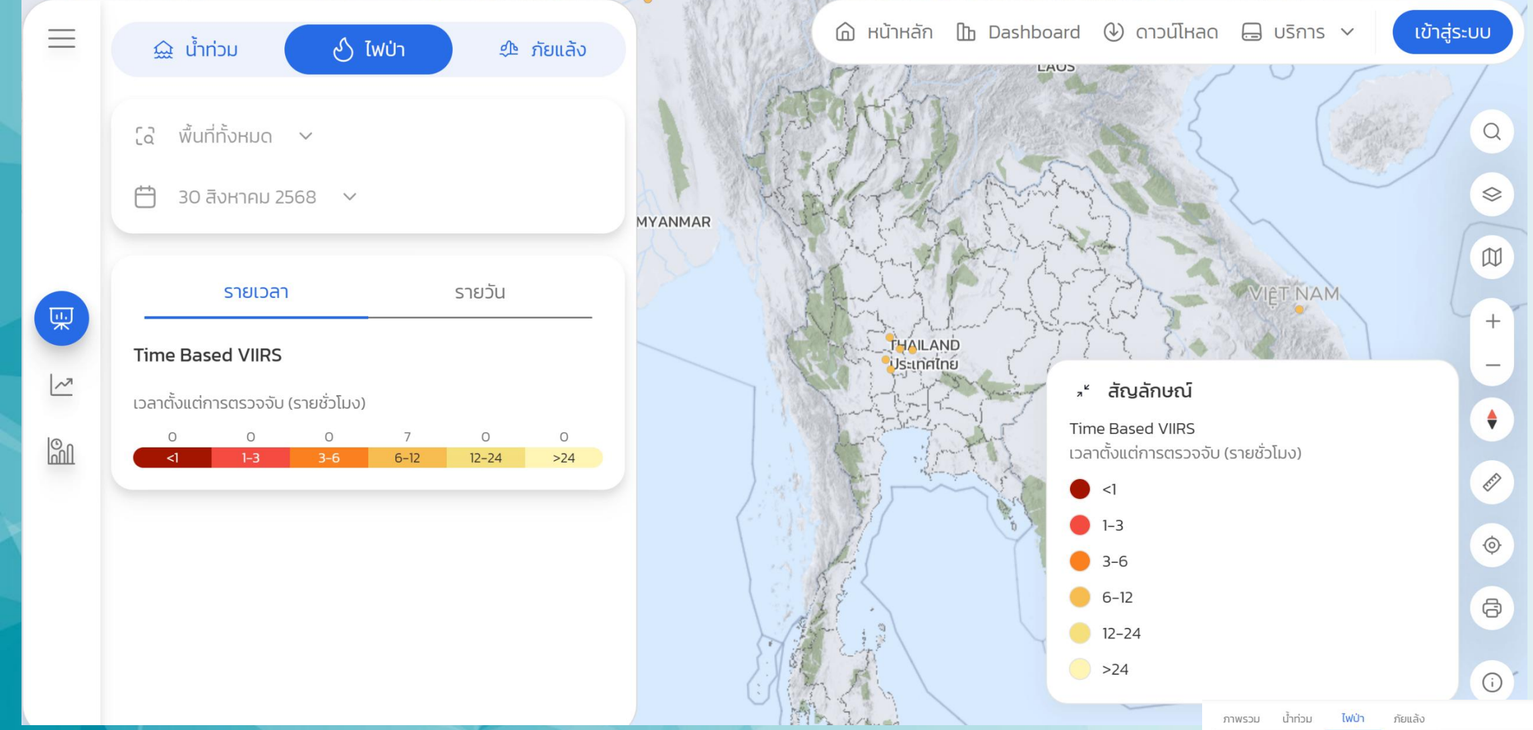


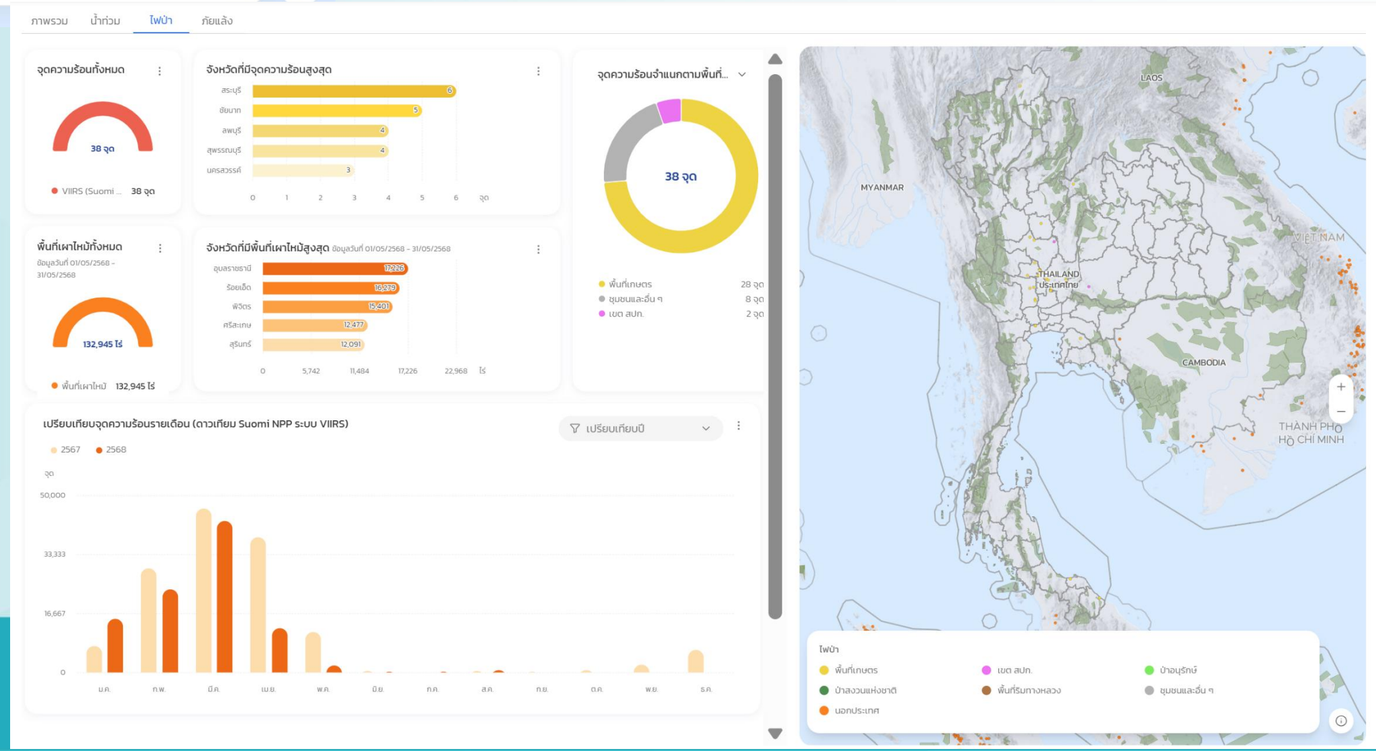
เปรียบเทียบภาพสีผสมจริง/สีผสมเท็จของภาพถ่ายดาวเทียม Landsat-8 บันทึกภาพวันที่ 15 มีนาคม 2567 จังหวัดเชียงใหม่



True color composite (RGB: Red, Green, Blue) แสดงกลุ่มหมอกควัน (smoke plume)

False color composite (RGB: SWIR, NIR, Red) แสดงพื้นที่เผาไหม้ (burn areas) และหัวไฟ (active fires)

