

# Outline of GEOGLAM Asia Rice crop team activity - Rice crop monitoring and outlook



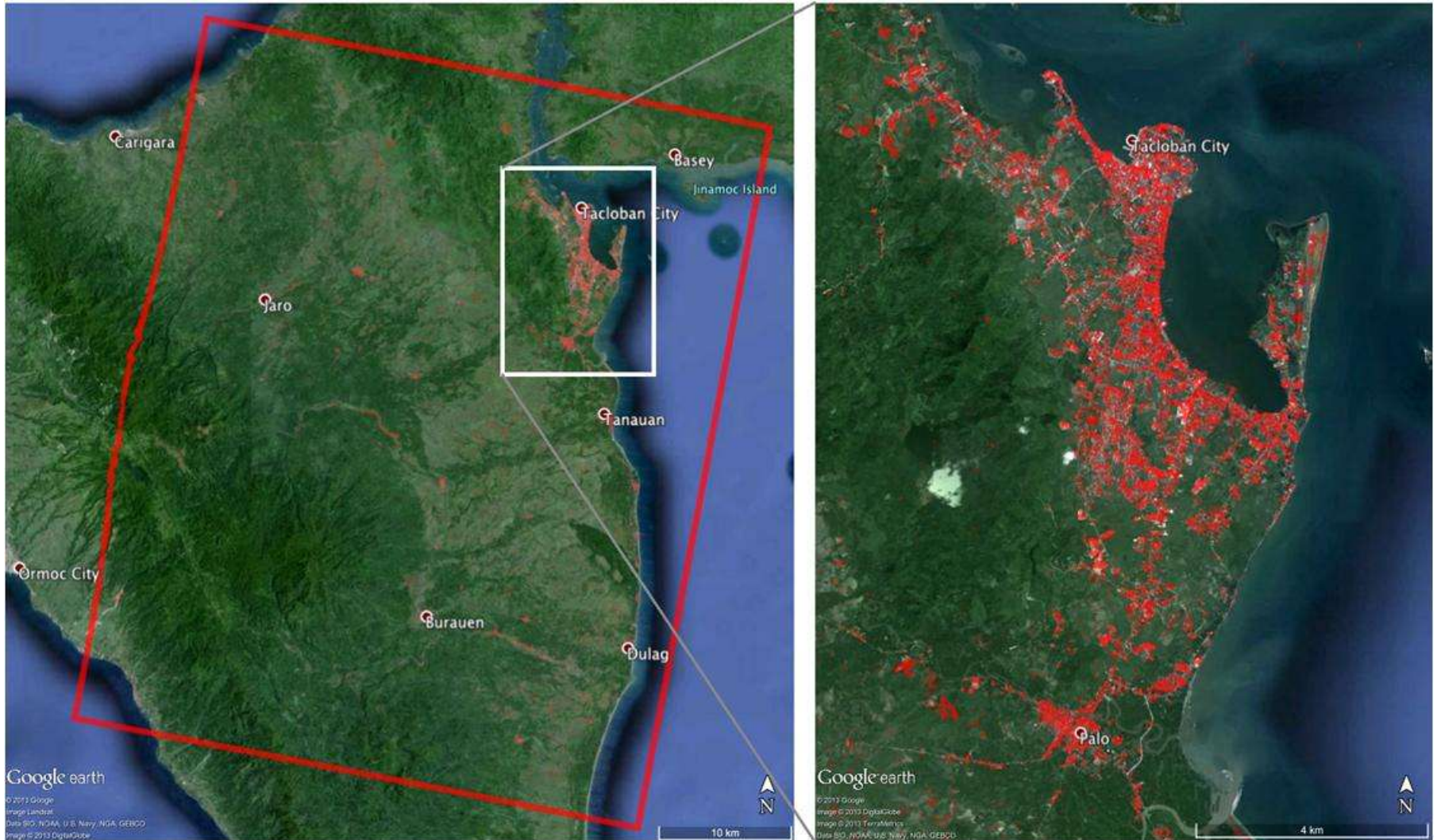
Shin-ichi Sobue

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On behalf of the Asian rice crop estimation and monitoring team

# NASA-Generated Damage Map To Assist With Typhoon Haiyan Disaster Response

<http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA17687>



# G20 France 2011 Summit Final Declaration

## ❖ **Action Plan on food price volatility and agriculture**

26. We recognize the importance of **timely, accurate and transparent information in helping to address food price volatility**, and agree on the need to improve the quality, reliability, accuracy, timeliness and comparability of data on agricultural markets (production, consumption and stocks). We decide to launch:

- Agricultural Market Information System (AMIS),
- **Global Agricultural Geo-Monitoring Initiative (GLAM).**

[Meeting of G20 Agriculture Ministers, 2011]

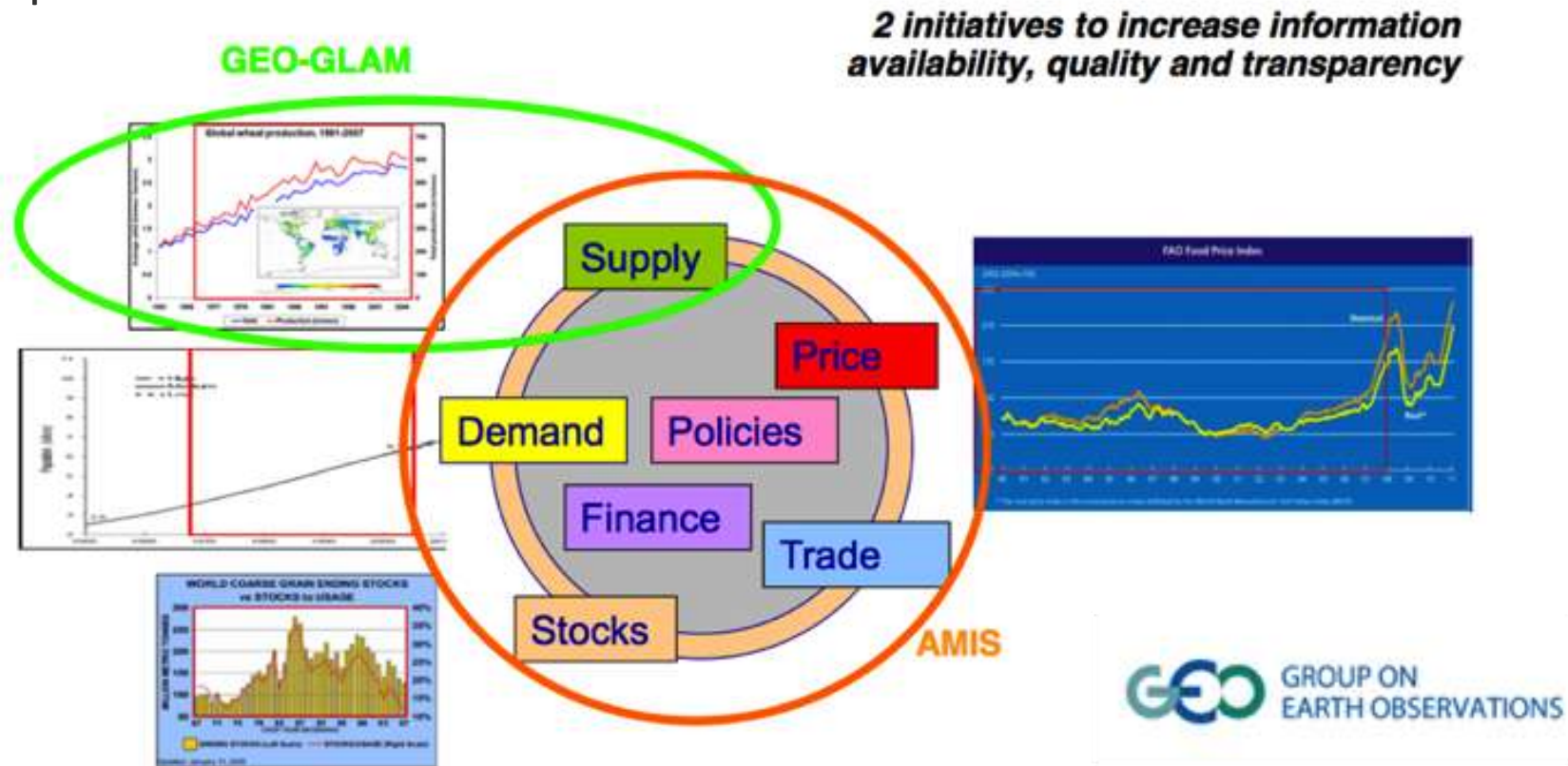
[G20 France 2011 Summit final declaration, 2011]



