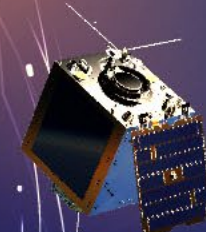




GISTDA Space Activities Update

Kandasri Limpakom
Deputy Executive Director
Geo-Informatics and Space Technology Development Agency
(GISTDA)



International Meeting on Air Pollution in Asia – Inventories, Monitoring and Mitigation
Hanoi, Vietnam
February 1-3, 2023

WWW.GISTDA.OR.TH

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.

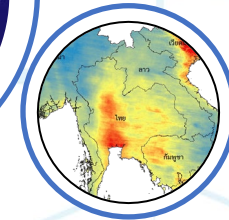
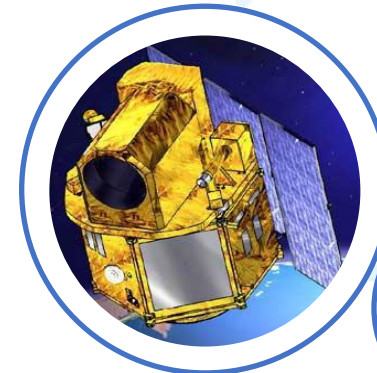
Upstream

Space Technology Development

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



Enhancement of
Space and GI manpower

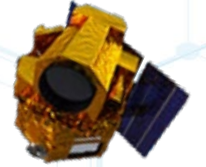


Downstream

Geo-Informatics Technology Development

- Satellite data services
- Applications & solutions development

Earth Observation Satellite Operation



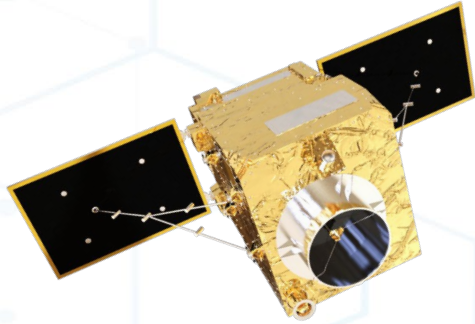
Space Krenovation Park
Sriracha, Chonburi

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

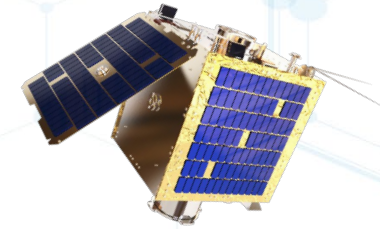
Earth Observation Program



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

Coming Up in 2023



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



AIRBUS



AIIT – Assembly Integration & Test Facility

Applications & Solutions Development

MAPPING




WATER MANAGEMENT



NATURAL RESOURCES AND ENVIRONMENT



AGRICULTURE



URBAN AND SOCIETY



DISASTER





Major Environmental Issues in Thailand

Sea Level Rise

Environmental Disasters

Pollution

Oil Spills

Ocean Acidification

Extinction of Animals

Climate Change

Loss of Biodiversity

Deforestation

Waste

Ozone Layer Depletion

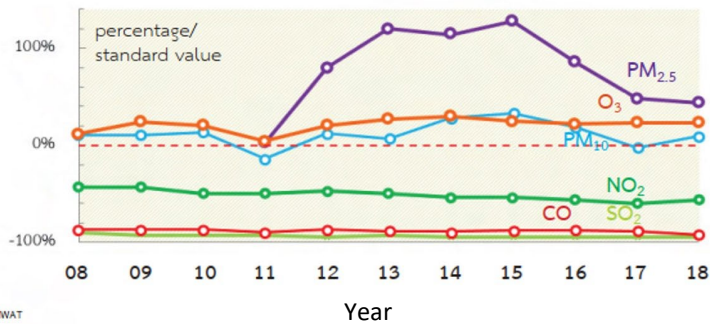
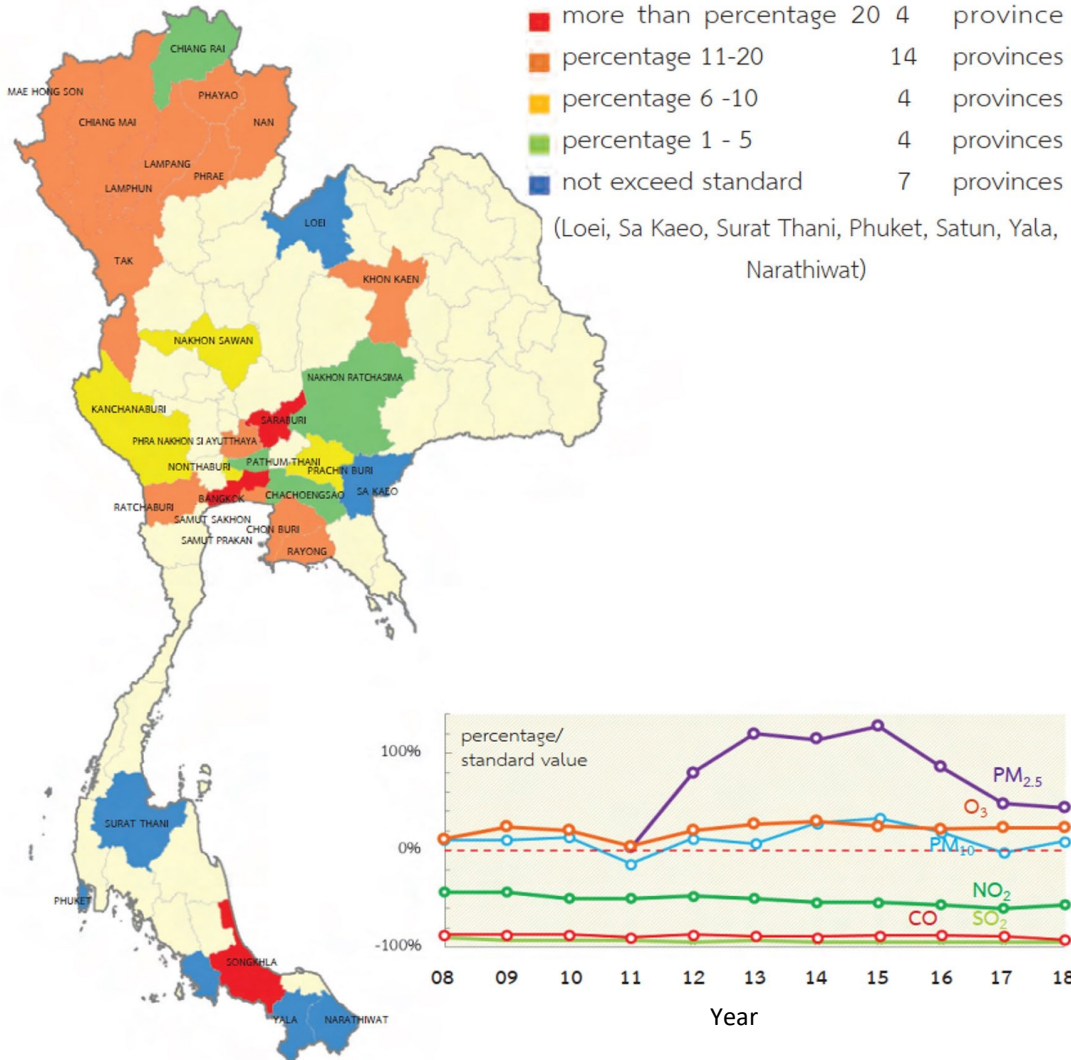
Habitat Loss