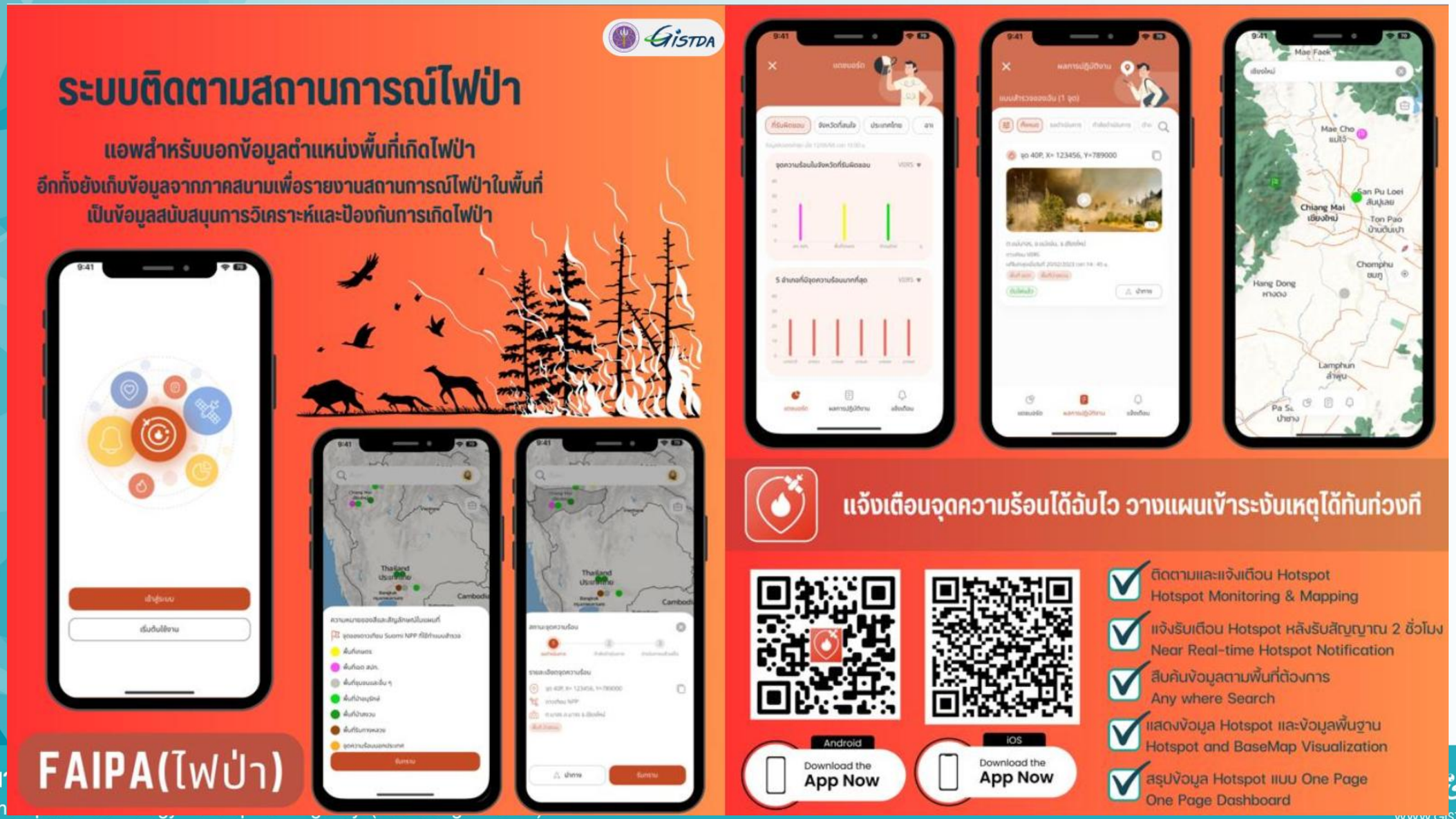




สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน)

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

FAIPA
(Application for Forest Fire Situation)