# Contributions of Remote Sensing to GLAM

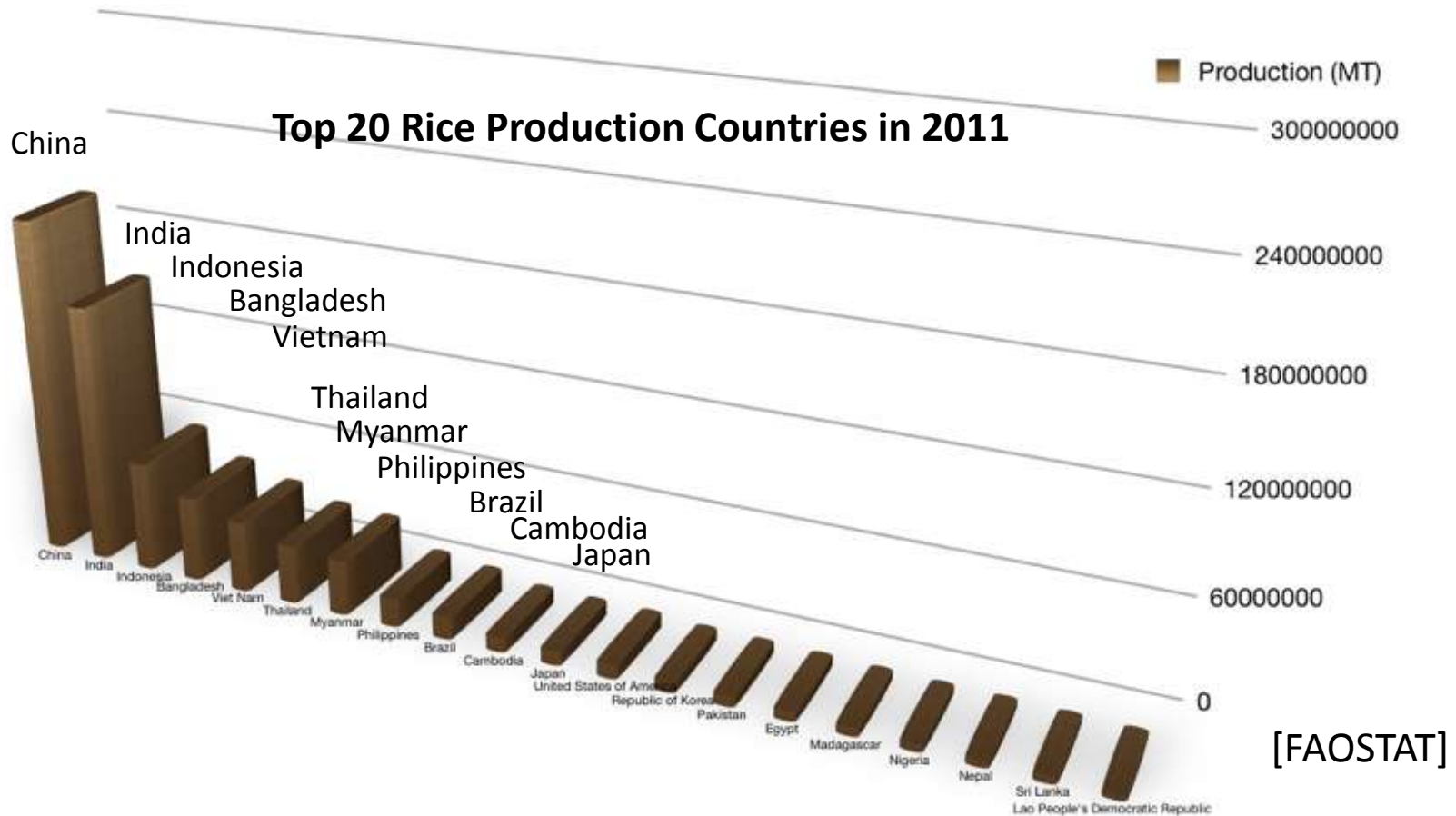
## ❖ Global Agricultural Geo-monitoring Initiative (GLAM)

- Strengthen global agricultural monitoring by improving the use of **remote sensing tools**.
- To enhance **crop production projections** and **weather forecasting**.
- **Useful input for AMIS** concerning the provision of more accurate crop forecasts data.



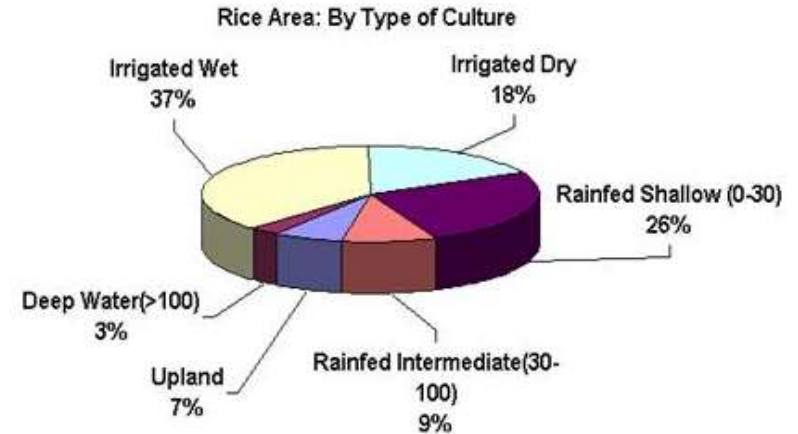
# Importance of Rice in Asia

- ❖ Asian countries are responsible for **approximately 90% of the world rice production and consumptions.**
- ❖ Rice is not just a food, but closely related to culture.



