THE 8TH PLENARY MEETING OF UN-GGIM-AP

SPACE TECHNOLOGY FOR MONITORING HEALTH AND YIELD OF RICE

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**OUTLINE**

**INTRODUCTION**
Agriculture Monitoring
current state of space and geo-informatics technology for crop monitoring Flood and Drought Disaster

**DISASTER MONITORING**
Agricultural area: extremely exposed and vulnerable to natural disasters

**AGRICULTURE SYSTEMATIC MONITORING**
Crop Area Estimation
Weather and Climate
Crop Stress
Crop Yield Prediction
The Agricultural Systematic Monitoring

Crop Type Identification & Mapping

Crop Monitoring

Crop Condition Assessment

Damage Assessment

Field Monitoring Networks

Crop Disaster Monitoring

Crop Health

CropWatch

CropBarn

CropMet

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Yield estimation was obtained based on estimated area and the average yield per area provided by the Office of Agricultural Economics.

Several passive sensors and active onboard different satellites were used to monitor the crop areas every week.
Field work and Data Validation

Tillering

Heading

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Rice Monitoring and Yield Estimating

http://rice.gistda.or.th

85% +
FLOOD AND DROUGHT DISASTER

Thailand, an agricultural country and one of the top rice exporters in the world, has been extremely exposed and vulnerable to natural disasters caused by hydro-meteorological hazards particularly floods and droughts.

The amount of satellite missions carrying sensors that can be applied for flood and drought management has increased considerably and there is now a general consensus among space agencies and scientists to strengthen the support that satellites can offer for disaster monitoring and warning.
Conceptual framework for agricultural disaster management.

http://www.floodgistda.or.th
http://www.drought.gistda.or.th
http://ecoplant.gistda.or.th
Early detection of regional drought, before it develops into a disaster, is very important.

The VHI monitors and identifies drought-related agricultural impacts. NDVI, VCI, and TCL are used to estimate the VHI. The VHI and all indices are calculated during the dry season on a weekly basis.

The VHI monitors and identifies drought-related agricultural impacts.
Evapotranspiration

MOD021KM
- TOA radiance and reflectance, ground elevation, solar zenith and azimuth angles, satellite zenith and azimuth angles

MOD05
- Column water vapor amounts (PWV)

MOD07_L2
- Air temperature (Ta)

ปริมาณการใช้หน้า  
Evapotranspiration (ET)

ปริมาณรั้งเสเอิสอร์ (Rsn)

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สั่งส่วนการระยะเวลา (EF)

ET

mm/week

0 5 10 15 20 25 30 >30

07/08/2559 – 13/08/2559

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Crop Water Stress Index (CWSI) has also been used for monitoring crop water stress.

\[
CWSI = \frac{(\rho_{SWIR} - \rho_{NIR})}{(\rho_{SWIR} + \rho_{NIR})}
\]
Ground Station: in-situ measurement

22 Stations
23 Stations

22 Stations
23 Stations

Seedling  Tillering  Heading  Harvesting

Time-series images

Phenological profile

Developing the Phenology of Crop Field

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The agreement between satellite data and in-situ data was good enough to suggest that the parameters estimated from satellite sources are reliable.
Satellite Climate/Weather Parameters

Remote Sensing & Direct Measurement

SATELLITE - BASED PRODUCTS FOR CLIMATE
- Air Temperature
- Water Vapour
- Cloud Properties
- Radiation Budget
- Ozone
- Aerosol Properties
- Carbon Dioxide
- Methane
- Albedo
- Land Cover
- FAPAR
- LAI
- Biomass
- Soil Moisture
- Land Surface Temperature
- Sea Surface Temperature
- Sea Level
- Water

In situ measurement

Spectral Signature Calibration Validation Algorithm

Accuracy, Stability, and Resolution
Monitoring stresses in plants: from in situ measurement and space technology

EO provide a supplement to in-situ measurements by offering observations that are regularly, temporally, and spatially reliable.

Satellite-derived data is validated based on in-situ data.

Stresses in plants:
- Water stress
- Heat stress
- Cold stress
- Evapotranspiration

Space Technology for Monitoring Health and Yield of Rice

Policy, Decision Making

Spatial analysis

Healthy Response

Stressed Response

Visible

Red edge

Near-Infrared

Mid-infrared

Near-Infrared

Thermal-Infrared

Farmer

Stresses in plants

Spatial analysis
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- Monitoring
  - Health
- Forecasting
  - Yield
- Warning

Temporal Vegetation (rice) Phenology

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Crop Health Monitoring

Temporal Vegetation (rice) Phenology

Creating the standard criteria for Crop Health Monitoring indices using 5-year historical weekly NASA MODIS data

Generating the Indices Data for Crop Health Monitoring using present (e.g., 2019 and so on) weekly NASA MODIS data

- Normal Situation
+ Actual current rice growth status will compare to the 10 years average normal situation

Analyst every single pixel for the entire country updated weekly

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Rice Yield Monitoring

Northern Thailand
Chiang Rai Province
Lampang Province

Central Thailand
Nakhon Sawan Province
Suphanburi Province

Southern Thailand
Phatthalung Province
Songkhla Province
Pattani Province

North Eastern Thailand
Surin Province
Roi Et Province

Rice Yield Sampling Sites
Rice Yield Monitoring/Estimation

Rice Yield Sampling Sites

Rice Yield Monitoring

Source: Assoc. Prof. Dr. Poonpipop KASEMSAP
Space Technology for Monitoring Health and Yield of Rice

Measure photosynthesis flux

- Monitoring
  - Health
- Forecasting
  - Yield
- Warning

Eddy Covariance Tower

CO-2

ET

GOSAT
(Greenhouse gases Observing Satellite)

Orbiting Carbon Observatory-2 (OCO-2)

Orbiting Carbon Observatory-3 (OCO-3)

Source: Assoc. Prof. Dr. Poonpipop KASEMSAP

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“Man must rise above the Earth—to the top of the atmosphere and beyond—for only thus will he fully understand the world in which he lives”

(Socrates 470 BC-399 BC)

“Man masters nature not by force but by understanding.....”

Jacob Bronowski

‘If You Can't Measure It, You Can't Manage It’... You can't improve It”

Peter Drucker (father of management)
THANK YOU

Delivering Values From Space

www.gistda.or.th
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