Agriculture with Satellite remote sensing & sensors

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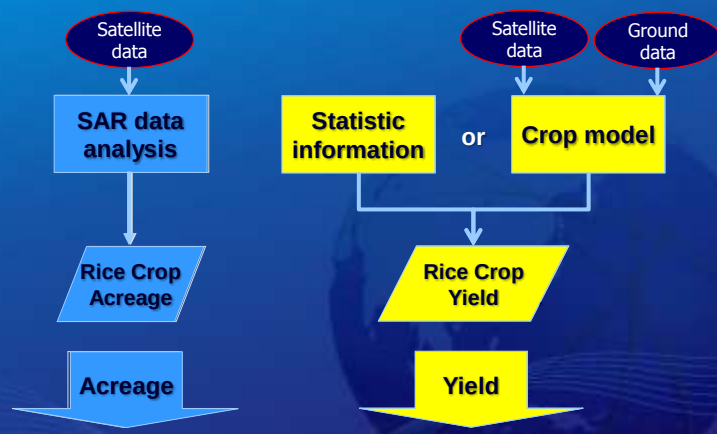
Geo-Informatics and Space Technology Development Agency (Public Organization)

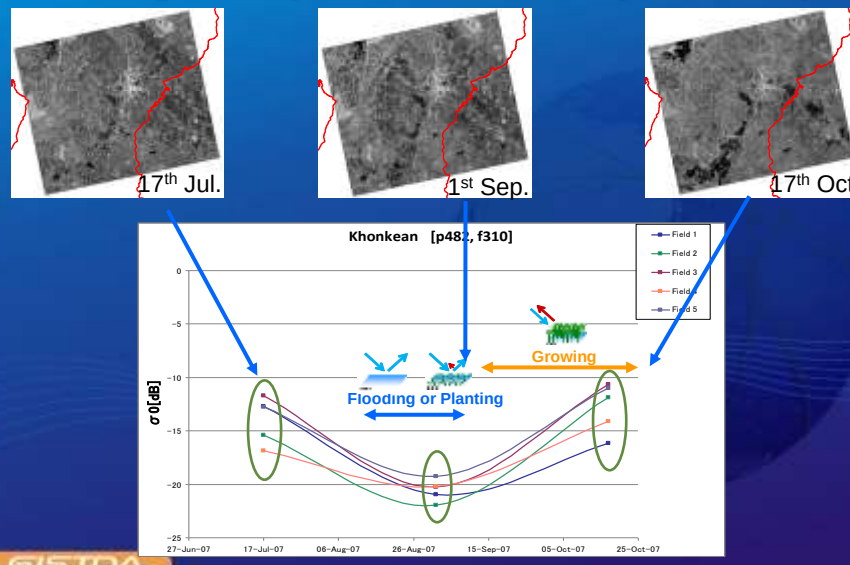
Rice crop working groups accomplishment in 2011

- Develop mock-up system to estimate rice crop production for rain-fed region at Khon Kaen province by using SAR data (ALOS and RADARSAT-2), crop growth model (KKU model) and ground observation data.

Estimation Process

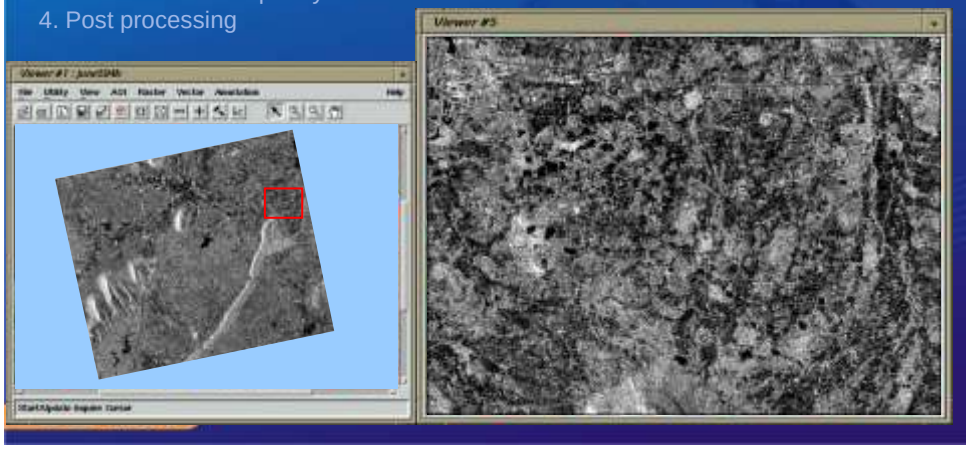


Rice crop acreage estimation using SAR image



Rice crop acreage estimation using SAR image

1. Image input (1)
(Transplanting season)
2. Image input (2)
(Well growing season)
3. Initial detection of paddy field
4. Post processing



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Rice crop acreage estimation using SAR image

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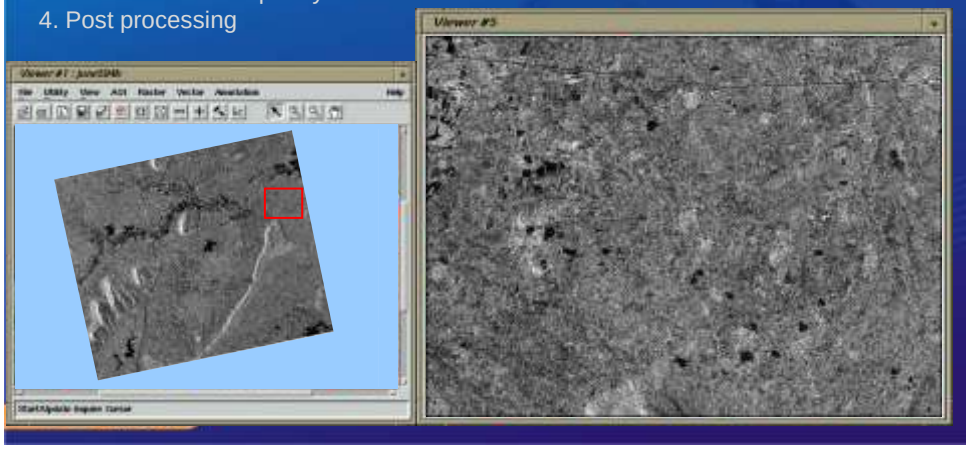

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Rice crop acreage estimation using SAR image

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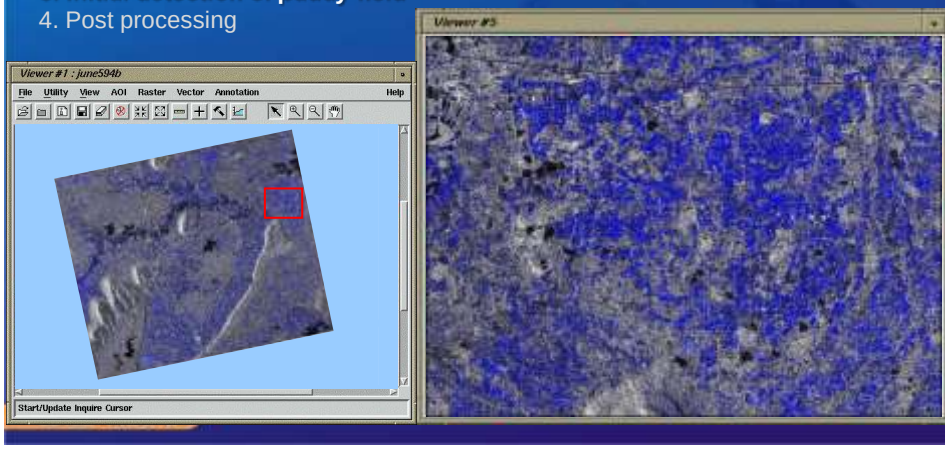
3. **Initial detection of paddy field**
4. Post processing



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Rice crop acreage estimation using SAR image