Rice related statics or information are imperative for decision making.

- Multi-season crops
- Variable crop calendars within a season
- Diverse growing practices
- Water resource dependency (Water stress – irrigated, rain-fed)
- Rainy season growth (cloud)



- 2012/7: Report about Asia rice crop monitoring requirement to CEOS UR meeting at Montreal (by Shinichi)
- 2012/9: Develop draft Asia rice crop monitoring work plan
- 2012/11: Review the work plan at ACRS2012 hosted by GISTDA, Thailand with AARS
- 2012/12: Approve the work plan version 1.0 at APRSAF-19 hosted by ANGASA and Japan and submit it to GEO secretariat
- 2013/2 : Revise the work plan version 2.0 with technical demonstration sites at GEOSS-AP
- Monthly Asia rice crop monitoring teleconferences



<http://www.asia-rice.org/files/workplan.pdf>



Asia-RiCE  
Crop Estimation and Monitoring

Home About Work Plan News/Events GEOGLAM Contacts Links

Rice is the staple food for more than half of humanity - with 90% of the world crop grown and consumed in Asia.

**About**

Asia-RiCE is the work of an ad hoc team of stakeholders with an interest in the development of an Asian Rice Crop Estimation & Monitoring (Asia-RiCE) component for the GEO Global Agricultural Monitoring (GEOGLAM) initiative.

Rice is the staple food for more than half of humanity - with 90% of the world crop grown and consumed in Asia.

World population, and therefore demand for food, has increased linearly over the last 100 years (1914-2014), and is projected to keep growing until around 2050 up to a billion inhabitants (United Nations Department of Economic and Social Affairs, Population Division 2004). This conjuncture is prone to create tensions in food markets that could lead to world food price crises, as in 2008 when the price of rice more than doubled in only seven months. In this context of price instability and threatened food security, issues to monitor rice production in real-time are highly needed by governments, traders and decision makers.

Accurate information is needed on the spatial distribution of rice fields, water resource management, risk occurrence and annual production projections. However, most agricultural surveys rely mainly on statistics based on limited ground samplings at which data are extrapolated on a national scale. Although the census can provide statistical estimates, slow and unsystematic collection of data can limit the ability to make timely decisions.

Moreover, rice agriculture is strongly linked to environmental issues, from water management to climate change. For these reasons, long term inter-annual monitoring is also required in order to study the production and climate impacts of these factors. Satellite remote sensing can support the long term monitoring requirement at regional and global scales.

**Objectives**

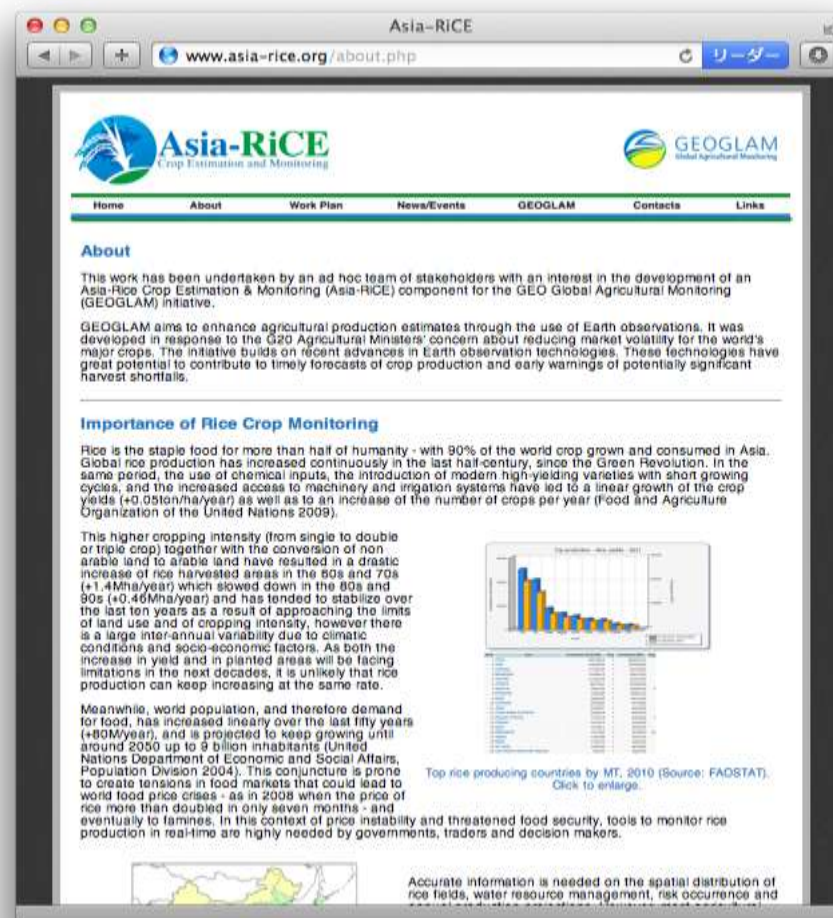
Asia-RiCE develops a work plan for the initiation and development of the Asia-RiCE component for GEOGLAM. The objectives are:

- to ensure that Asian countries receive the full potential benefits of GEOGLAM, and that they are suitably engaged and prepared to do so;
- to ensure that rice crop monitoring issues are given suitable priority and attention within the scope of the full GEOGLAM initiative, including in the development of the observing requirements; and
- to establish a framework for the coordination necessary to engage, manage and support the various stakeholders.

The regional activities suggested by the Asia-RiCE Work Plan will be consistent with and undertaken within the broader GEOGLAM Work Plan and there will be a number of interdependencies and interchanges between the two Plans.

Website provided by JICA

GEO GLOBAL AGRICULTURAL MONITORING



Asia-RiCE  
Crop Estimation and Monitoring

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**About**

This work has been undertaken by an ad hoc team of stakeholders with an interest in the development of an Asia-Rice Crop Estimation & Monitoring (Asia-RiCE) component for the GEO Global Agricultural Monitoring (GEOGLAM) initiative.

GEOGLAM aims to enhance agricultural production estimates through the use of Earth observations. It was developed in response to the G20 Agricultural Ministers' concern about reducing market volatility for the world's major crops. The initiative builds on recent advances in Earth observation technologies. These technologies have great potential to contribute to timely forecasts of crop production and early warnings of potentially significant harvest shortfalls.