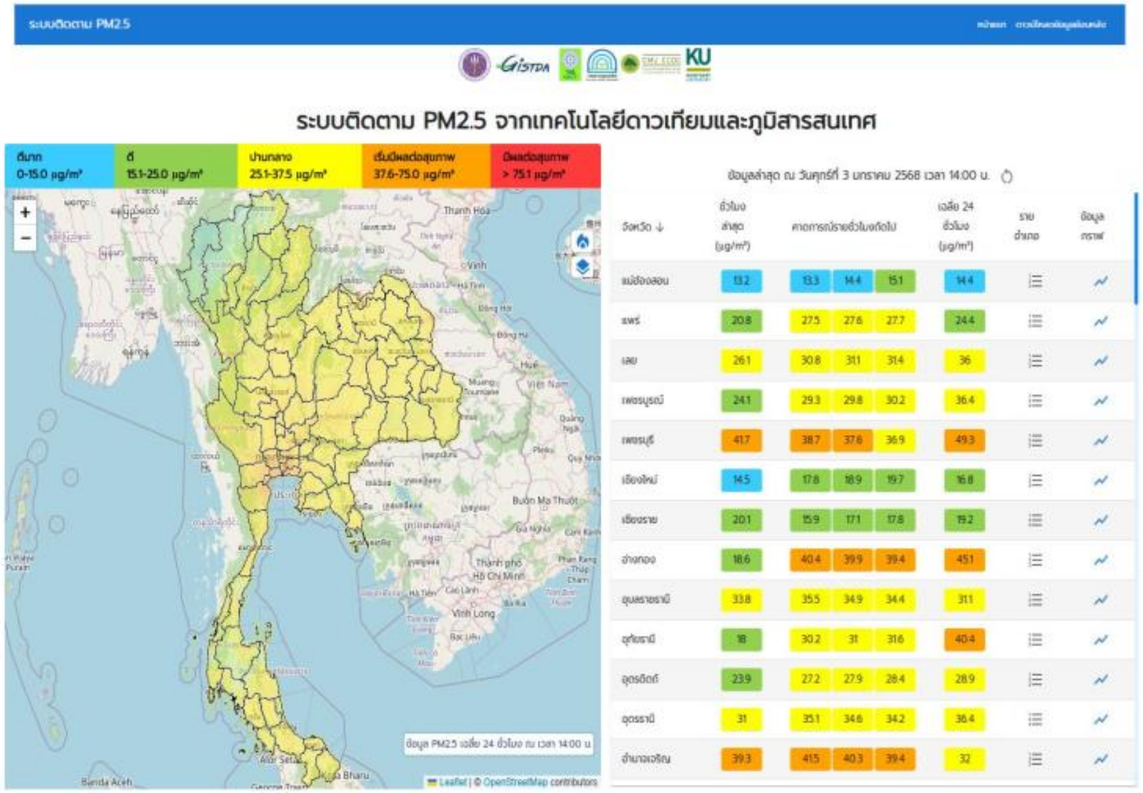


Air Quality Monitoring

Checkfoon
(Application for checking and Monitoring PM2.5)

Web Application

http://pm25.gistda.or.th



Mobile Application

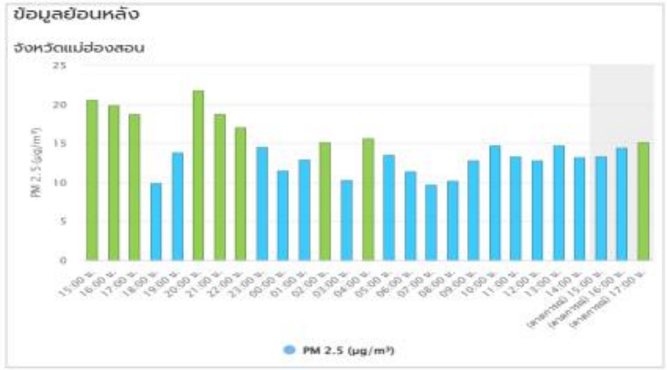
"เช็คฝุ่น"











Satellite and GI Data integration

+ Ground stations

เกี่ยวข้องกับการบริหารจัดการ PM 2.5 เชิงพื้นที่

- กรมควบคุมมลพิษ (108 สถานี)
- CCDC (706 สถานี)
- กรมอุตุนิยมวิทยา (128 สถานี)
- USGS / NASA (GEE)
- GISTDA sphere