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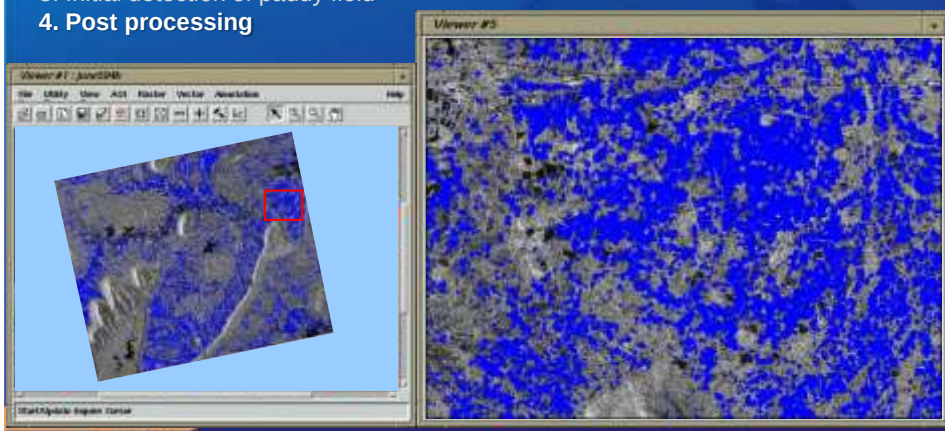
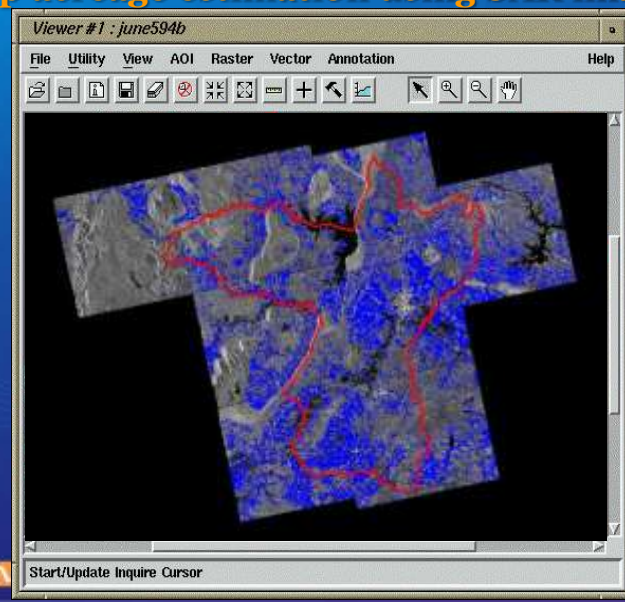
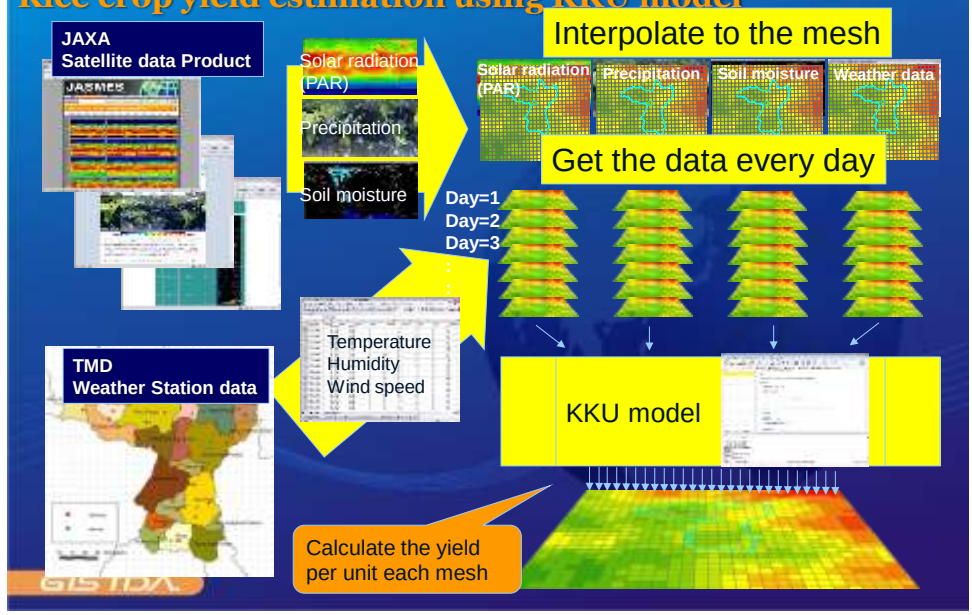


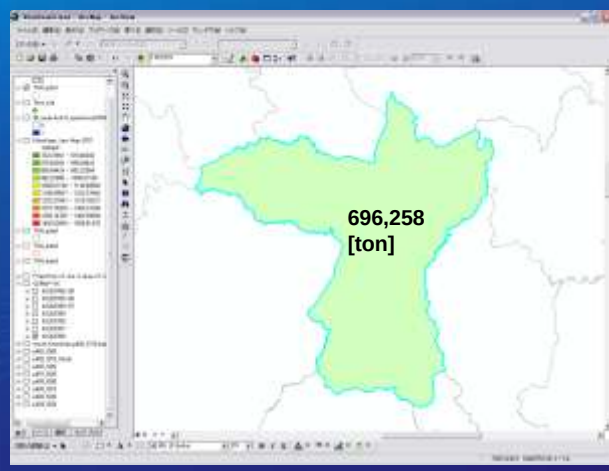
Rice crop acreage estimation using SAR image



Rice crop yield estimation using KKU model



Rice crop production estimation



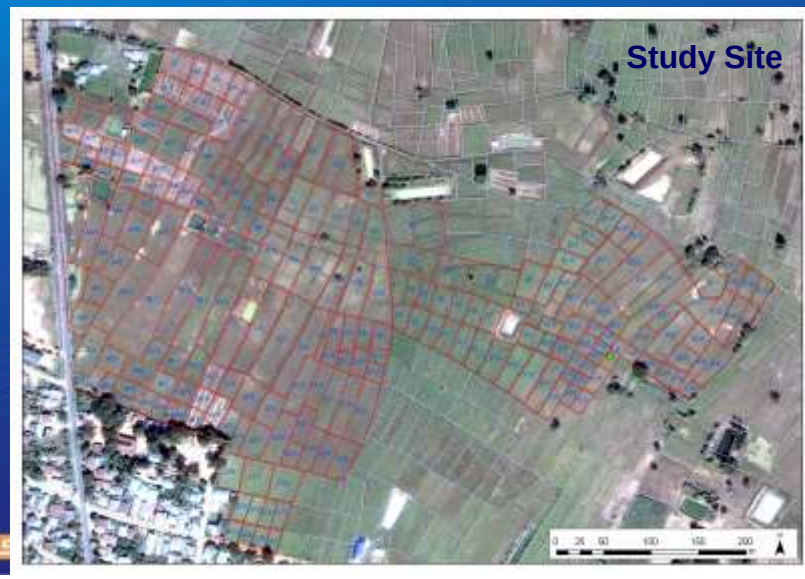
Acreage

*

Yield

Production

Validation



Validation

	Acreage [m2]	Yield [g/m2]	Production [ton]
Result of estimation		Statistic Information*	Acreage x Yield
	164,405.99	203.96	33.53
Validation data by field survey	166,766.39	2.47 – 750.08	40.96
Accuracy	98.58%	–	81.87%

*Statistic information : Average of the past five years.

- Estimating acreage is good.
- Estimating production depends on yield by statistic information.

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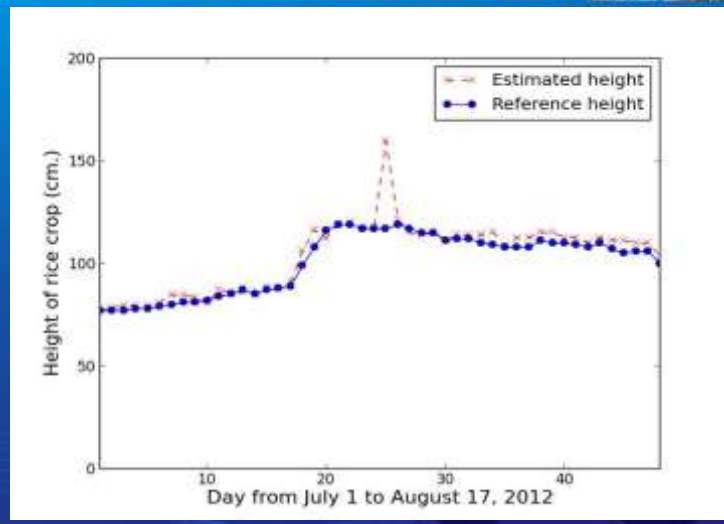
Field server for agriculture monitoring

NECTEC field server

The field server at a rice crop field in Suphanburi province, Thailand

Photo at a rice crop field in Suphanburi province, Thailand on date of July 1, 2012

The flowchart of rice crop height measurement



Sritarapipat, T., Rakwatin, P., Kasetkasem, T., 2014, Automatic Rice Crop Height Measurement using Field Server and Digital Image Processing, Sensors, 14(1), 900-926

Vegetation Index

To measure the levels of live green plants, vegetation indices will be considered

Excessive green (ExG)

$$ExG = 2 \cdot g - r - b$$

When rgb is normalised of RGB component.

$$r = \frac{R}{R+G+B}$$
$$g = \frac{G}{R+G+B}$$
$$b = \frac{B}{R+G+B}$$

Normalized Green-Red Difference Index (NGRDI)

$$NGRDI = \frac{g - r}{g + r}$$

ExGR is a difference of ExG and ExR.

$$ExGR = ExG - ExR$$

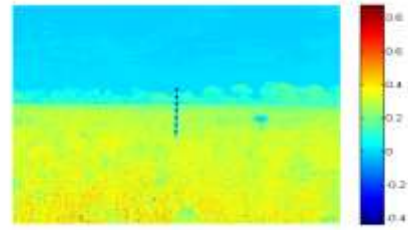
When $ExR = 1.4 \cdot r - g$

Similar in RGB normalized

A. Rice field segmentation

RGB image (Suphan Buri)

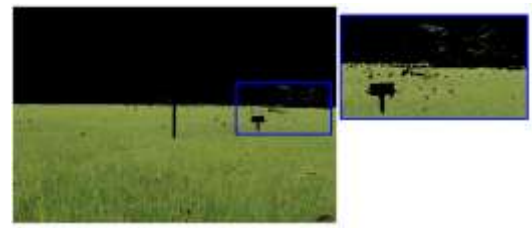
Excessive Green : $ExG = 2 \cdot g - r - b$