**Importance of Rice Crop Monitoring**

Rice is the staple food for more than half of humanity - with 90% of the world crop grown and consumed in Asia. Global rice production has increased continuously in the last half-century, since the Green Revolution. In the same period, the use of chemical inputs, the introduction of modern high-yielding varieties with short growing cycles, and the increased access to machinery and irrigation systems have led to a linear growth of the crop yield (+0.05ton/ha/year) as well as to an increase of the number of crops per year (Food and Agriculture Organization of the United Nations 2009).

The higher cropping intensity (from single to double or triple crop) together with the conversion of non arable land to arable land have resulted in a drastic increase of rice harvested areas in the 50s and 70s (+1.4Mha/year) which slowed down in the 80s and 90s (+0.46Mha/year) and has tended to stabilize over the last ten years as a result of approaching the limits of land use and of cropping intensity, however there is a large inter-annual variability due to climatic conditions and socio-economic factors. As both the increase in yield and in planted area will be facing limitations in the next decades, it is unlikely that rice production can keep increasing at the same rate.

Meanwhile, world population, and therefore demand for food, has increased linearly over the last fifty years (+80M/year), and is projected to keep growing until around 2050 up to 9 billion inhabitants (United Nations Department of Economic and Social Affairs, Population Division 2004). This conjuncture is prone to create tensions in food markets that could lead to world food price crises - as in 2008 when the price of rice more than doubled in only seven months - and eventually to famines. In this context of price instability and threatened food security, tools to monitor rice production in real-time are highly needed by governments, traders and decision makers.

Top rice producing countries by MT, 2010 (Source: FAOSTAT).  
Click to enlarge.

Accurate information is needed on the spatial distribution of rice fields, water resource management, risk occurrence and annual production projections.



- Phase 1A of Asia-RiCE will consist of four technical demonstration sites in three countries
- Each of these will focus on the development of developing provincial-level rice crop area estimations.
- Phase 1B, and/or Phase 2, additional technical demonstrators will be added, and/or the scope may be increased to produce whole country estimates.
  - Thailand will likely be used as a demonstration of whole-country “wall-to-wall” rice crop area estimation capability, using ScanSAR and other data.

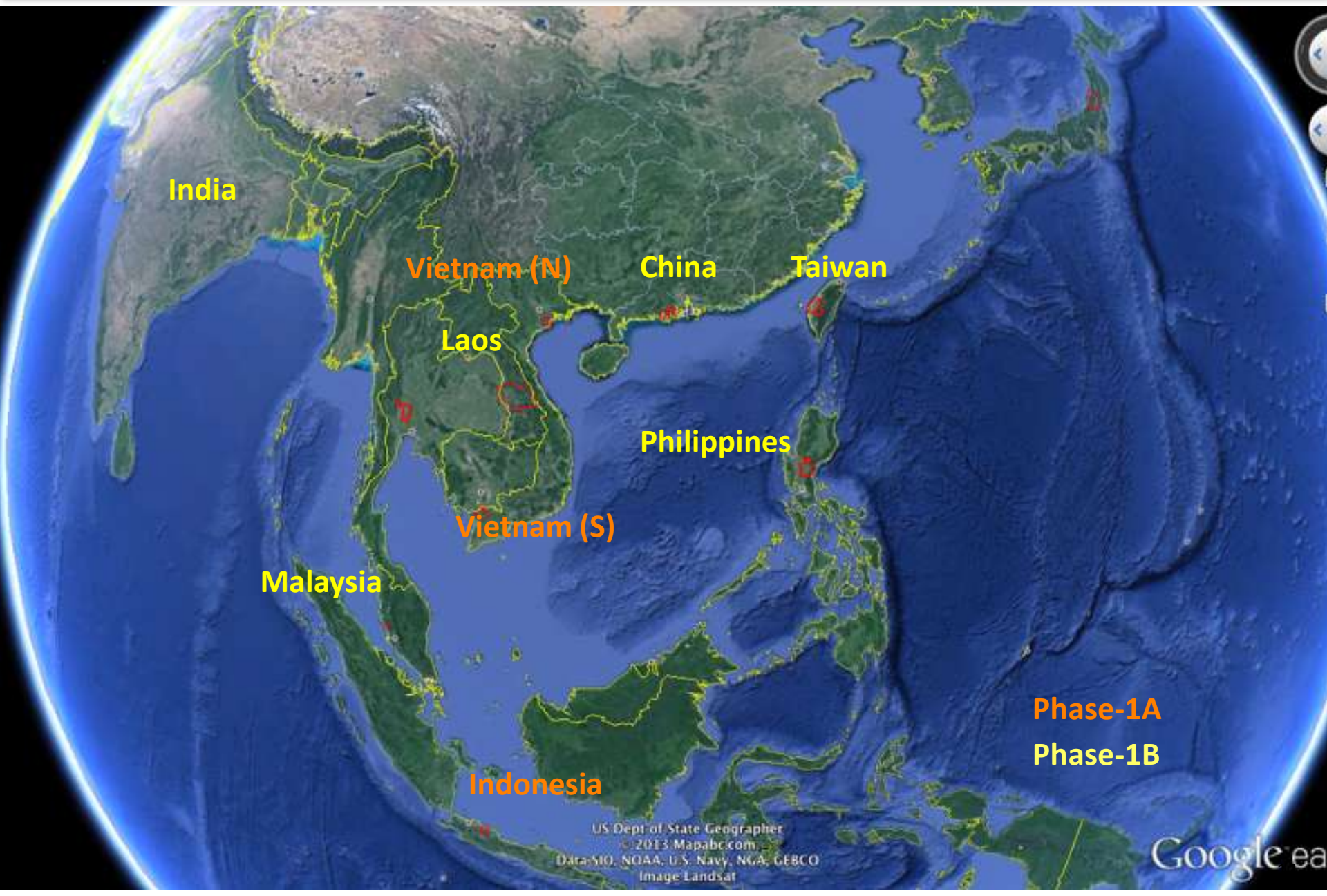
## **Phase-1A**

- Indonesia (Subang, West Java Island);
- Thailand (Suphan Buri province);
- Vietnam (Thai Binh (North));
- Vietnam (An Giang (South));

## **Phase-1B**

- Lao P.D.R. (Savannakhet province);
- Philippines (Nueva Ecija for RIICE project, TBD for BAS);
- China (Taishan, Guangdong Province);
- India (Location TBD);
- Japan (Tsuruoka, Yamagata Prefecture);
- Malaysia (IADA Barat Laut Selangor Province).
- Chinese Taipei (Taiwan) (Chang Hua, Yun Lin, and Chiayi Counties)

# Technical Demonstrator Sites (TDS) for Asia-RiCE



US Dept of State Geographer  
© 2013 Mapabc.com  
Data: SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image: Landsat