Land Degradation

Desertification

Natural Resource Depletion

Energy Crisis

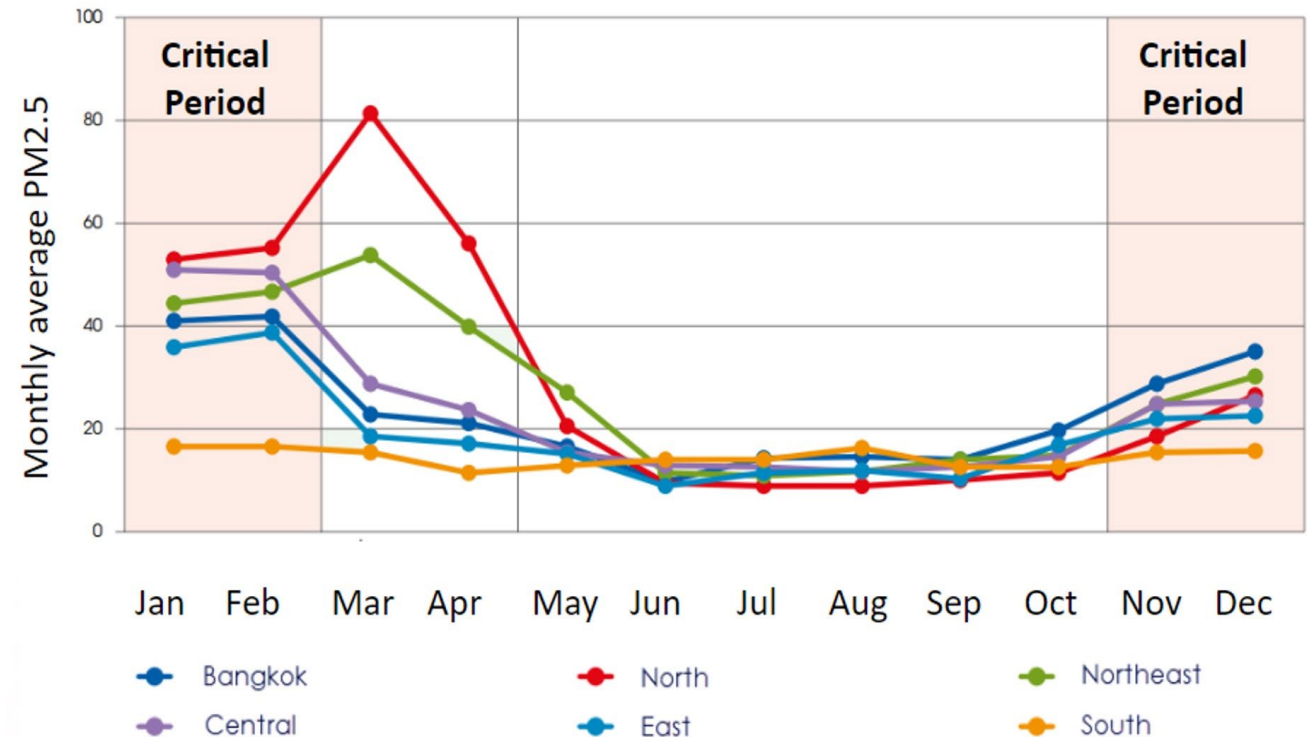
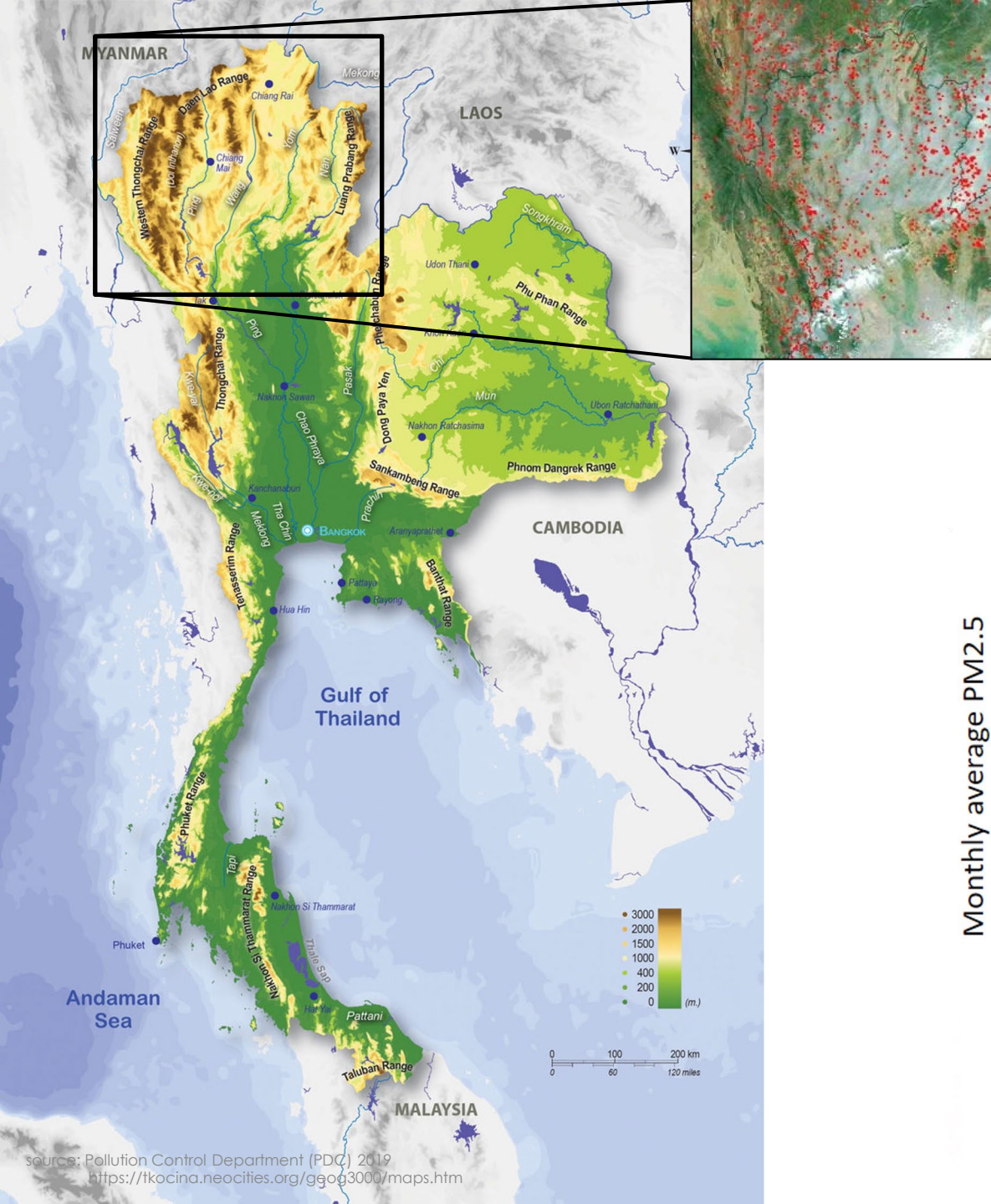


Air pollution situation

- Recently, air pollution is on of the **biggest pollution issue** for Thai people.
- Based on **ground station measurement** available in 33 provinces, 4 provinces including Bangkok showed **air quality exceed the standard on >20% of year in 2018 (over 70 days)**.
- 3 out of 6 main pollutants are exceed standard including **PM_{2.5}, PM₁₀, and Ozone**.