- Data API
  - PM2.5 Mapping
  - Province/District/Subdistrict
  - 24 hr data

Web Services

- Hourly PM2.5

- Web Application
- Mobile Application

ให้บริการแอปพลิเคชัน

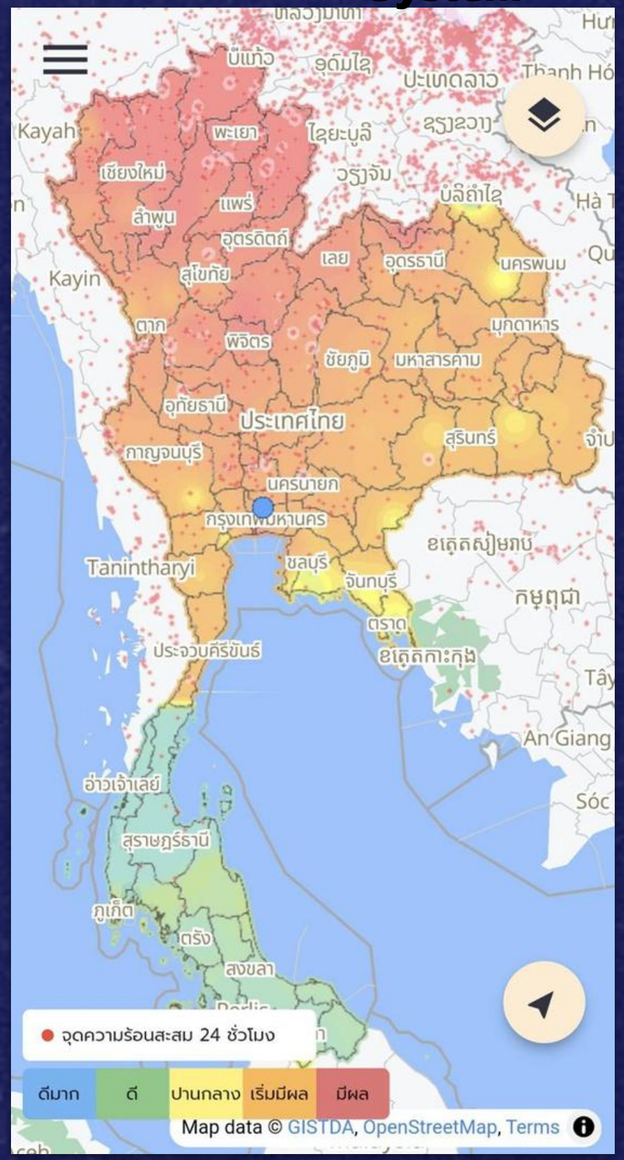
- Web Application
- Mobile Application

- ติดตามค่าฝุ่น PM2.5 ผ่านมือถือ และหน้าจอคอม
- แสดงตำแหน่งค่าฝุ่น ณ ปัจจุบัน (รายชม.) และตรวจสอบย้อนหลัง 24 ชม.