Google ea

<b>Product</b>	<b>Description</b>
<b>P1: Rice Crop Area Estimates/Maps</b>	<p>Cultivated area (every year)</p> <p>Inventory of agricultural facilities</p>
<b>P2: Crop Calendars/Crop Growth Status</b>	<p>Timing of sowing, planting, growing and harvesting/growing status.</p> <p>Identification of growth stages</p> <p>Planted area progress (every month) per season.</p> <p>Crop growth anomaly</p>
<b>P3: Crop Damage Assessment</b>	<p>Detection of flooding and other disaster impacted area</p> <p>Detection of drought or inundated area</p> <p>Detection of diseased plants, pests and diseased infestation</p>
<b>P4: Agro-meteorological Information Products</b>	<p>Early warning</p> <p>Anomaly detection (drought, extreme temperatures)</p> <p>Crop growth anomaly</p>
<b>P5: Yield Estimation and Forecasting</b>	<p>Empirical-statistical model estimate</p> <p>Crop-growth simulation model estimates</p>

# Phase 1A Space Data Requirements

## SAR

Type	Mission/Instrument/Agency	Product(s)
<b>C-Band SAR</b>	Envisat / ASAR / ESA	P1, P2, P3, P5
	RADARSAT / SAR (RADARSAT) / CSA	P1, P2, P3, P5
	RADARSAT-2 / SAR ( RADARSAT-2) / CSA	P1, P2, P3, P5
	RISAT-1 / SAR (RISAT) / ISRO	P1, P2, P3, P5
	Sentinel-1 / C-Band SAR / ESA	P1, P2, P3, P4, P5
<b>L-Band SAR</b>	ALOS / PALSAR / JAXA	P1, P2, P3, P4, P5
	ALOS-2* / PALSAR-2 / JAXA	P1, P2, P3, P4, P5
<b>X-Band SAR</b>	COSMO-SkyMed / SAR 2000 / ASI	P3, P5
	TerraSAR-X / X-Band SAR / DLR	P3, P5

# Phase 1A Space Data Requirements

## Optical

Type	Mission/Instrument/Agency	Product(s)
Optical >100m	Aqua / MODIS / NASA	P2, P4, P5
	SPOT / VGT / CNES	P2, P4, P5
	Terra / MODIS / NASA	P2, P4, P5
	Suomi NPP / VIIRS / NOAA	P2, P4, P5
Optical 10-30m	Landsat-7 / ETM+ / USGS, NASA	P2, P3, P5
	Landsat-8 / OLI / USGS, NASA	P2, P3, P5
	THEOS / MS, PAN / GISTDA	P2, P3, P5
Optical <10m	ALOS / AVNIR-2 / JAXA	P2, P3, P5
	SPOT-5/6 / HRG, HRS / CNES	P2, P3, P5

## Result from Asia rice crop team face-to-face meeting in rice crop workshop in ACRS at Bali co-hosted by MOA and JAXA

### 1. Radarsat-2 JECAM-SOAR proposal by TDSs phase 1

- Submitted: Chinese Taipei, Indonesia, Japan, Malaysia, Philippine, Vietnam
- Preparation: China, India, LaoPDR, Thailand

### 2. RISAT-1 – ISRO: Coordinate with ISRO

### 3. ALOS/ALOS-2

- Completed: ALOS archive to phase 1A TDSs
- ALOS-2 observation planning is underway
- Asia rice crop team plans to submit team JAXA's K&C RA proposal next year (TBD)
- ALOS-2 basic observation plan is at least 7 times a year using ScanSAR

### 4. TerraSAR-X

- Tandem-X science proposal was accepted but there was very few chance to receive Balistic mode of SAR data
- New TerraSAR-X proposal was under-review

### 5. Cosmo-Skymed

- Thai and south Vietnam have some data under their own frameworks
- Need Indonesia data

### 6. Sentinel-1

- Coordinate with ESA

Revised our requirement document of Asia RiCE with adding Indian TDS

# ALOS-2 observation plan draft

## Deforestation

【伐採監視】 年9回(右9回)

・広域観測[350km]、2偏波(HH+HV)、14MHz



## Wet land monitoring

【湿地観測】 年9回(右9回)

・広域観測[350km]、2偏波(HH+HV)、14MHz



Asia rice crop observation area of TDSs are almost same as tropical rainforest deforestation monitoring area using ScanSAR mode with HH+HV



# *Institutional Arrangement for Phase 1A and...*

1. Asian Development Bank - ADB funded project 2013-4 (- Japan Fund for Poverty Reduction)

“R-CDTA 8369: Innovative Data Collection Methods for Agricultural and Rural Statistics”

Aims to assist the selected pilot countries (Lao PDR, Philippines, Thailand, and Viet Nam (North)) in developing and adopting space-based technology (SBT) and similar tool application methods in estimating rice crop area and production.

Under JAXA-ADB agreement (LOI) using JAXA’s satellite data and application

2. APRSAF SAFE projects 2013-4 (Supported by JAXA)

Asia Pacific Regional Space Agency Forum – Space Application for Environment

Aims to encourage environmental monitoring for climate change mitigation and adaptation studies, as well as studies on other forms of practical application, using space applications.

Open to every agency in Asia-Pacific Region for submitting new proposal.

Two prototyping for rice crop monitoring are on-going in Indonesia and South Vietnam

3. IFC, World Bank and JICA

Some discussion with donors about crop insurance to insurance company using space based observation data

4. Other on-going and/or operational activities

FASCAL-India, CropWatch-China, RIICE-IRRI and other R&D in Asia-RiCE team

# Phase 1A: Indonesia

## Indonesia – Subang, West Java Island

**Aim:** To develop and use the rice crop yield estimation model (with a focus on Western Java Island) to provide comprehensive and accurate information to the BPS and Ministry of Agriculture.