Air pollution situation (cont.)

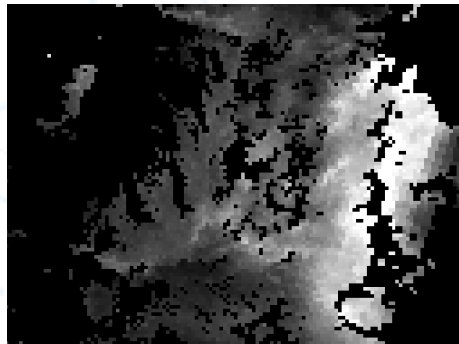
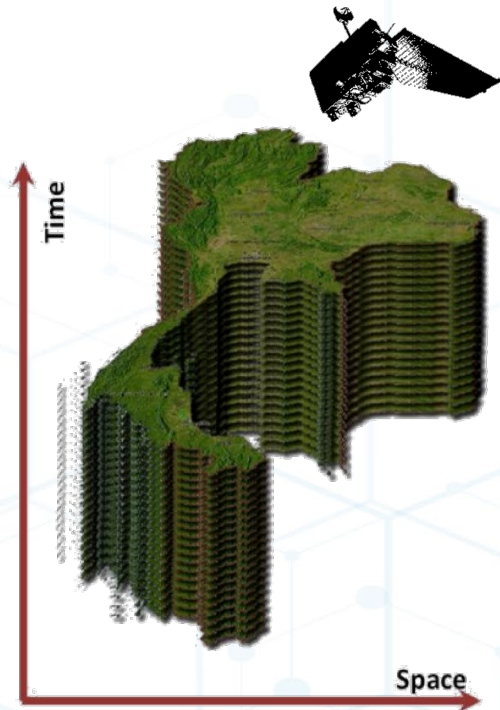
- Generally, **critical period** with high PM2.5 occurs during **dry season**
- **North and Northeast** region have the highest PM2.5 in March and April likely caused by forest fire.



source: Pollution Control Department (PDC) 2019
<https://tkocina.neocities.org/ggog3000/maps.htm>

SATELLITE DATA

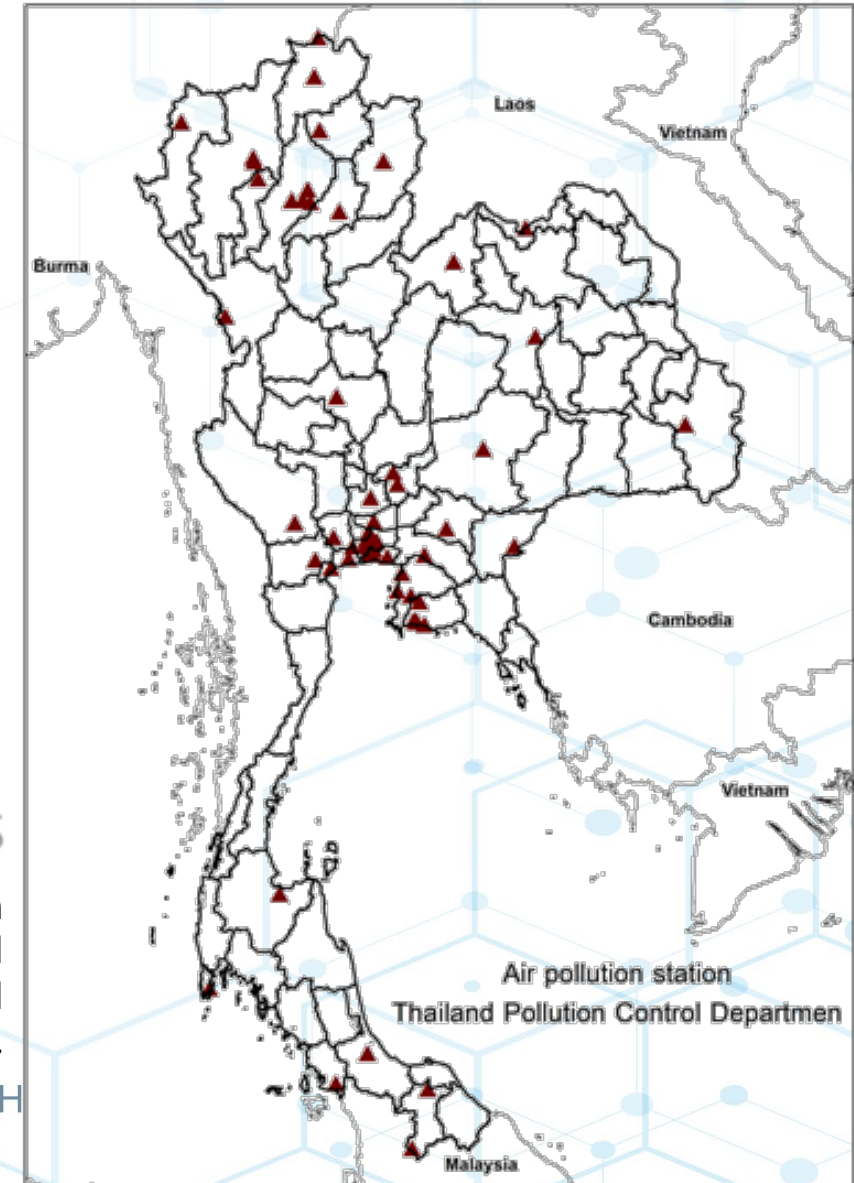
The Level-2 product, the MODIS Aerosol Product at 3 km resolution within the latest Collection 6.1 (MOD04_3K) for 2002 to 2021 was acquired from the National Aeronautics and Space Administration Land Processes Distributed Active Archive Center. A total of 20,590 images were used.