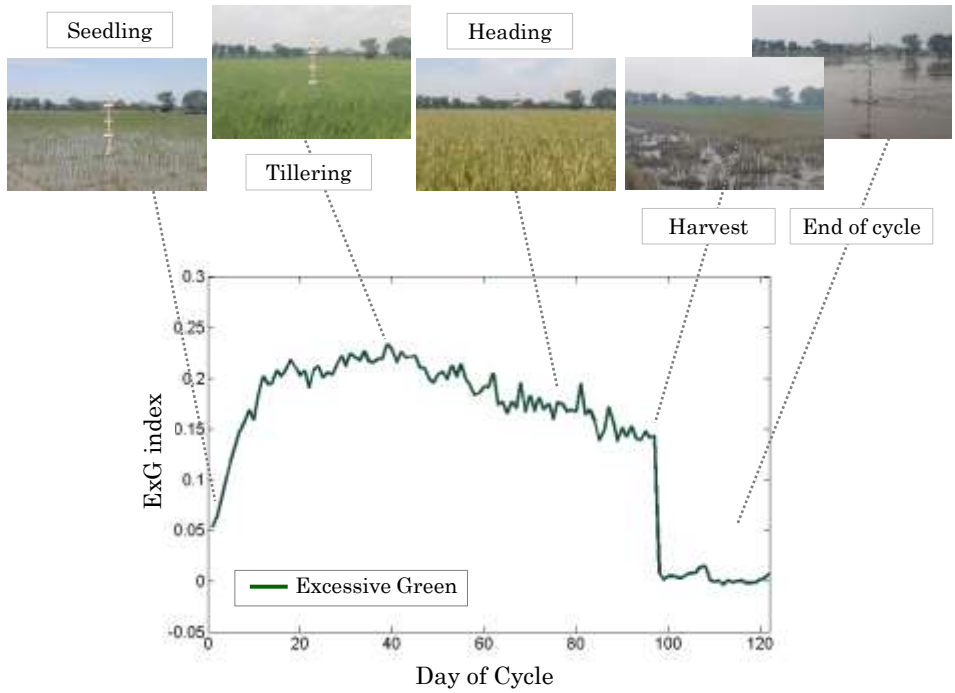


ExG is varied between [-2, 2].

Initial rice field mask

$$Mask_{rice\_field}(i, j) = \begin{cases} 1, & ExG(i, j) \geq 0.2 \\ 0, & otherwise \end{cases}$$

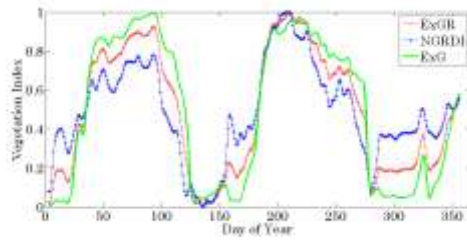




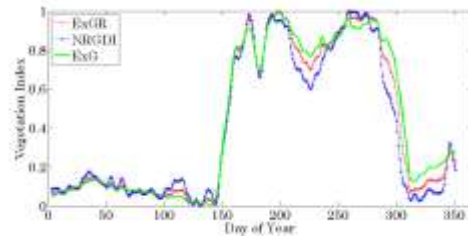
Experiments

Comparative results of vegetation indices (**ExG**, **NGRDI**, **ExGR**)

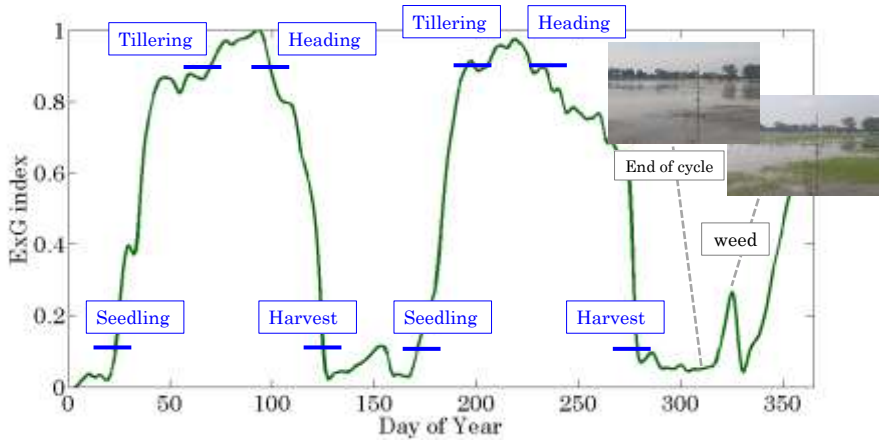
Suphanburi



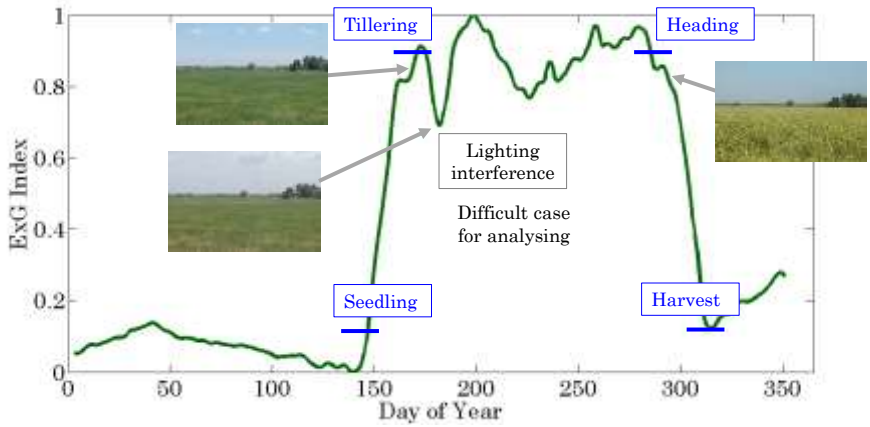
Roi Et

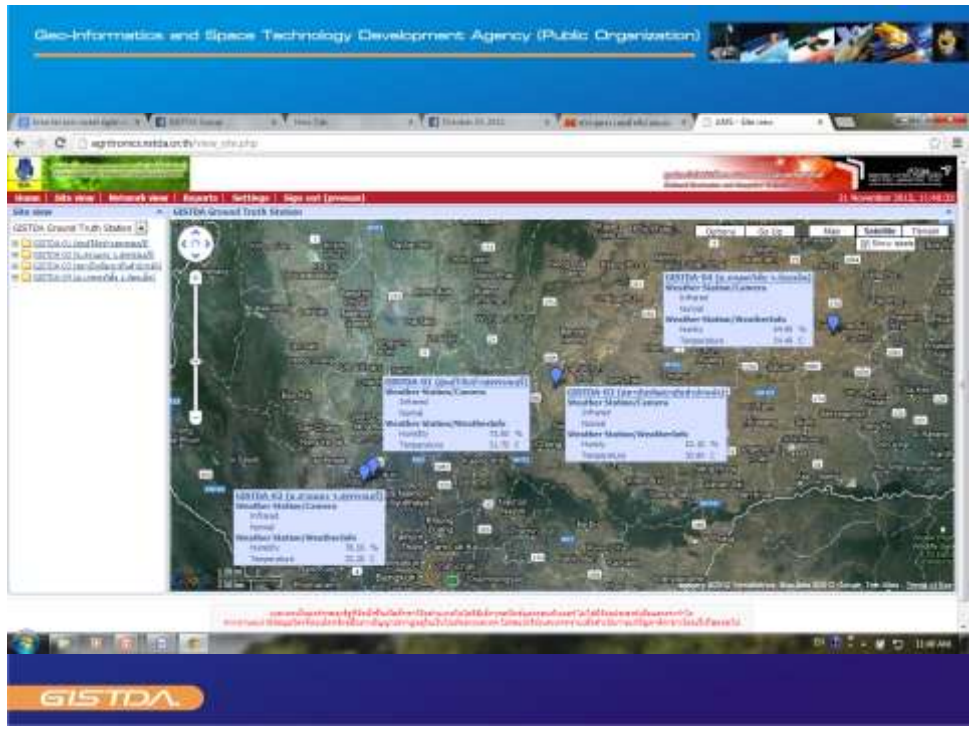


Rice growing stages, Suphanburi



Rice growing stages, Roi Et

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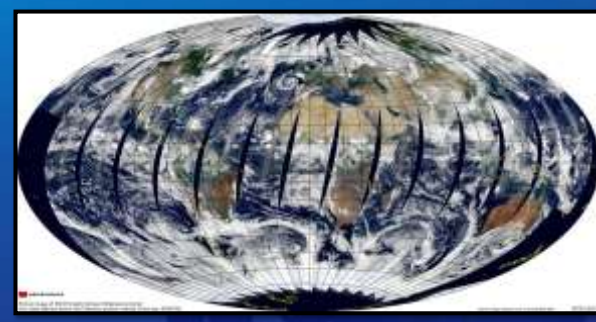
Phenology monitoring using Time-series MODIS imagery

Data Used

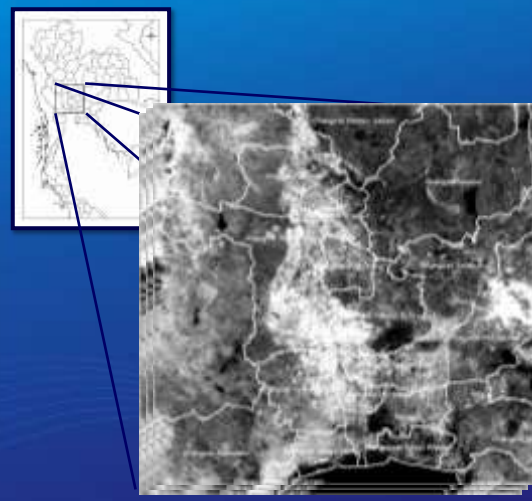
MODIS

Moderate Resolution
Imaging Spectroradiometer



MODIS is a device that is installed on the Terra and Aqua satellites, used to measure the spectrum to track and monitor natural resources. The characteristic of sensor has 705 km. of altitude, 36 bands of product between 0.4 – 14 um., resolution of data is between 250 – 1000 meter, and repeat in every 16 days.