**Responsible Agency:** Indonesian National Institute of Aeronautics and Space (LAPAN).

**Technical/Implementation Agency:**

LAPAN, Indonesian Center for Agricultural Land Resources Research and Development (ICALRD), Indonesian Agency of Agricultural Research and Development (IAARD), Ministry of Agriculture (MoA) of Republic of Indonesia, Bogor Agricultural Institute (IPB)

**Links to Existing Agricultural Authorities:** Ministry of Agriculture (MoA).



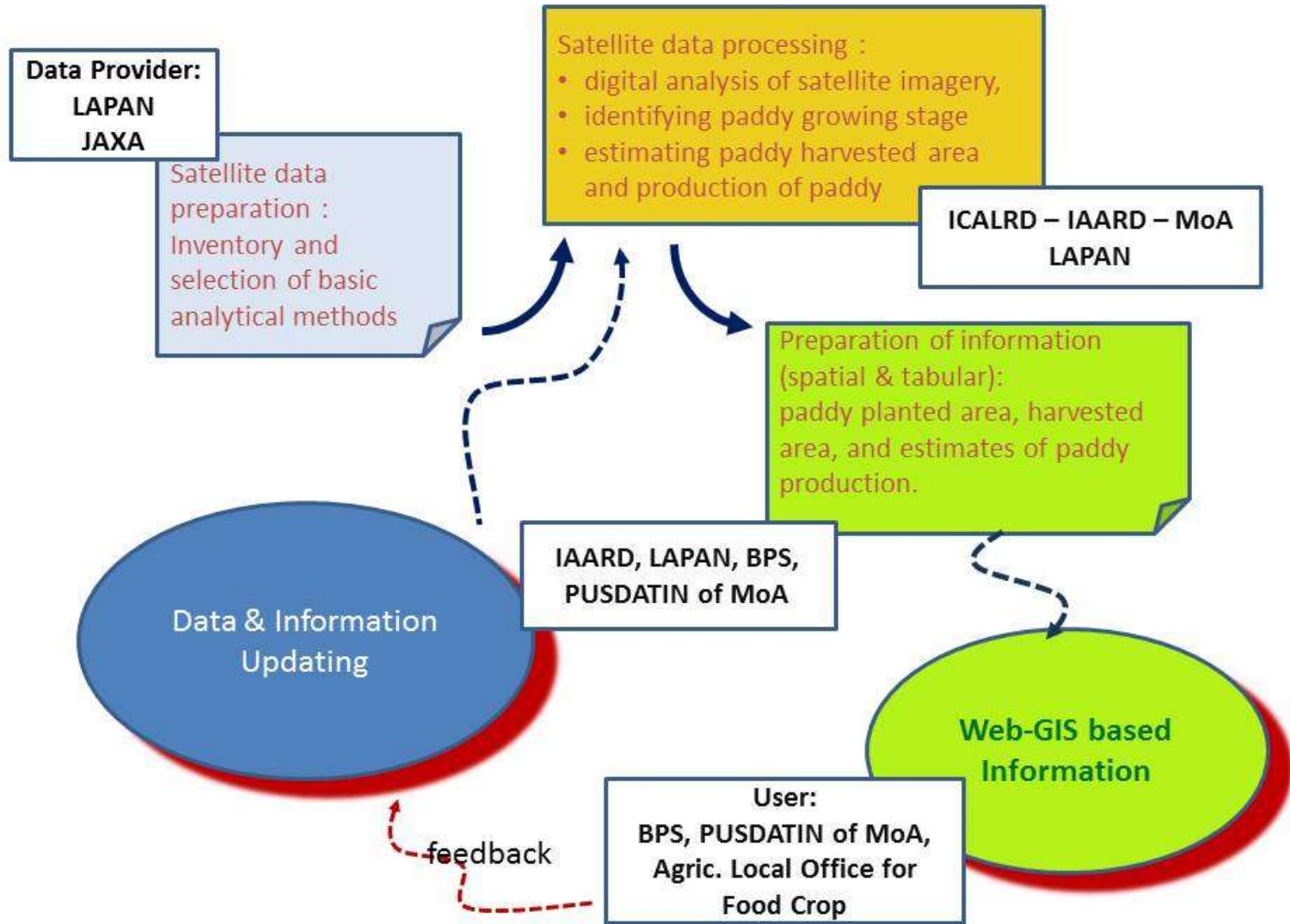
*Subang Region, West Java Island.*

Bounding Box	Coordinates
Top-left	-6.22,107.56
Bottom-right	-6.45,108.21

# Indonesia TDS - framework of operational use after this prototyping

Engagement between space organization, Ministry of Agriculture, university and statistic office with successful prototyping to proof of concept

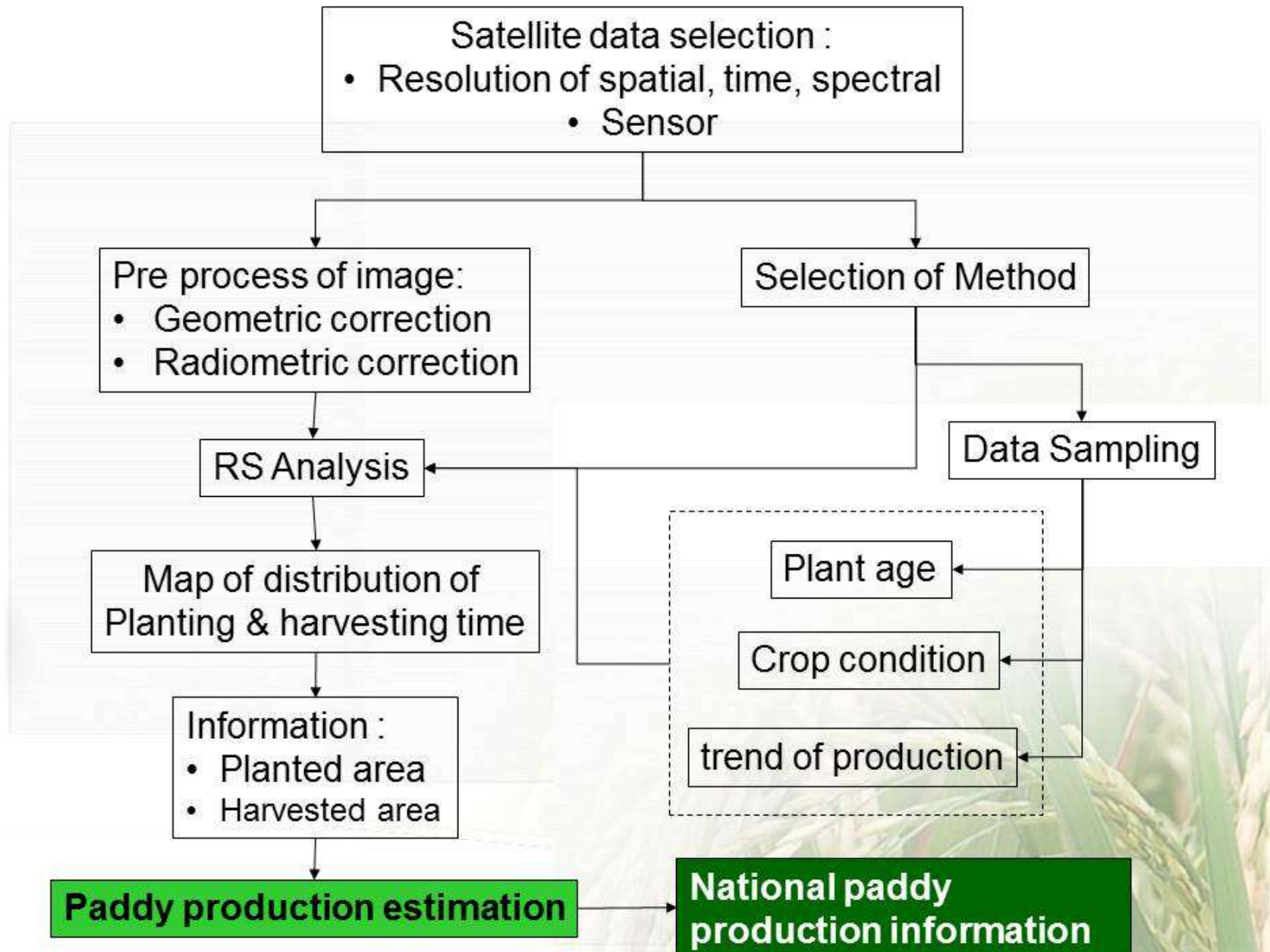
## Framework of operational use after this prototyping