IN-SITU DIRECT MEASUREMENTS

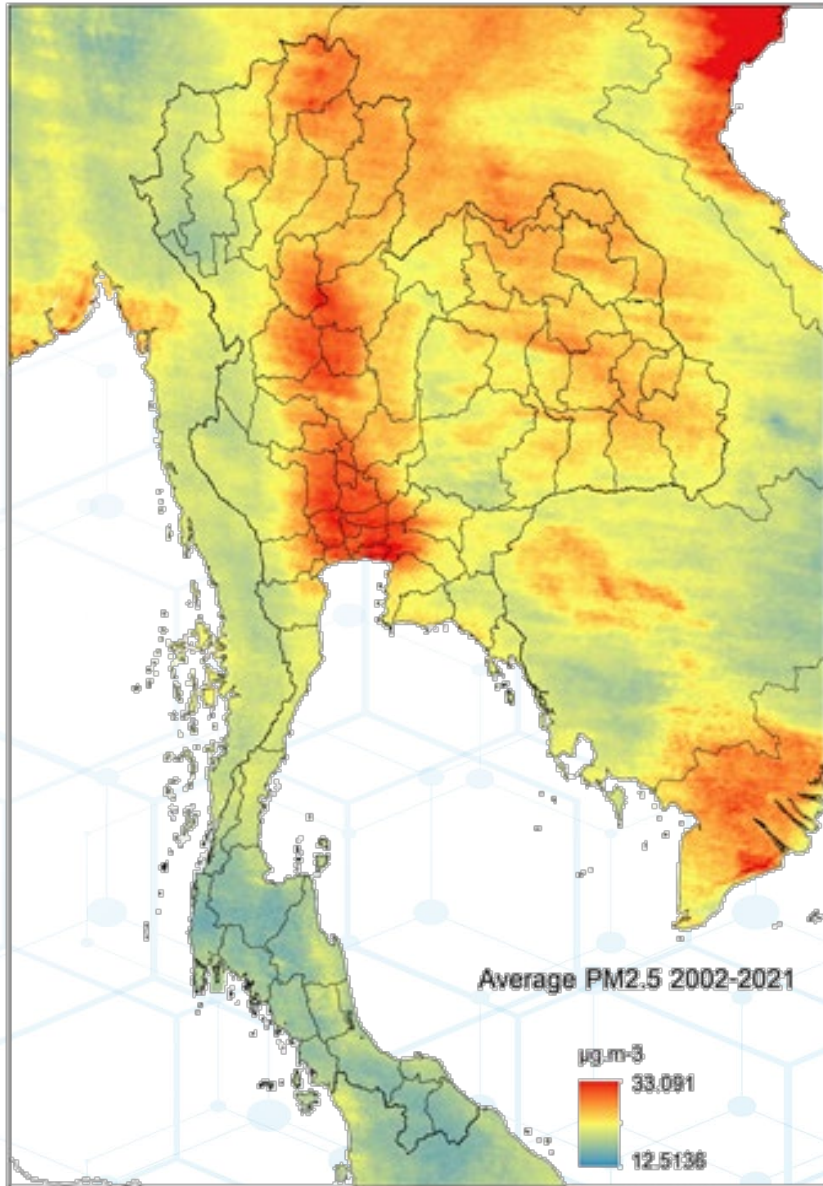
4 Years recorded data from 65 air quality-monitoring stations from 2018-2021. Ground measurement stations has started since 2018 and complied with the standards of the United States Environmental Protection Agency (U.S. EPA).

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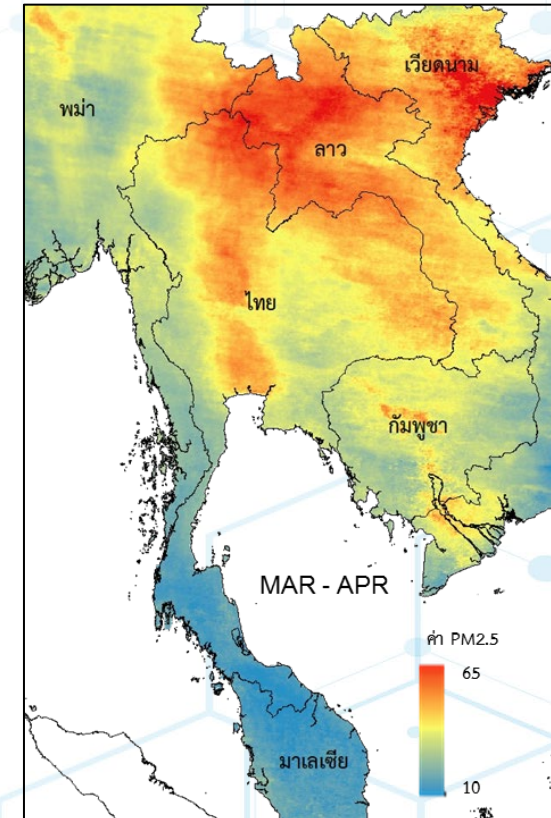
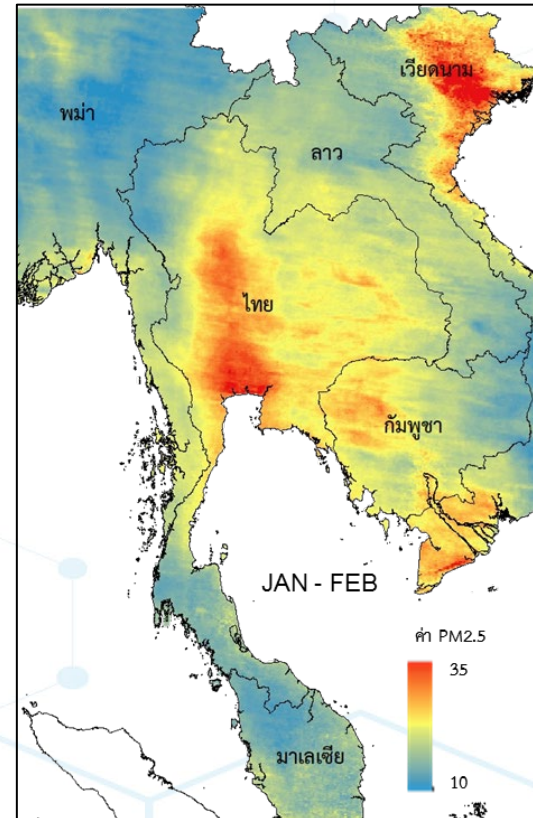


The 20 years average spatial distributions of PM2.5 conditions across the entire countries obtained from the remote sensing data between 2002 and 2021

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



Jan - Feb
2002 - 2021



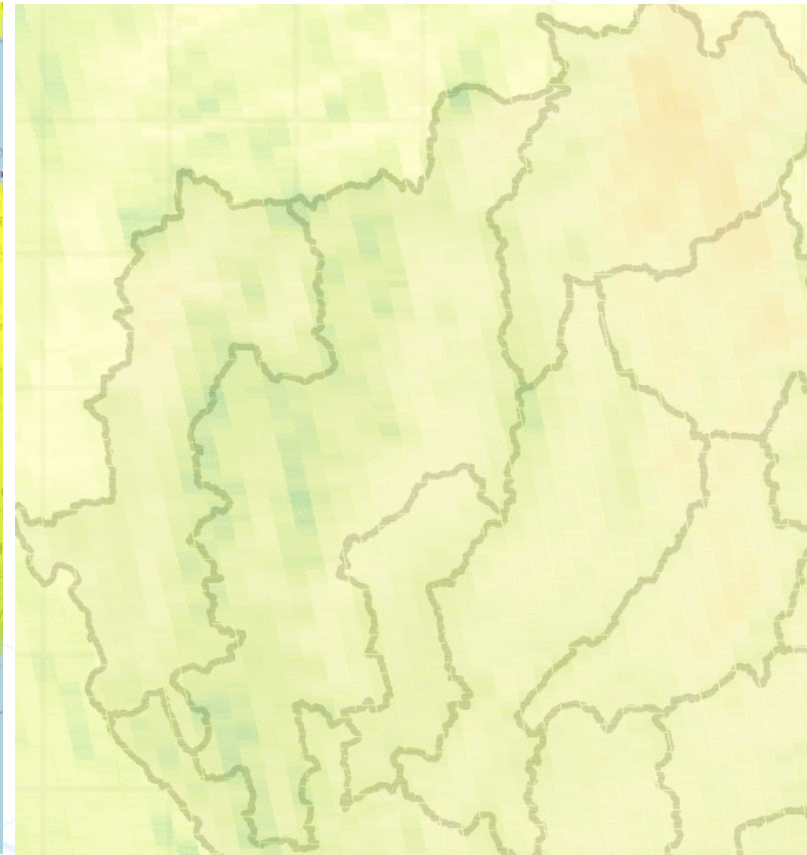
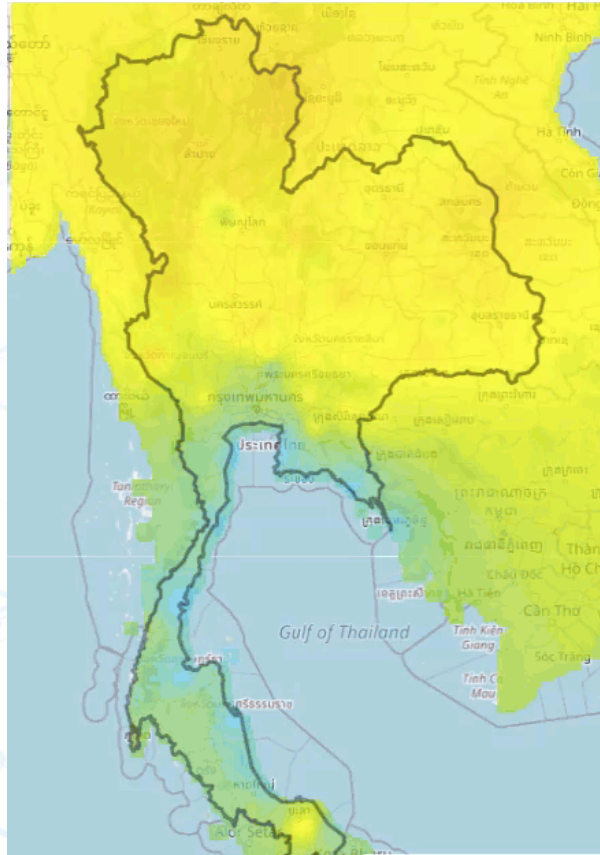
Mar - Apr
2002 - 2021