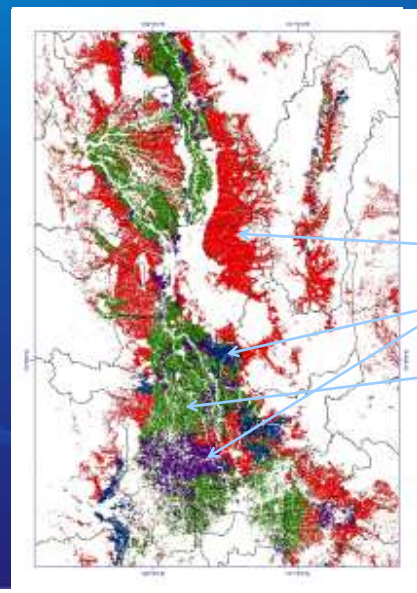
Time-series NDVI



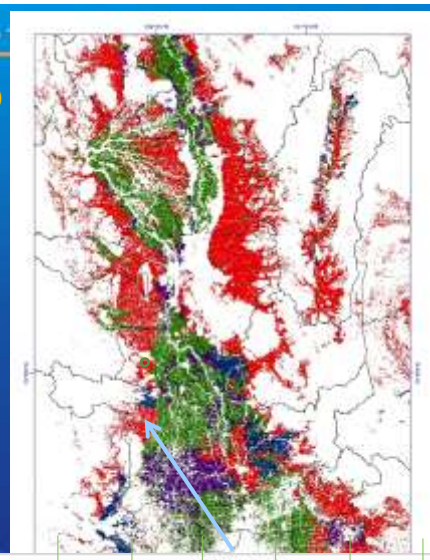
- **The white is area of agriculture activity where is plants spectrum reflection is more than other area, so white in picture is area where have active agricultural.**

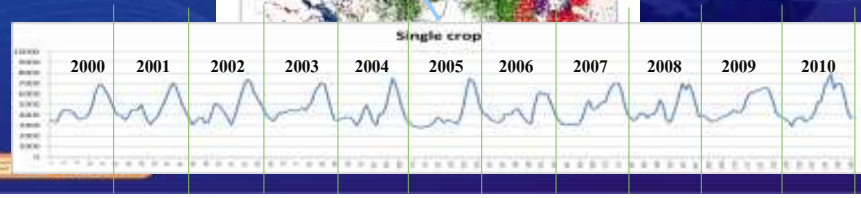
0 1

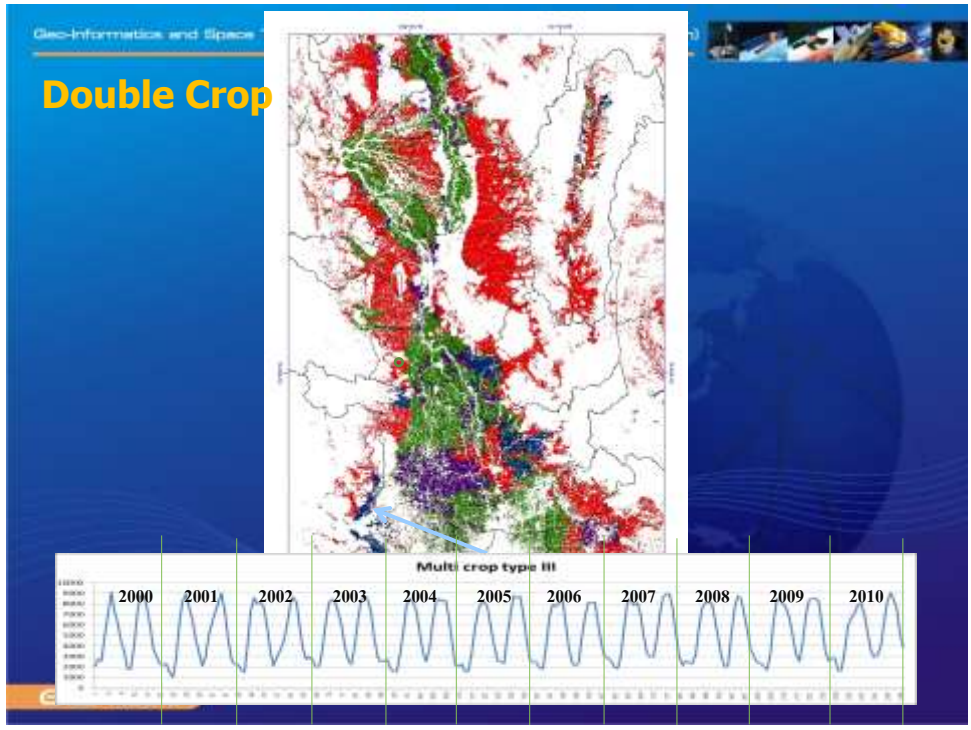
Rice Crop calendar

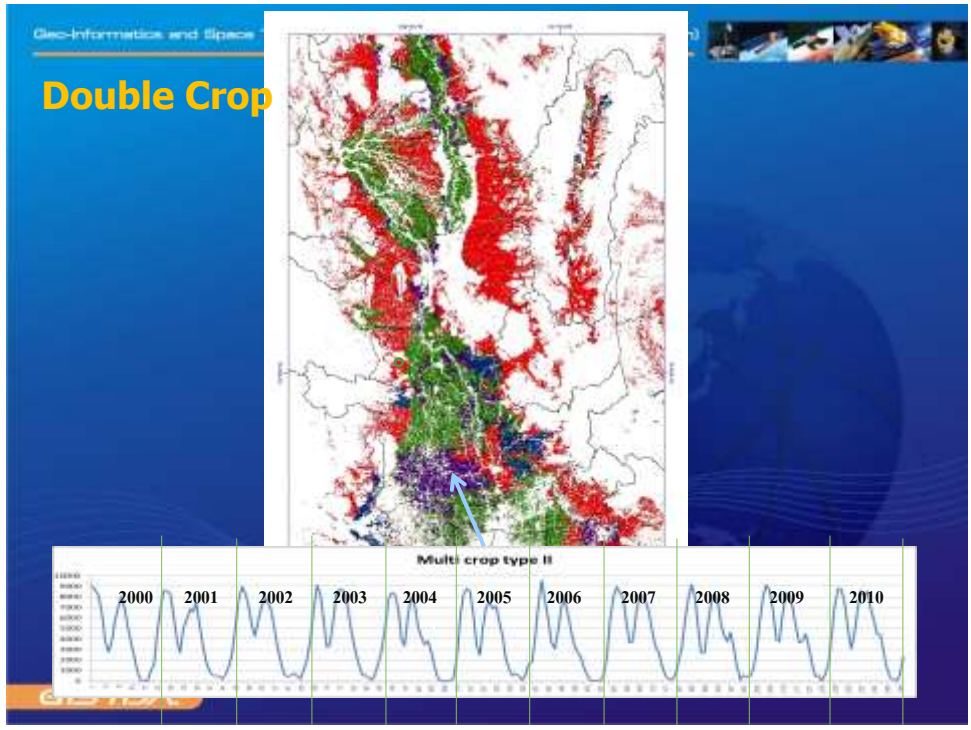


Single Crop



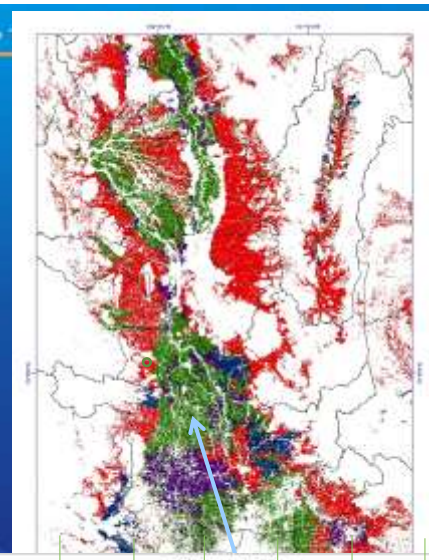


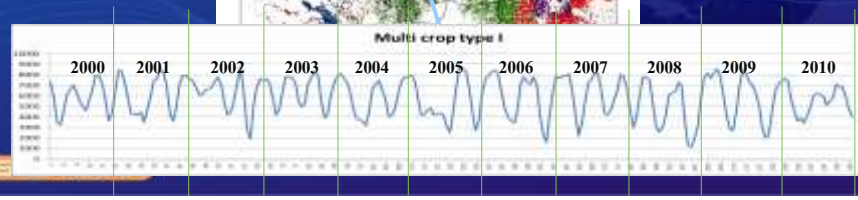

Geo-Informatics and Space
Double Crop
Multi crop type III
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010