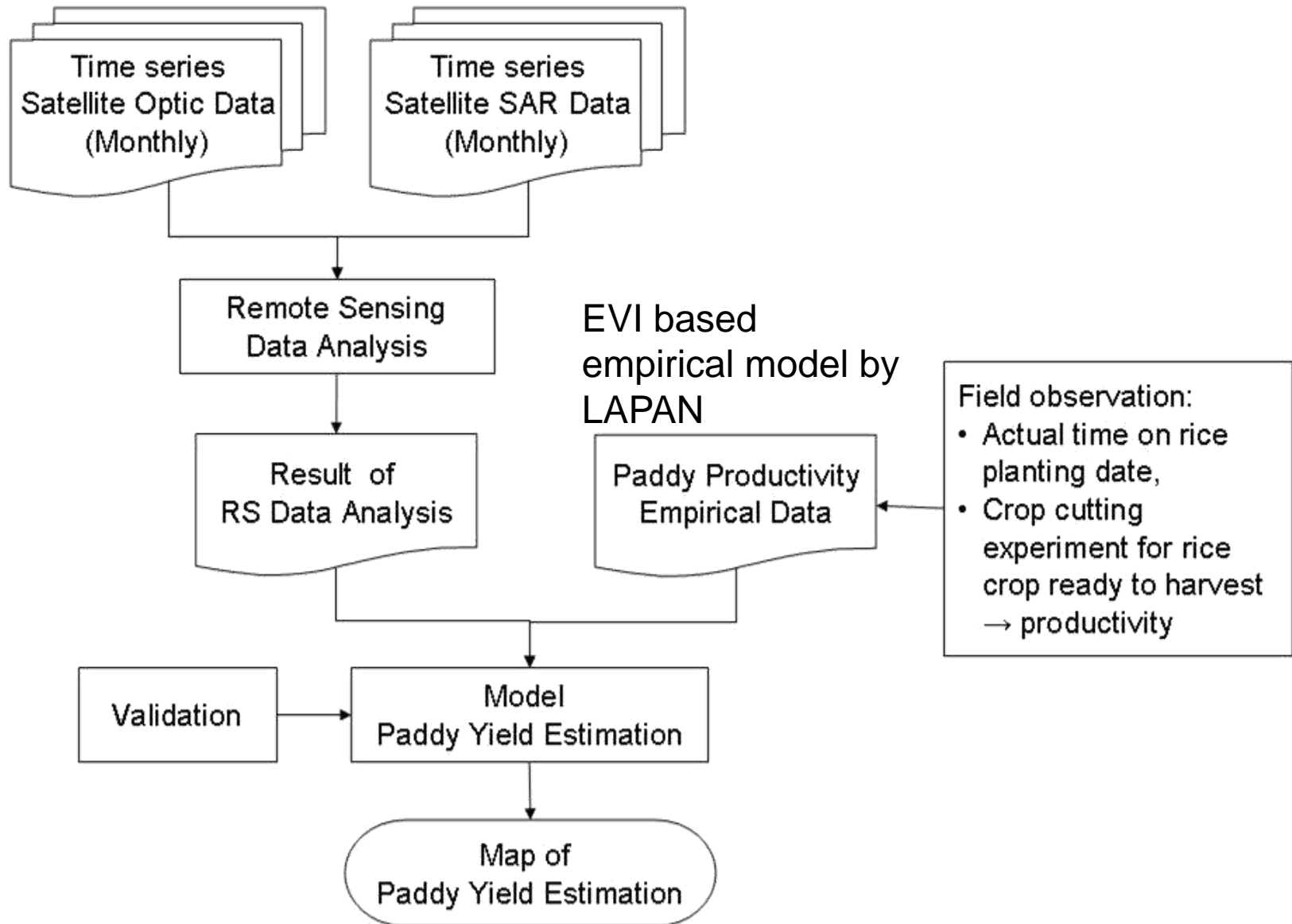
# *Indonesia TDS - Methodology and Data Used*

- **Study Area** : Subang of West Java (Asia Rice TDS phase 1A), South Sulawesi and South Kalimantan.
- **Data Used** :
  - ALOS (2007 – 2011)
  - Pi-SAR-L2 (2012)
  - Radarsat-2 for Subang in Asia rice (2013-2014)
  - ALOS-2, Sentinel, etc. (2014 – Future)