Checkfoon: Mobile Application PM 2.5 Monitoring System



Current Location Data



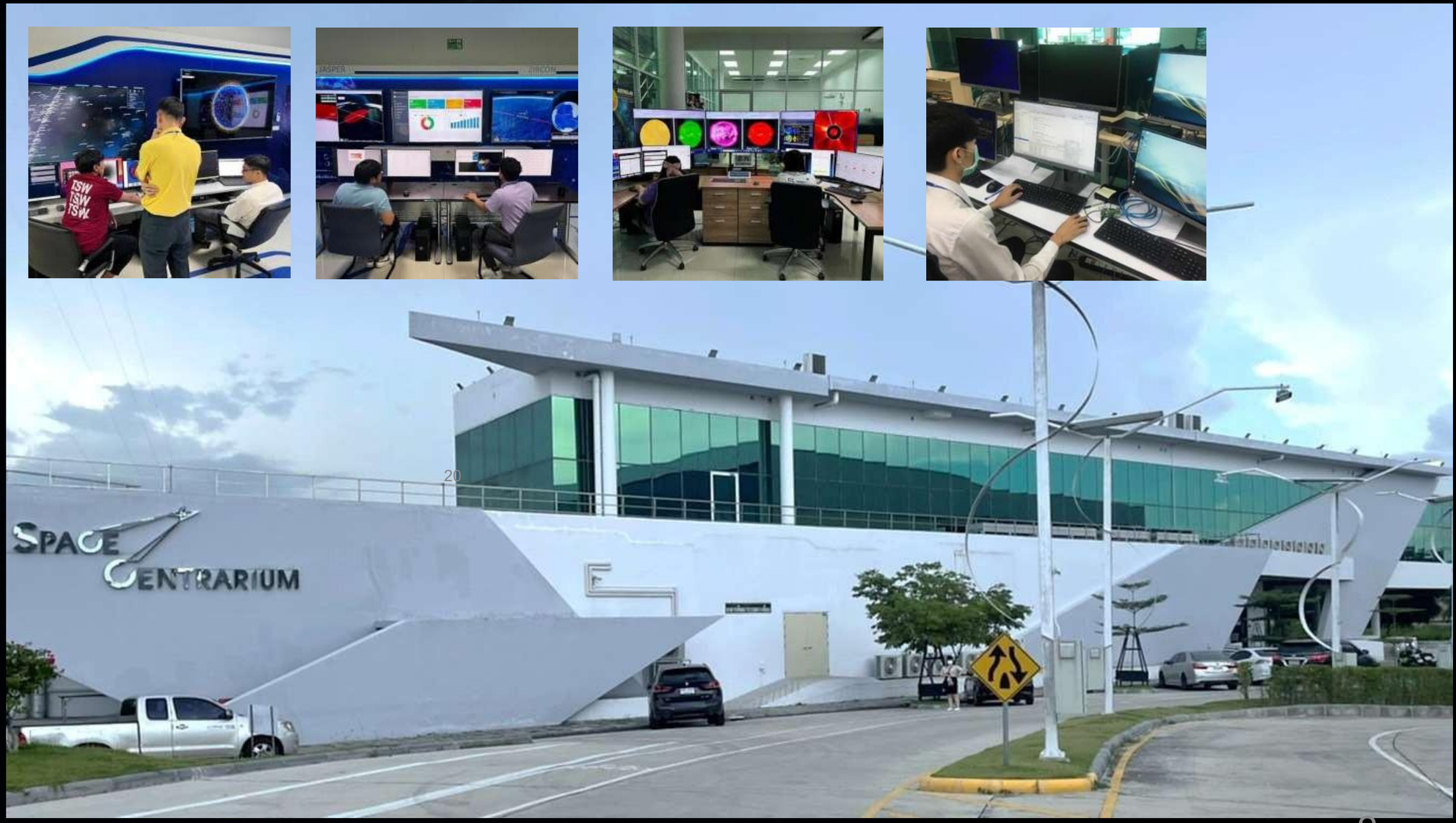
Map Monitoring



Provincial Data

SPACE TECHNOLOGY RESEARCH CENTER (S-TREC)





Research and development on Space Technology

ZIRCON

AMETHYST

Asteroid warning system

Space Traffic Management System

Active debris removal

Space weather forecast

Space Surveillance monitoring and tracking system

JasPer

GARNET

National space safety and security technology

Aerospace and spacecraft technology development

Data analysis and AI

Space telecommunication

NATIONAL SPACE DATA CENTER

Space flight dynamics

Onboard flight software

EMERALD

TOPAZ

Classification

Machine learning

AI detection

SPACE TECHNOLOGY RESEARCH CENTER (S-TREC)