Geo-Informatics and Space
Double Crop
Multi crop type II
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010

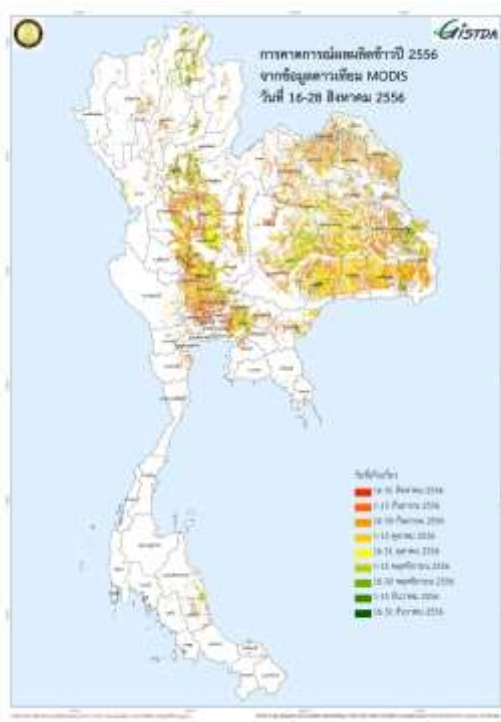
Geo-Informatics and Space

2.5 Crop





Geo-Informatics and Sp



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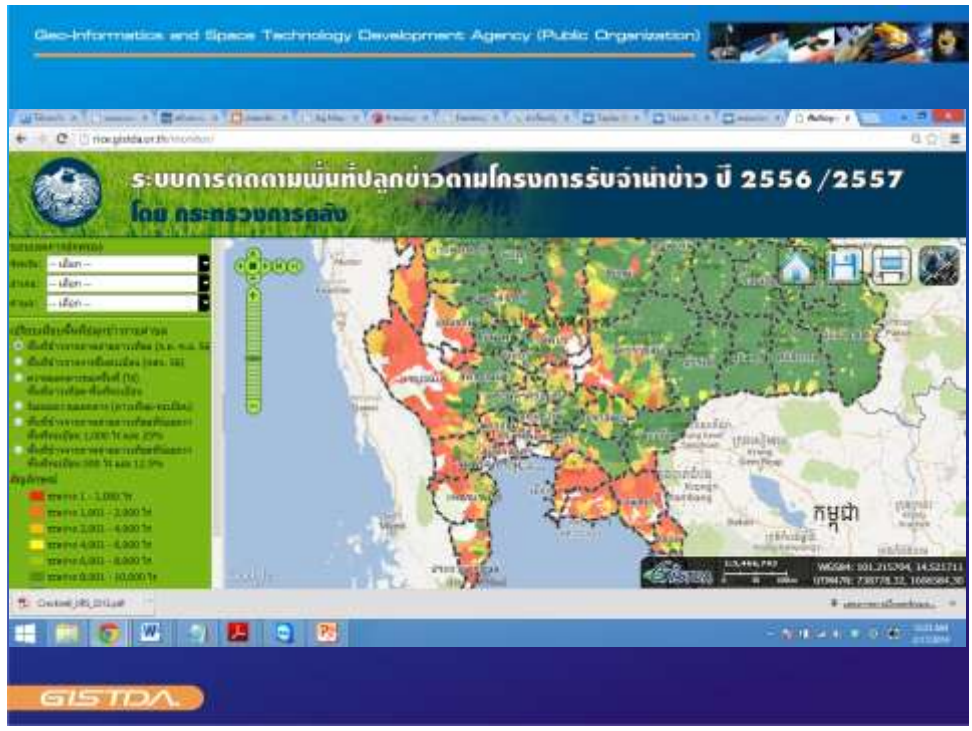


Using Time Series Segmentation for Deriving Vegetation Phenology Indices from MODIS NDVI Data

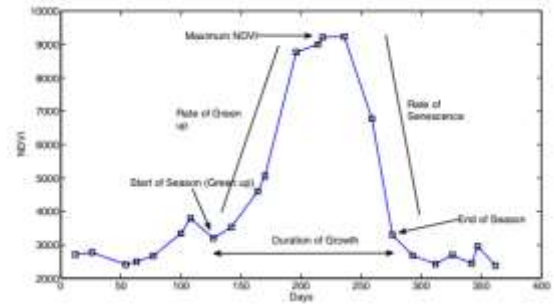


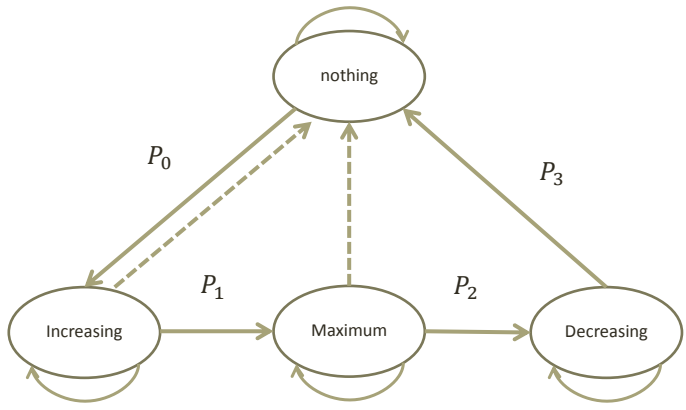
Figure 1. Phenological Characteristics from NDVI Time Series for a Cropland Site (Bondville, USA, 2006)

Ref:

Chandola, V.; Dafeng Hui; Lianhong Gu; Bhaduri, B.; Vatsavai, R.R., "Using Time Series Segmentation for Deriving Vegetation Phenology Indices from MODIS NDVI Data," Data Mining Workshops (ICDMW), 2010 IEEE International Conference on , pp.202,208, 13-13 Dec. 2010