Multi-sensor Integration for Monitoring & Forecasting

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

PM2.5 Thailand
(Hourly)

Public service



AIS 4G 13:33

เมนู

ฝุ่นละออง PM2.5 จากดาวเทียม

19
มคก./ลบ.ม.

วันพฤหัสบดีที่ 11 พฤศจิกายน 2021
เวลา 13:00

แขวงทุ่งสองห้อง เขตหลักสี่ จังหวัดกรุงเทพมหานคร

Lat : 13.8820 , Long : 100.5645

อากาศ: ดีมาก

ปริมาณฝุ่นย้อนหลัง 24 ชม.

LAT : 13.8820 , LONG : 100.5645

PM2.5 (มคก./ลบ.ม.)



Satellite Observations



Research Aircraft

Improved Air Quality Understanding



Research

- Satellite validation and detailed mapping,
- Emission evaluation and model,...

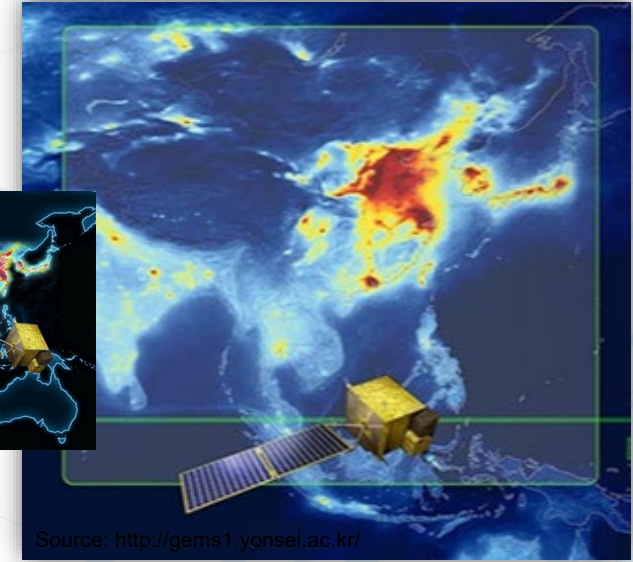
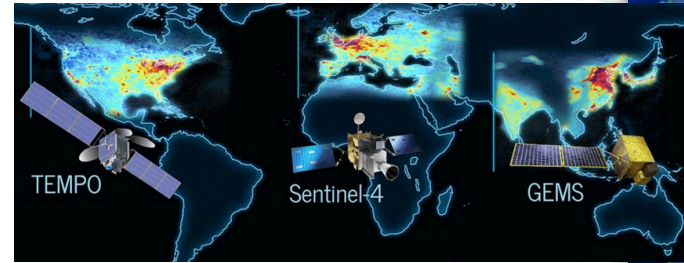
Supporting the ASIA-AQ campaign



Pandora, AERONET, ...

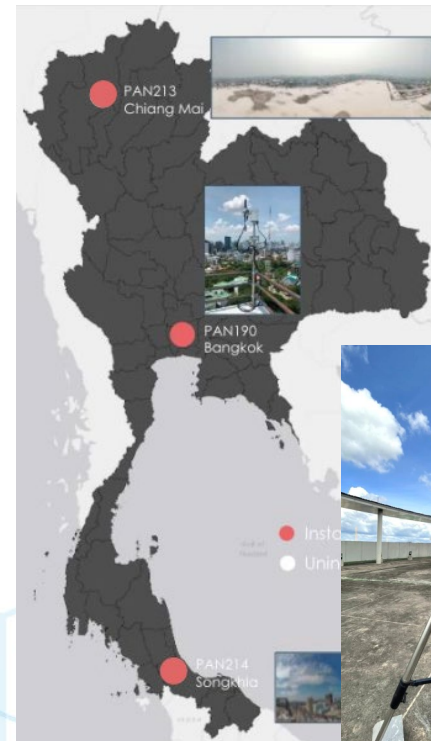
Aerosols, Air Pollution

Geostationary Environment Monitoring Spectrometer (GEMS)