S-TREC

Space Technology Research Center

AI FOR S-TREC

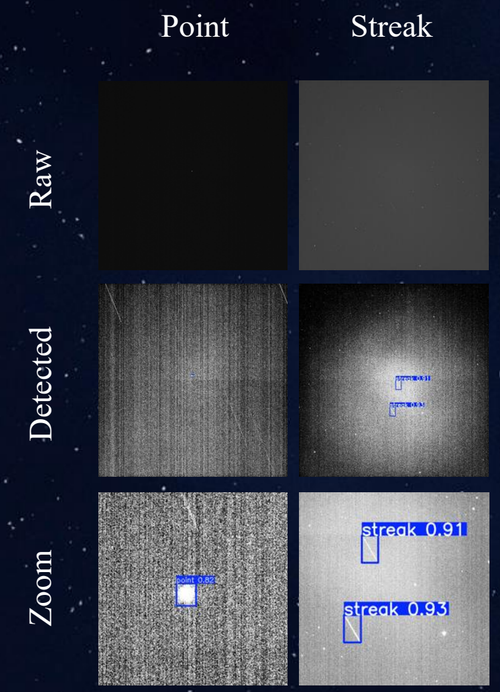
Ai For Space Technology Research Center

Space Situational Awareness

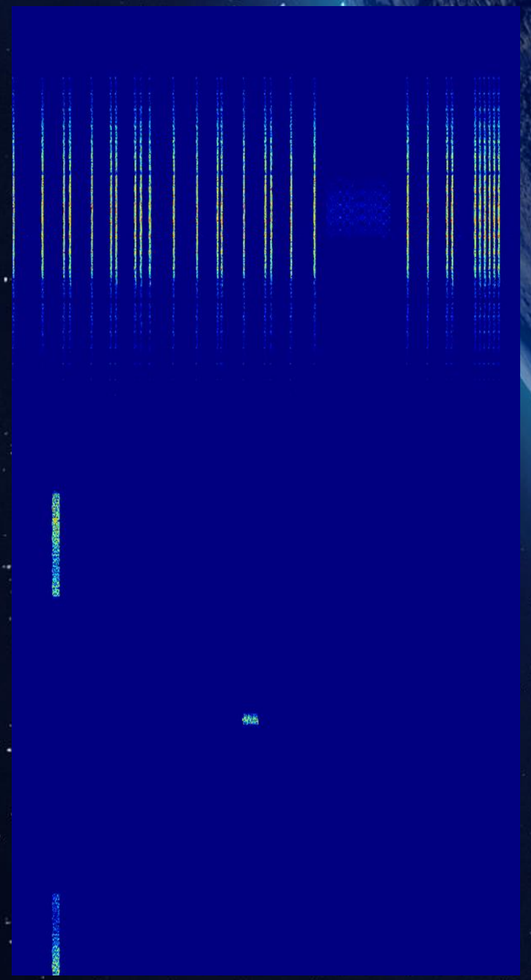
GARNET

Space Object Detection

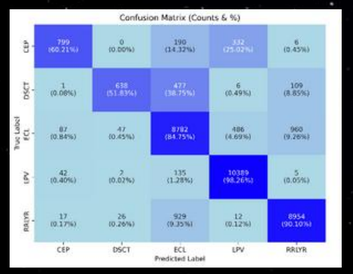
Developing an artificial intelligence (AI) model for detecting space objects and debris from images captured by ground-based telescope sensors, supporting both bounding-box detection and precise object localization in terms of angles and centroids, to enhance orbital calculation and collision avoidance in space.



AMETHYST







Space Object Lightcurve Classification

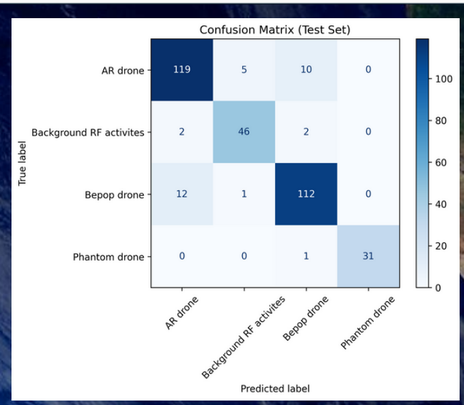
Applying AI models to analyze lightcurve data of space objects for classification and anomaly detection, accelerating the event screening process and supporting the tracking and risk assessment of space objects

Space Traffic Management

- **Unmanned Traffic Management s**
- **(UTM)**

Drone RF Raw Signals

High RF	0	0	-1	0	...	-2	-2	2	-1
Low RF	0	-6	-7	-26	...	1	-2	0	-2



Drone Classification

Drone presence classification from RF signals using AI models, which transform numerical data into spectrograms for preprocessing before training the classification model. This approach enhances surveillance accuracy while reducing errors compared to traditional detection methods.