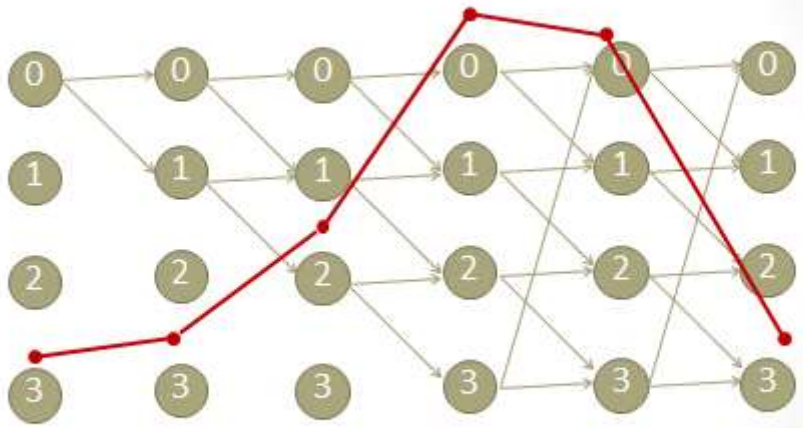
Ideal NDVI Data

HMM for NDVI Data



The Viterbi Algorithm

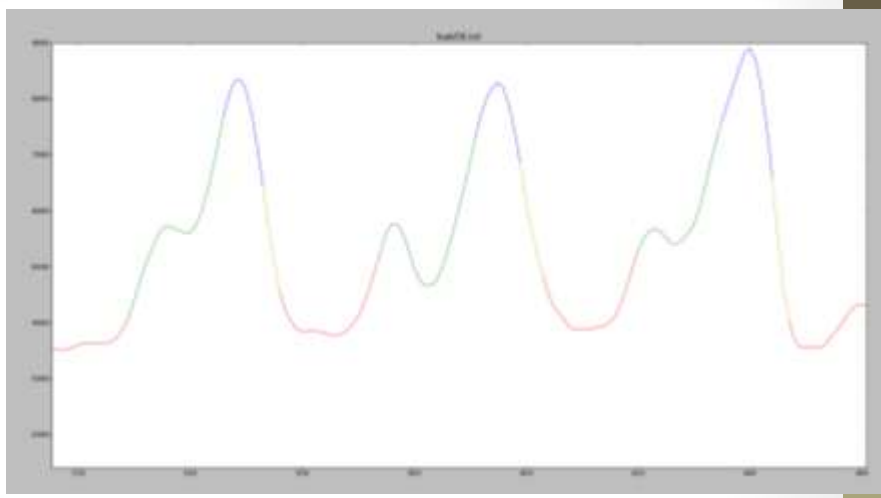
Applied with NDVI Time-series Data



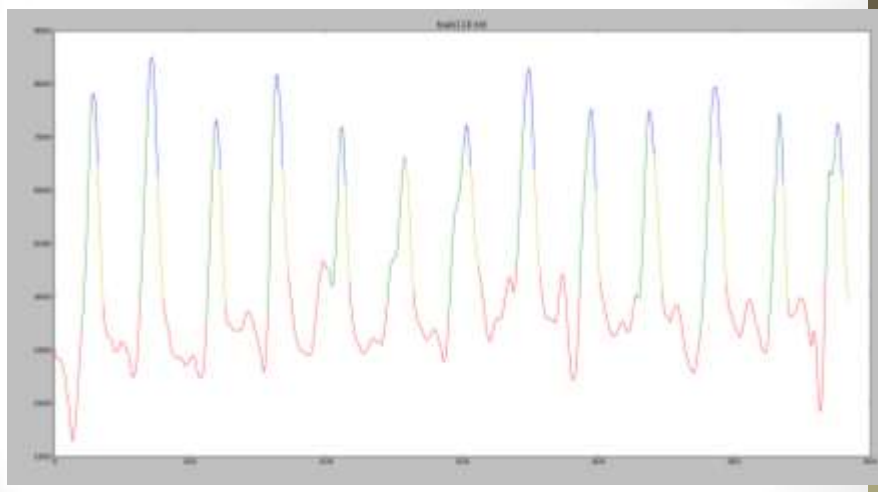
0 = Nothing, 1 = Increasing, 2 = Maximum, 3 = Decreasing

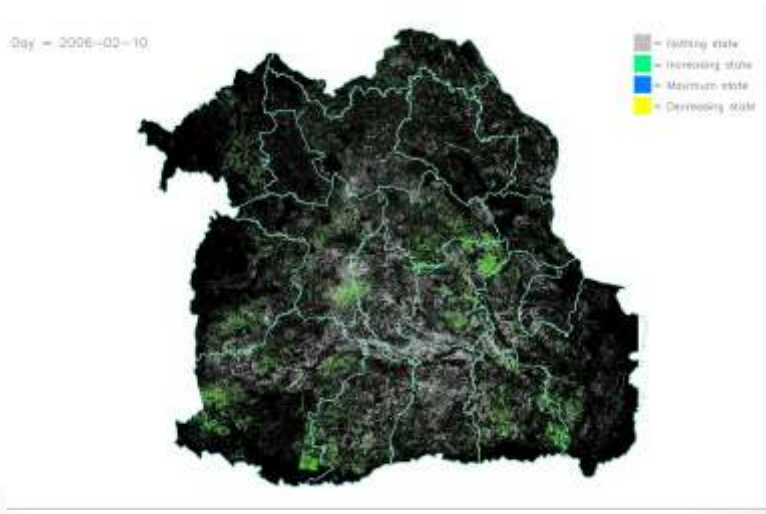
= NDVI data

Result



Result




Day = 2006-02-10
Nothing state
Increasing state
Maximum state
Decreasing state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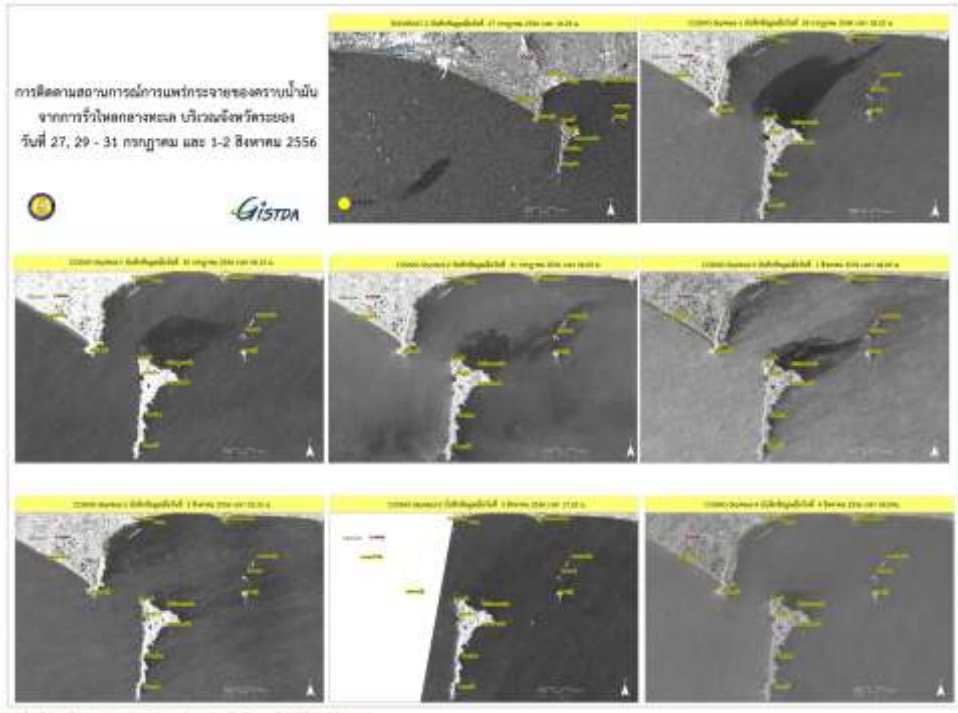
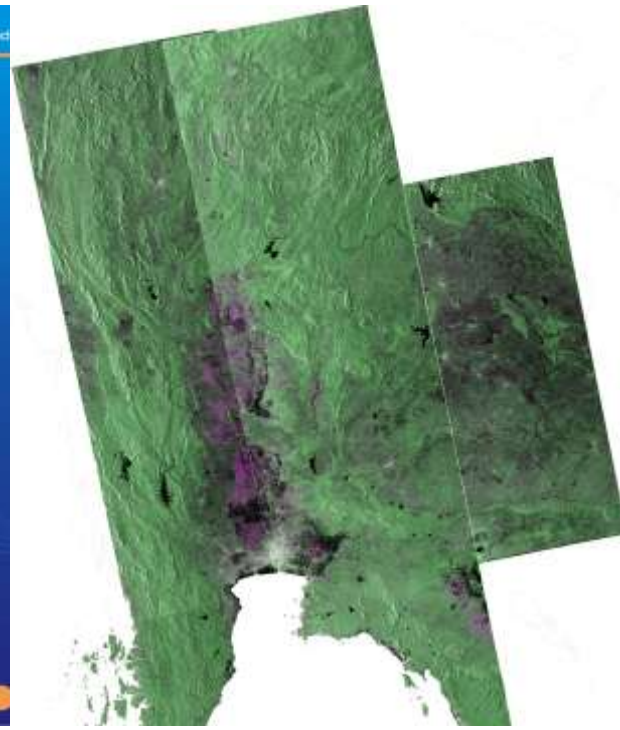
Update 30.08.2013


การติดตามสถานการณ์การแพร่กระจายของคราบน้ำมัน
จากการรั่วไหลกลางทะเล บริเวณจังหวัดระยอง
วันที่ 27, 29 - 31 กรกฎาคม และ 1-2 สิงหาคม 2556
GISTDA

Geo-Informatics and



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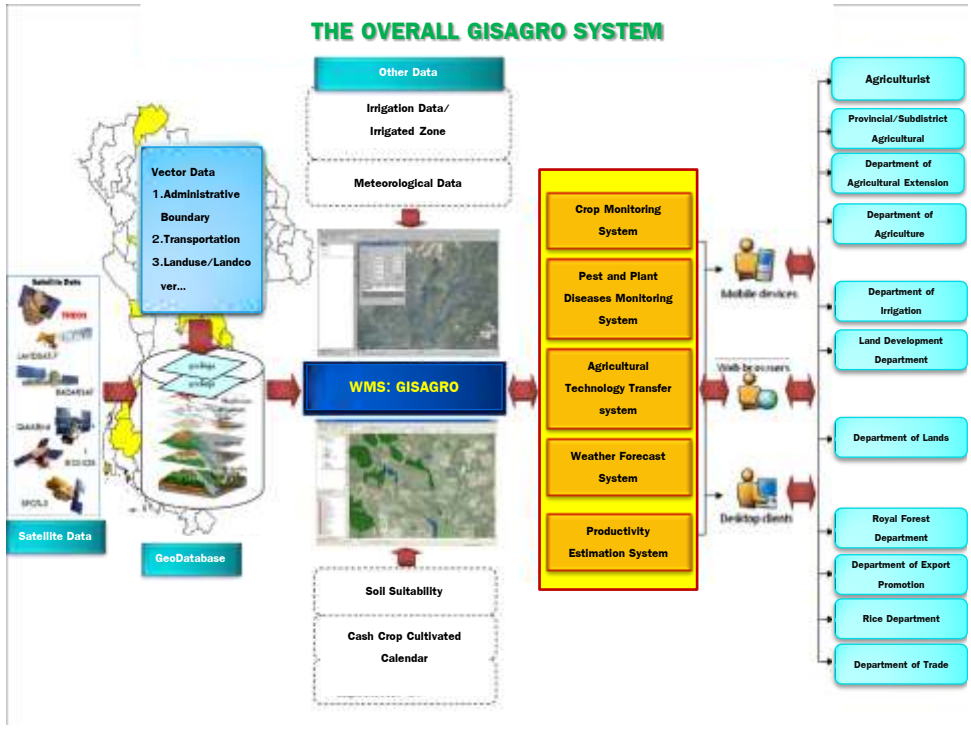
GISAGRO project