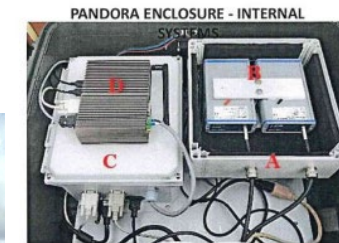


<https://www.spiedigitallibrary.org/>

Source: <http://gems1.yonsei.ac.kr/>

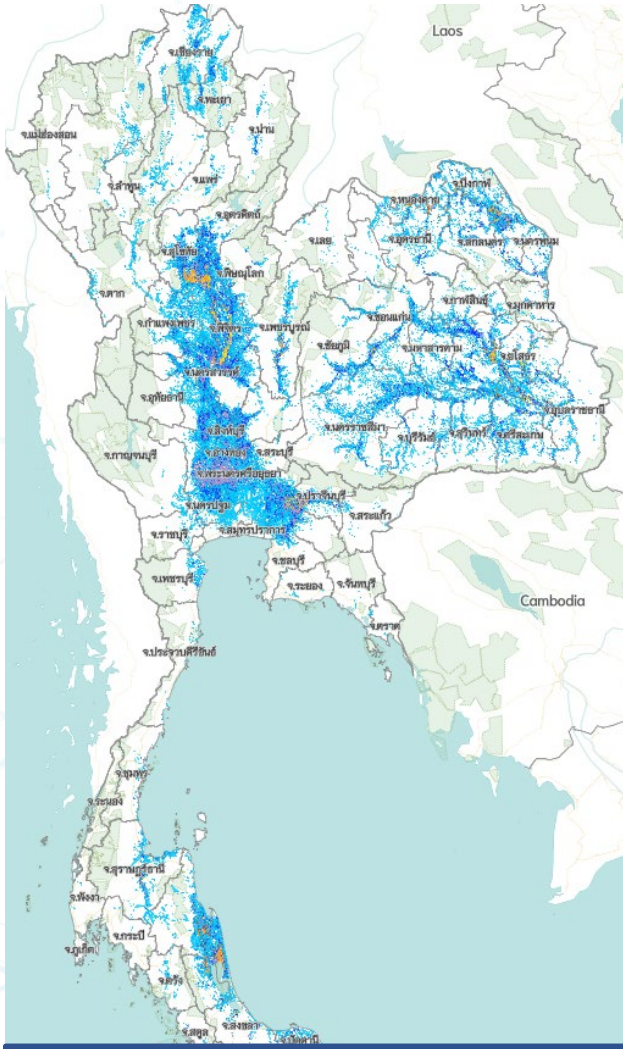


PANDORA instrument

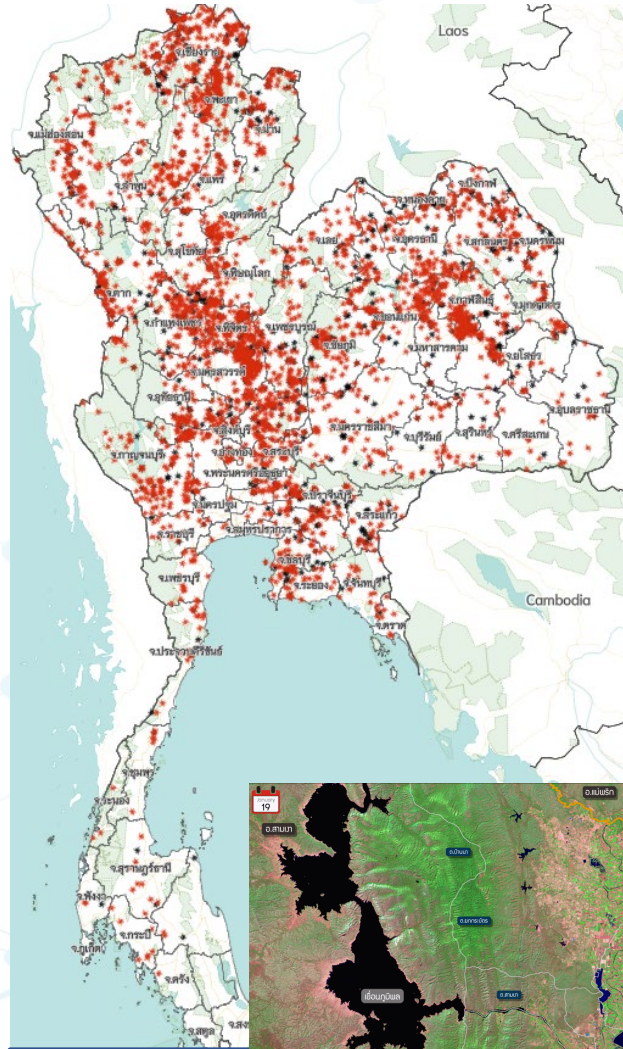


- A - Spectrometer box (maintains spectrometer temperature)
- B - Spectrometer(s) (measure spectra)
- C - Electronics box (power and electronics)
- D - Control computer (runs control software)