AI FOR S-TREC

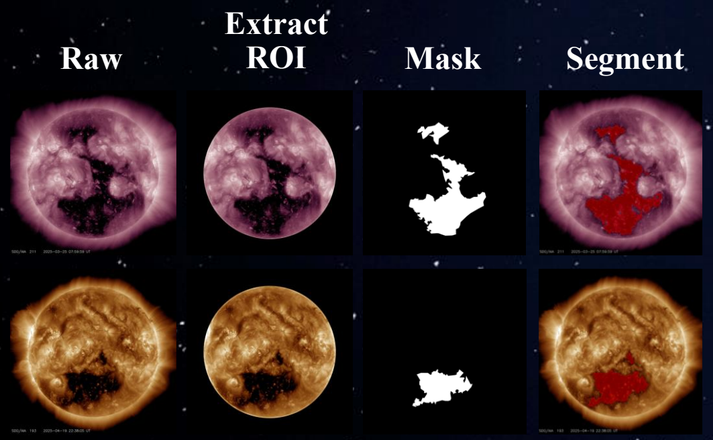
Ai For Space Technology Research Center

Sunspot Detection and 24hr Solar Flare Forecasting

Space Weather Forecast

Advanced Detection and Forecasting of Corona Mass Ejection: An Integrated AI-Driven Framework

Solar Coronal Hole Segmentation



Segmentation techniques are incorporated into AI models to detect coronal holes on the Sun, enhancing the accuracy of solar wind variation analysis and improving the efficiency of space weather forecasting.





Key Challenges in Digital Innovation

Policy Gaps

Addressing regulatory and compliance issues

Policy frameworks need to adapt quickly to innovation.

Sustainable Financing

Securing investments for digital projects

Innovative financing models are essential for project sustainability.

Talent Shortages

Bridging skills gaps in the workforce

Developing a skilled workforce is critical for growth.

Digital Divide

Ensuring equal access to technology

Bridging the digital divide is crucial for inclusivity.

Future Opportunities

Identifying emerging trends and solutions

Future growth hinges on embracing new technologies.





Opportunities for Growth



EO-driven Solutions

Earth Observation (EO) technologies provide **insights for decision-making** in agriculture and disaster management.

Improved data sharing and accesability capabilities

Private Sector Startups

Emerging startups are vital for **driving innovation** and enhancing Thailand's digital landscape.

Regional Cooperation

Strengthening partnerships across nations will enhance **resource sharing** and boost regional capabilities.
Talent Exchange, Data Sharing

Policy Integration

Aligning regulations with digital advancements is crucial for seamless implementation and growth.

Building capacity for sustainable development and innovation



Partner Organizations

The **collaboration** between universities and space agencies like ITC, Ireland, JAXA… enhances knowledge sharing and drives innovation in the digital space sector.



Training Initiatives

Our training initiatives help to **develop skilled professionals** who can effectively utilize digital innovations for space technology and applications, ensuring a robust workforce in the industry.

Capacity Building

Fostering talent through partnerships, training, and collaboration initiatives



Collaborative Program

Training, exchange program, with partners facilitate **strategic planning** and alignment on shared goals, paving the way for impactful projects and initiatives in the field of space technology.

Future Directions in Space



Strengthening partnerships

Collaborative projects aimed at enhancing regional cooperation

Capacity building

Launching training programs to develop skills i

Public awareness

Outreach initiatives to educate communities about space

Innovation ecosystems

Establishing incubators and accelerators to support startups

Sustainability practices

Promoting technologies for space solutions

“Digital innovations in space are not just about technology—they are about enabling sustainable futures for our region.”

Thank You