for Agriculture Effectiveness and Efficiency Management in Thailand



Overview

Main Factors

Longan Precision Farming

QC Management

Cultivated Planning

Main Agricultural Products in Thailand

Overview

Main Factors

Longan Precision Farming

QC Management

Cultivated Planning

Main Factors Quality Agricultural Products

Overview

Main Factors

Longan Precision Farming

QC Management

Cultivated Planning

Longan Quality Control

Overview

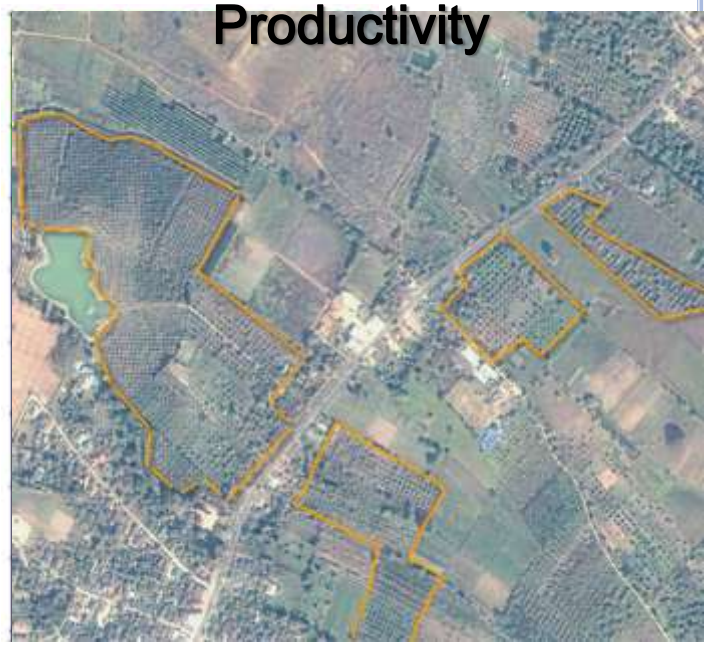
Main Factors

Longan Precision Farming

QC Management

Cultivated Planning

Longan GIS Productivity



Overview

Main Factors

Longan Precision Farming

QC Management

Cultivated Planning

Initial Meeting with Farmers

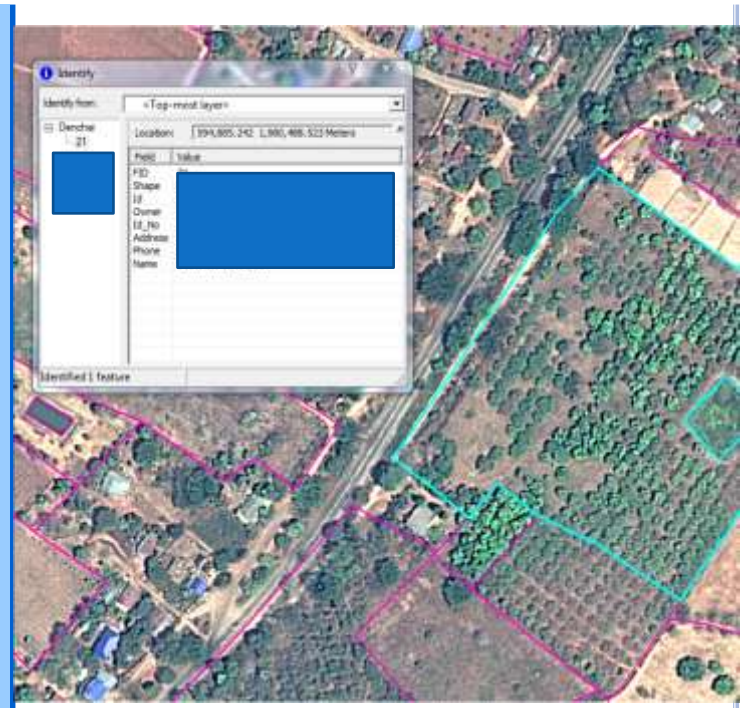
Overview

Main Factors

Longan Precision Farming

QC Management

Cultivated Planning



Overview

Main Factors

Longan Precision Farming

QC Management

Cultivated Planning

Farm Assistant Training

Overview

Main Factors

Longan Precision Farming

QC Management

Cultivated Planning

Surveying & Assisting

Overview

Main Factors

Longan Precision Farming

QC Management

Cultivated Planning

Cultivating & Grading

Overview

Main Factors

Longan Precision Farming

QC Management

Cultivated Planning

Cultivated Planning

Ambassador of India and Counselor in Chiangrai

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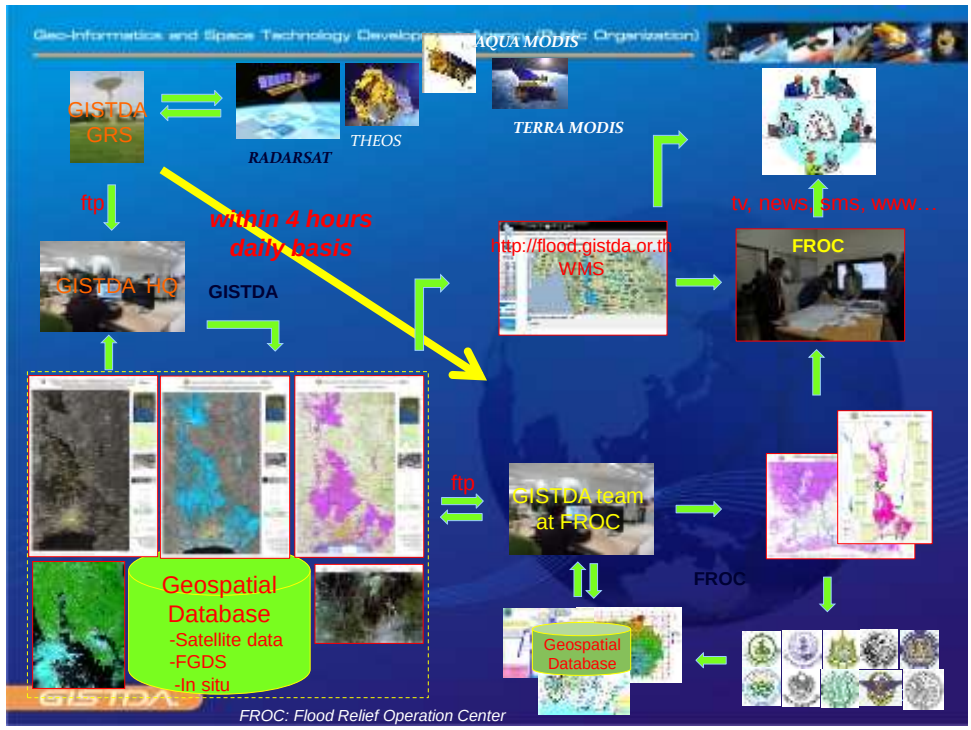
Agriculture and flood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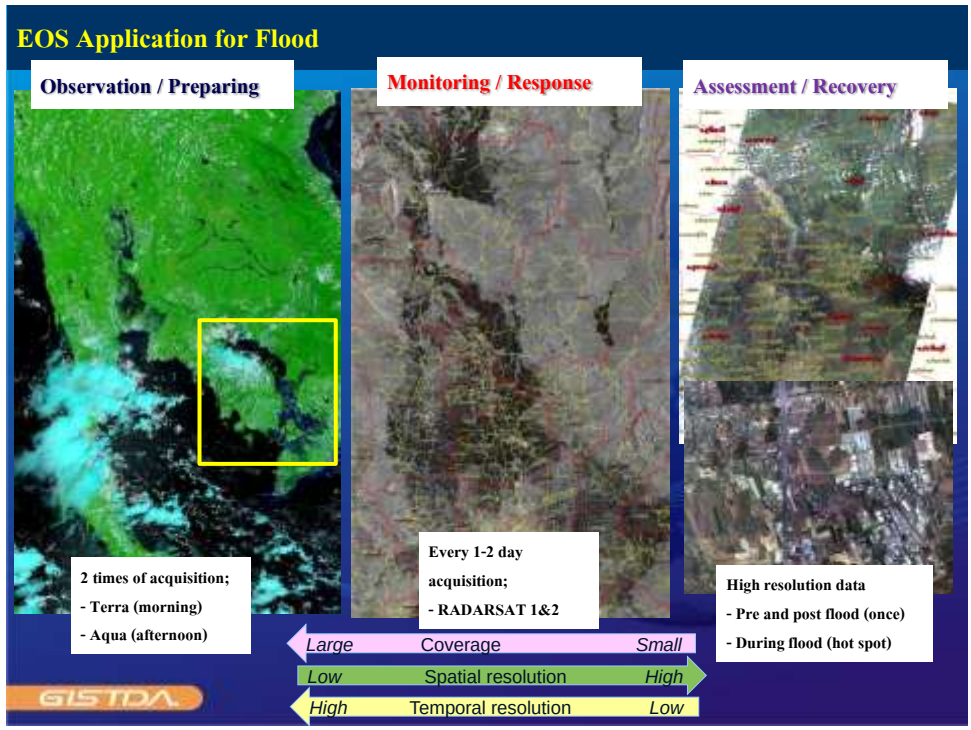
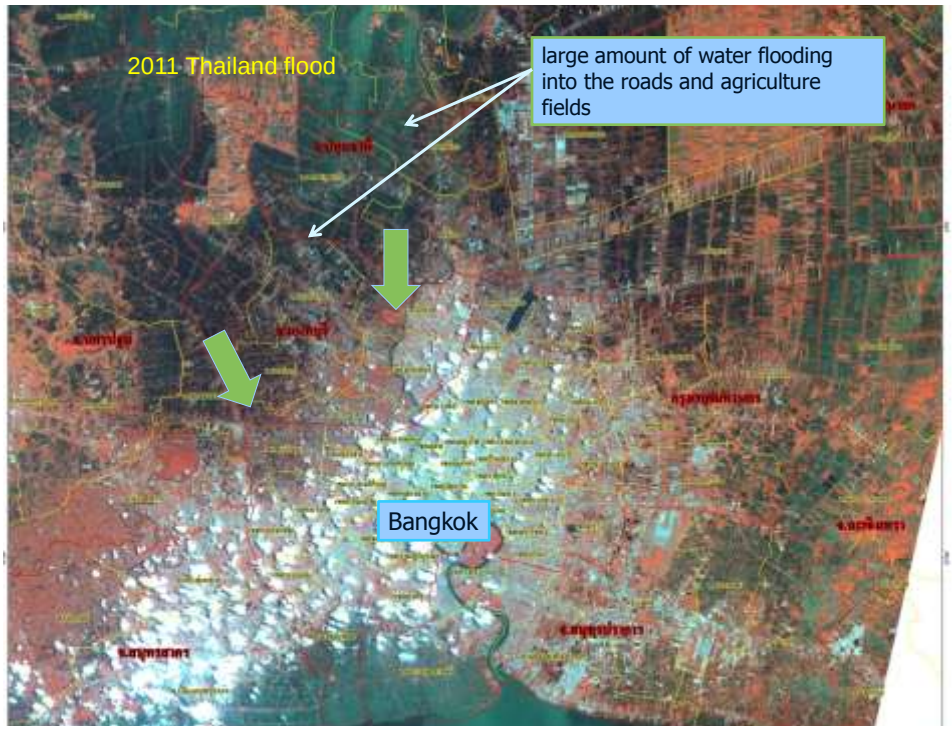
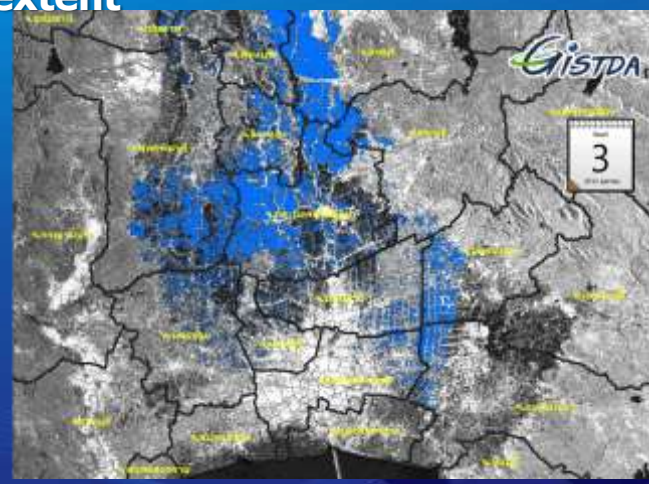
AQUA MODIS
TERRA MODIS
GISTDA GRS
RADARSAT
THEOS
ftp
within 4 hours daily basis
GISTDA HQ
GISTDA
http://flood.gistda.or.th WMS
FROC
tv, news, sms, www…
ftp
GISTDA team at FROC
FROC
Geospatial Database
-Satellite data
-FGDS
-In situ
Geospatial Database
FROC: Flood Relief Operation Center