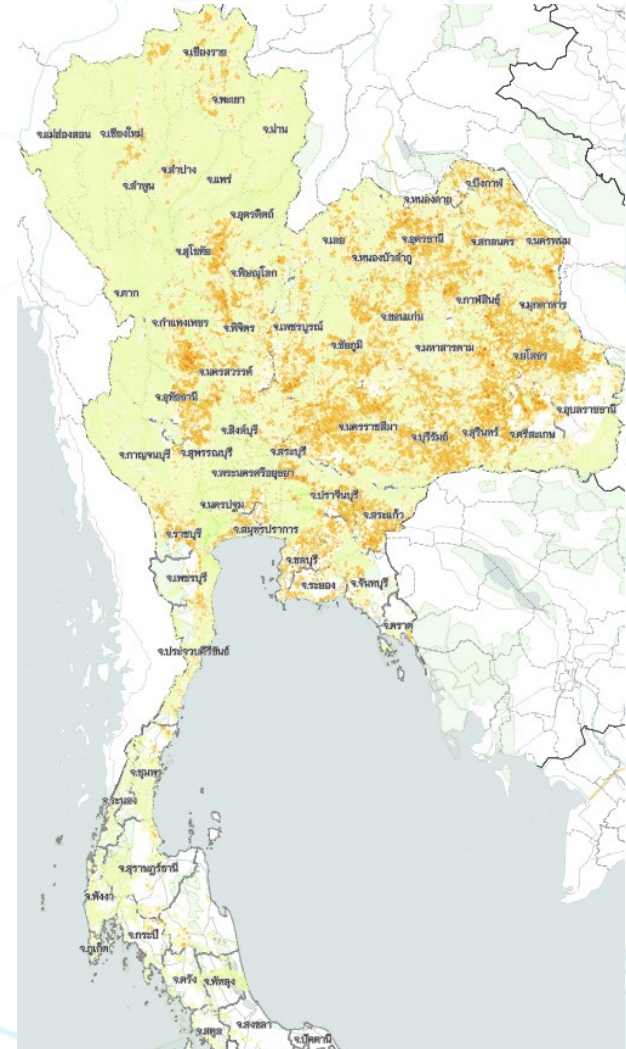




Repeated Flood

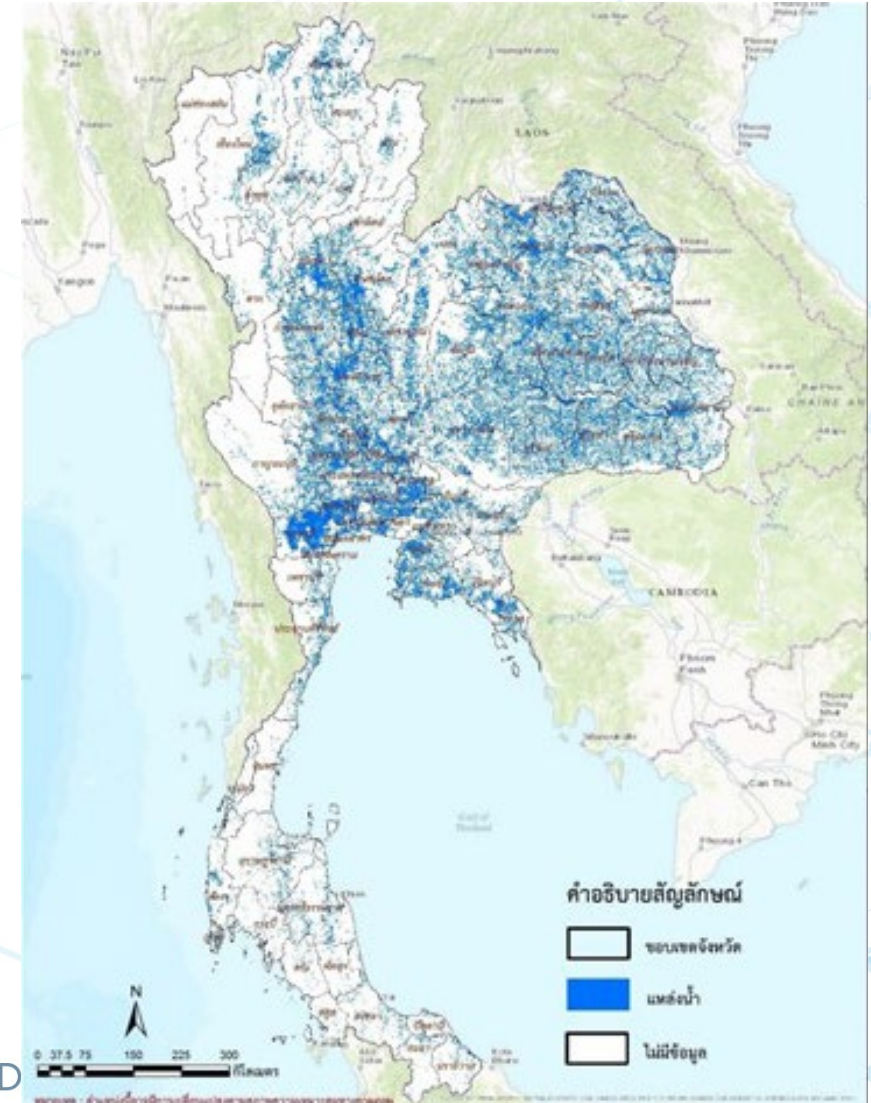
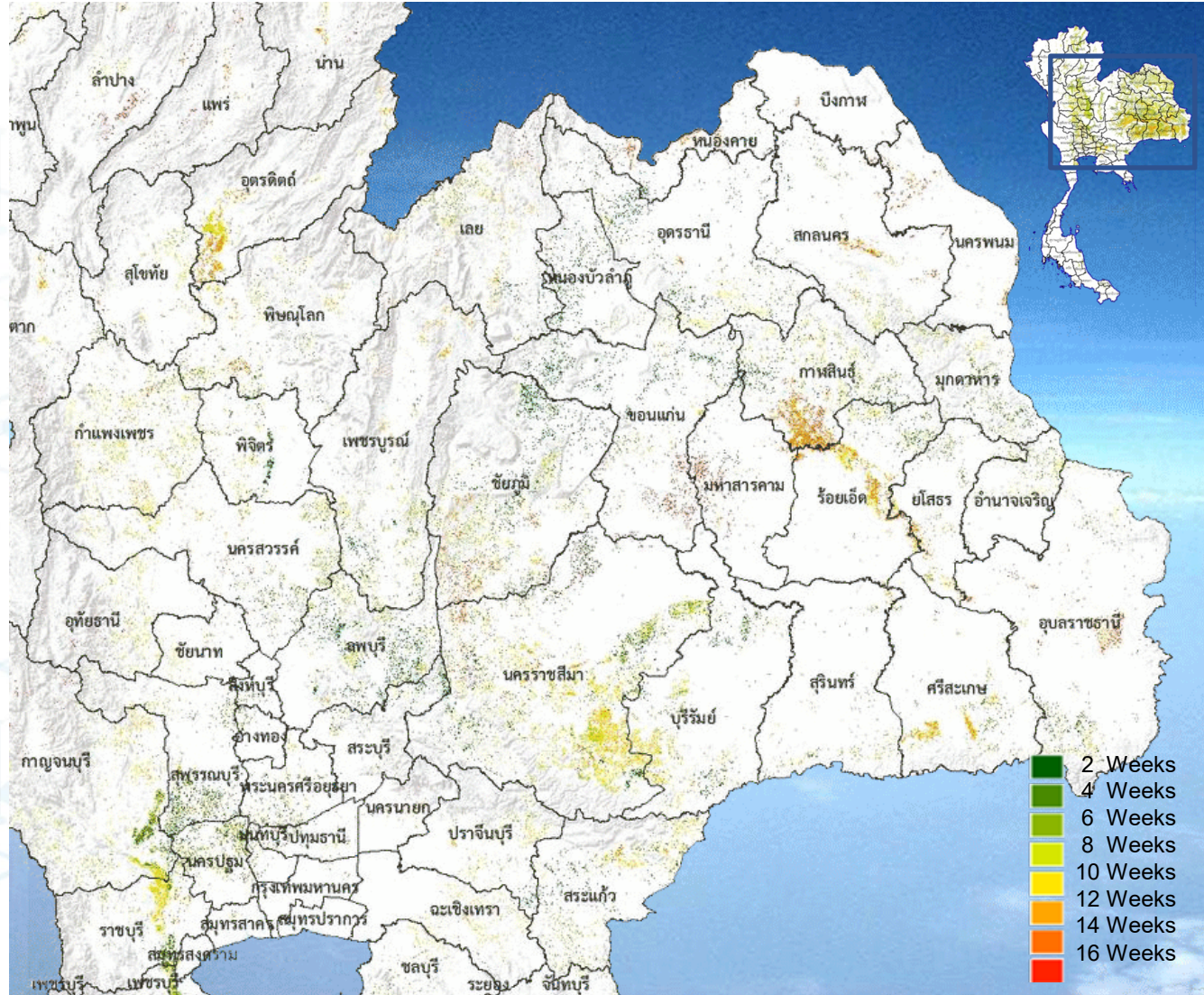


Active Fire

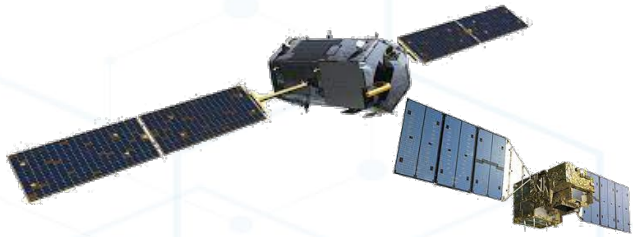


Drought Risk



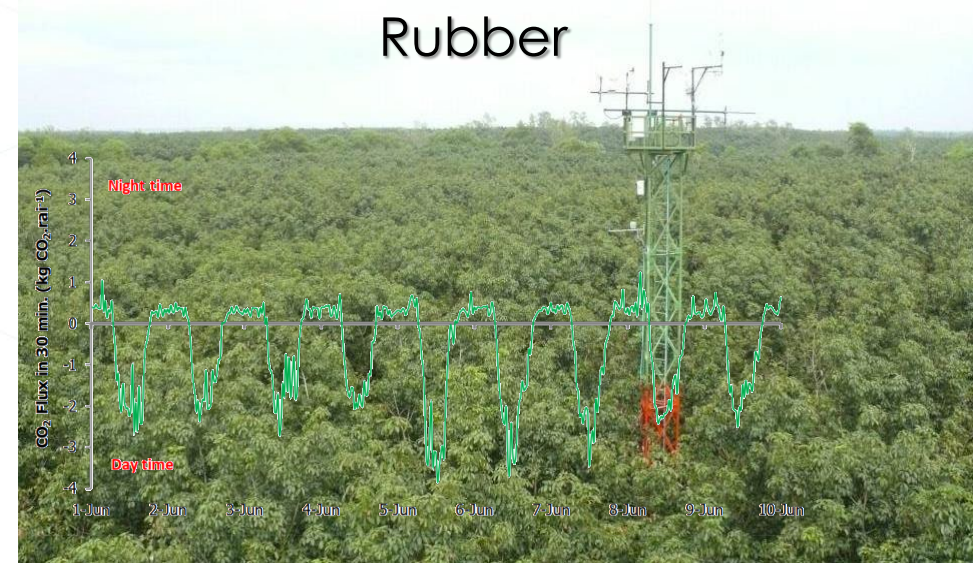


Atmospheric GHG Monitoring



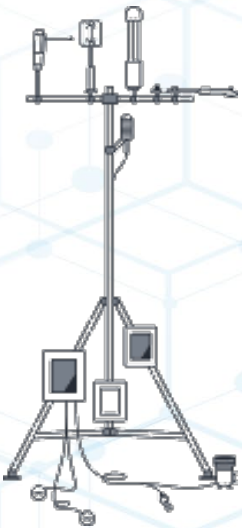
Applying earth observation satellites to monitor CO₂ and CH₄ in the atmosphere