EOS Application for Flood
Observation / Preparing
Monitoring / Response
Assessment / Recovery
2 times of acquisition;
- Terra (morning)
- Aqua (afternoon)
Every 1-2 day acquisition;
- RADARSAT 1&2
High resolution data
- Pre and post flood (once)
- During flood (hot spot)
Large Coverage Small
Low Spatial resolution High
High Temporal resolution Low



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

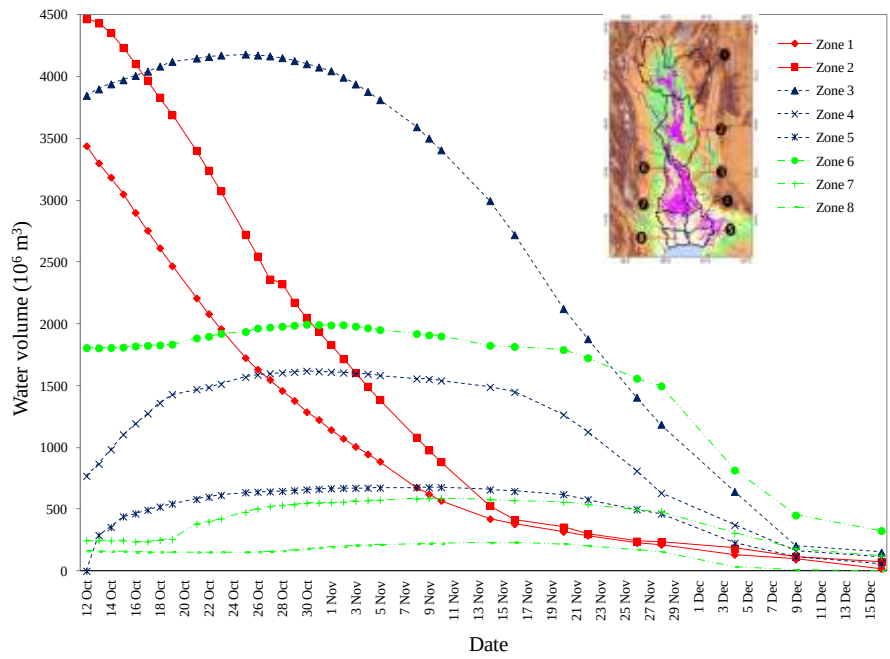
Flood extent



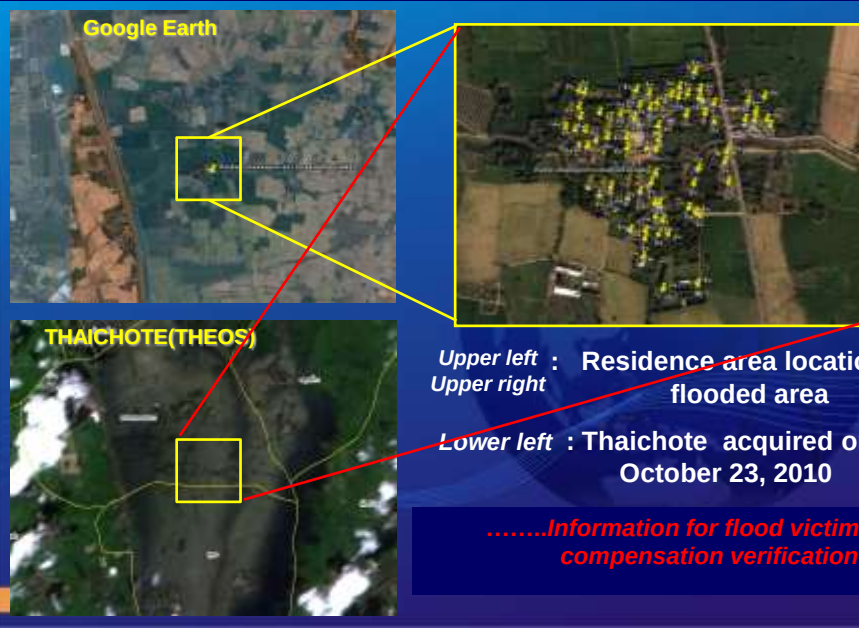
Rakwatin, P., Sansena, T., Marjang, N., Rungsipanich, A., 2013, Using multi-temporal remote sensing data to estimate 2011 flood area and volume over Chao Phraya river basin, Thailand. Remote Sensing letters, 4(3), 243-250

GISTDA

Water volumes in Chao Phraya river basin



Affected houses localization by HRS Data



Upper left : Residence area location in *Upper right* flooded area

Lower left : Thaichote acquired on October 23, 2010

…….Information for flood victims compensation verification

ตารางสรุปพื้นที่ได้รับผลกระทบแบ่งตามการใช้ประโยชน์ที่ดินและช่วงระยะเวลาเกิดอุทกภัย

Land use	Flood extent (Unit: Ha)			
	1-7 Day	8-15 Day	> 15 Day	Total
Rice	1,261,875	207,960	726,973	2,196,808
Farm	40,639	2,608	15,058	58,306
orchard	85,131	12,876	31,520	129,527
Aquaculture	73,617	16,750	42,034	132,401
อื่นๆ	400,750	93,054	254,495	748,299
Total area	1,862,013	333,248	1,070,080	3,265,341