GHG Flux

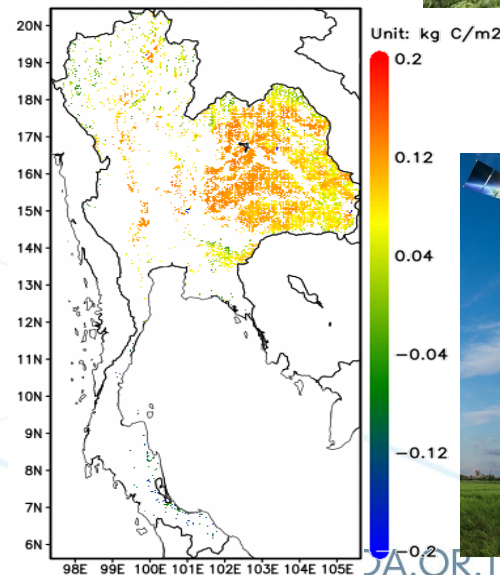
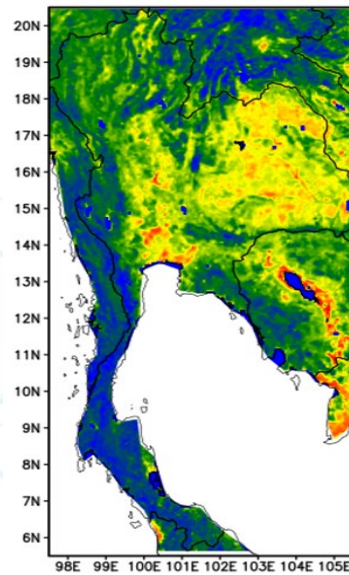


Rubber

Rice

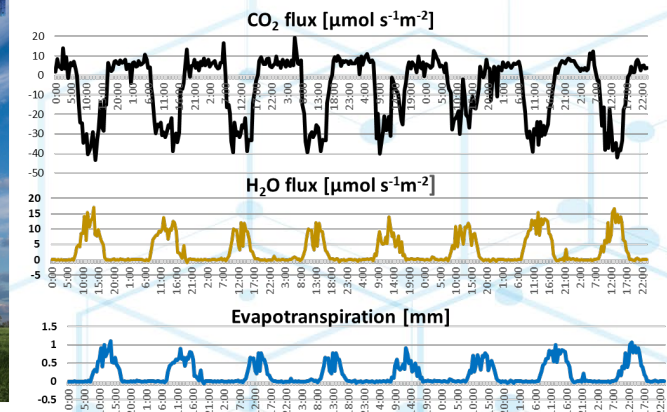


Integrate satellite data and Eddy Covariance method



Net Ecosystem Exchange

Rice



Climate-Resilient Agriculture

Climate Change

(Rise in temperature and Subsequent Changes in other climate parameters)

Increases weather variability Aggravating risks in agriculture

Carbon sequestration mitigates the problem of climate change

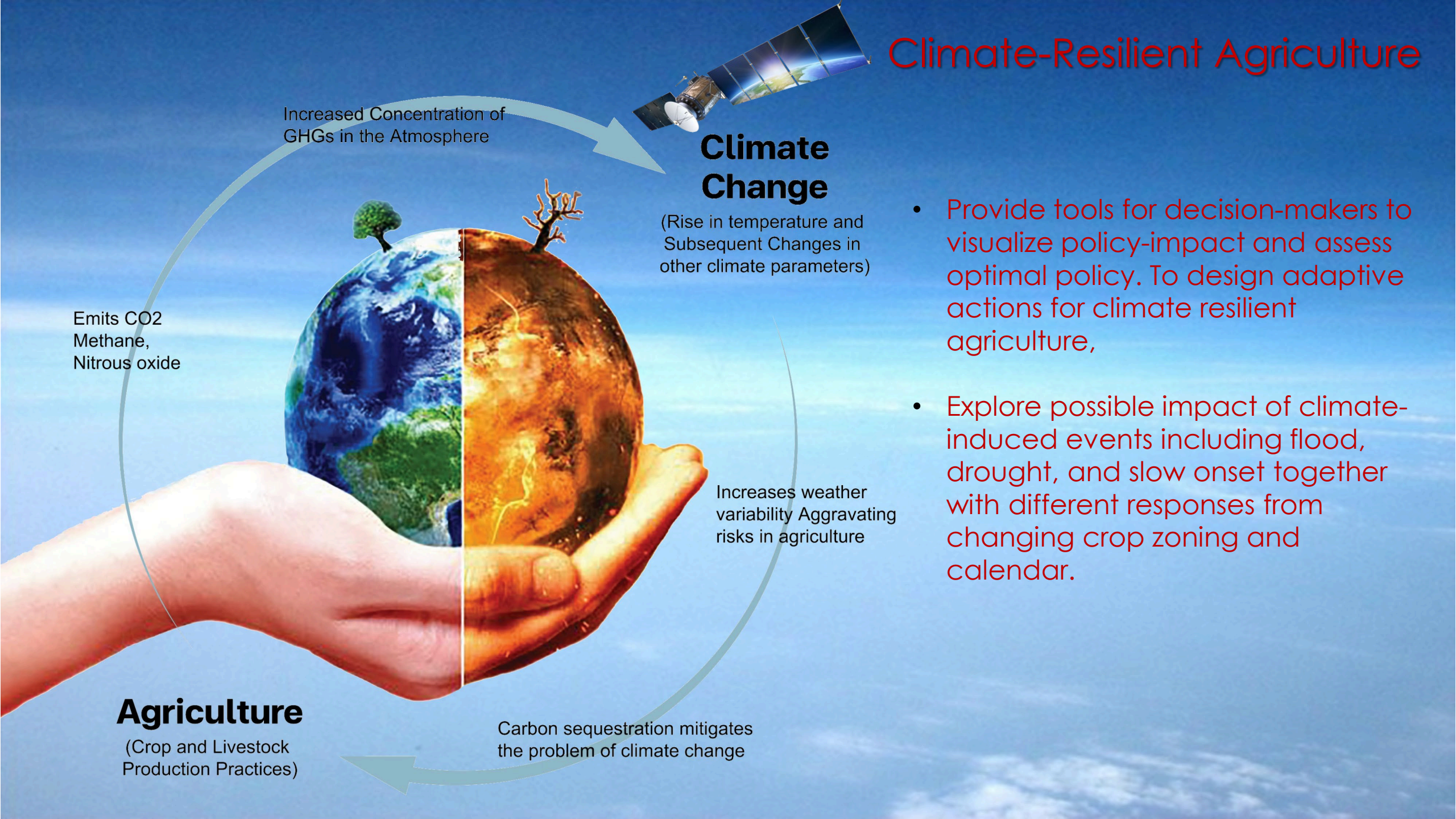
Emits CO2
Methane,
Nitrous oxide

Increased Concentration of
GHGs in the Atmosphere

Agriculture

(Crop and Livestock
Production Practices)

- 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.





THANK YOU