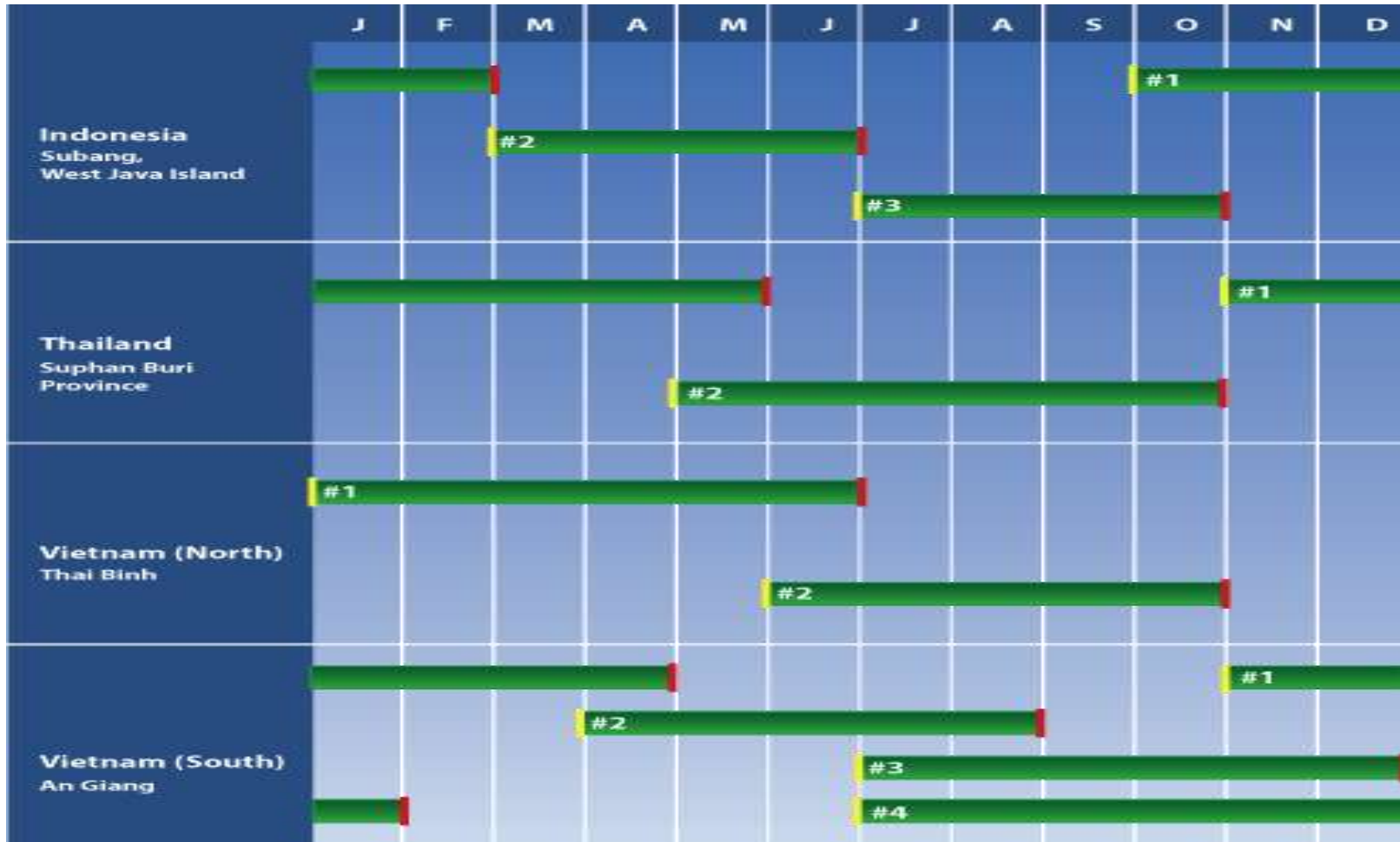
# Indonesia TDS - Methodology and Data Used



# Indonesia TDS - Methodology and Data Used



# Phase 1A Crop Calendars



Indonesia (Subang, West Java Island);  
Thailand (Suphan Buri province);  
Vietnam (Thai Binh (North)), (An Giang (South));

# **GEO GLAM Outlook to FAO AMIS**

## **Agro-met information using satellites**



# Collaboration with AFSIS for phase 1A - Rice Growth Outlook

GEOGLAM Consultation Meeting co-hosted by ASEAN+3 Food Security Information System (AFSIS) project and JAXA

- ▶ Phase1A Country: Indonesia, Thailand, Vietnam
- ▶ Submit outlook description to phase 1A countries statistic organizations through AFSIS (20th), then share in Asia-RiCE (23rd) , and submit to GEOGLAM
  - Outlook is not directly connected with official statistic information from statistic organizations because of temporal requirement and administrative issue
- ▶ Satellite derived agro-met information will serve as supporting evidence & data



**RESTEC**

18 October 2013

@OAE, Bangkok, Thailand

AFSIS : ASEAN+3 Food Security  
Information System (Office in Bangkok)

# Asia-RiCE phase 1A crop outlook flow to FAOAMIS



(a) Drought index (KBDI), Precipitation, LST, NDVI, Soil moisture (provincial / national / regional) anomaly by GCOM-W, GSMaP, MODIS, etc. by JAXA with UT(contract to RESTEC) and other team members



(b) Interpret agro-met information to a rice outlook information by rice crop experts in Asia in cooperation with AFSIS project (for phase 1, three countries (Indonesia, Thai, Vietnam) are targeted)



(b1) Review and add some outlook information with provision of additional agro-met information and rice crop growth information derived from Asia rice crop team



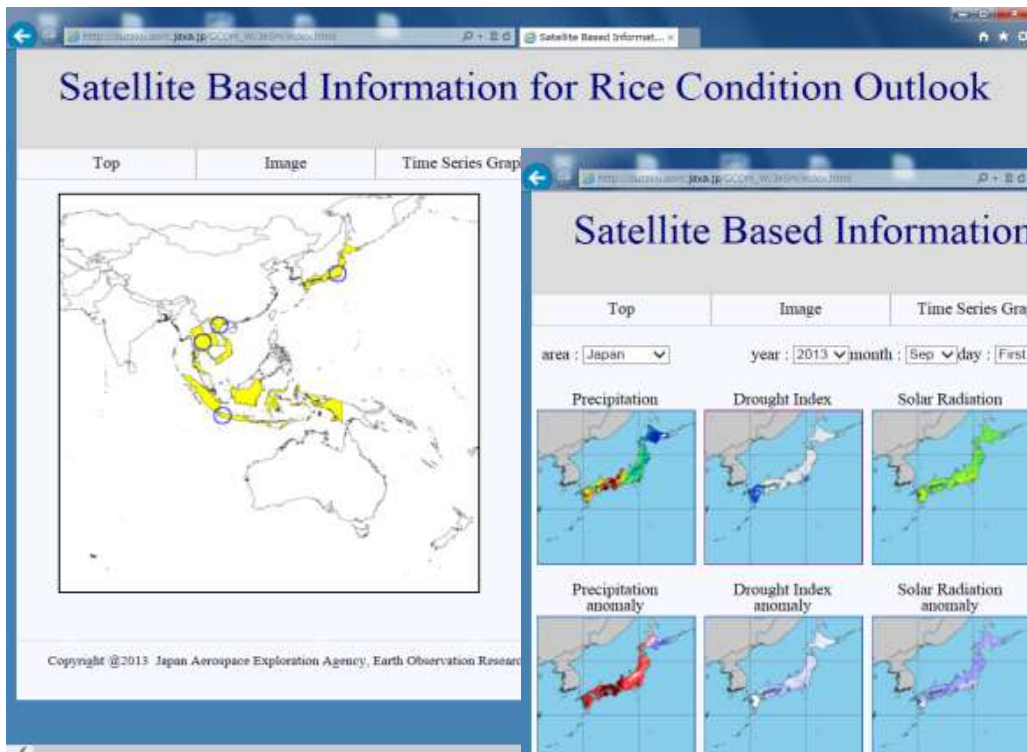
(c) Develop monthly outlook report for corn, wheat, soy bean and rice by GEO GLAM team including Asia rice crop outlook submitted by AFSIS and post on UMD outlook page by USDA and other crop experts with GEO GLAM team (NASA, USDA, CSA, JAXA, EC, ...)



(d) Submit monthly outlook report using EO satellites information to FAO AMIS from this September

# JASMIN – Agro-met. data-distribution system for Asia-RiCE Outlook

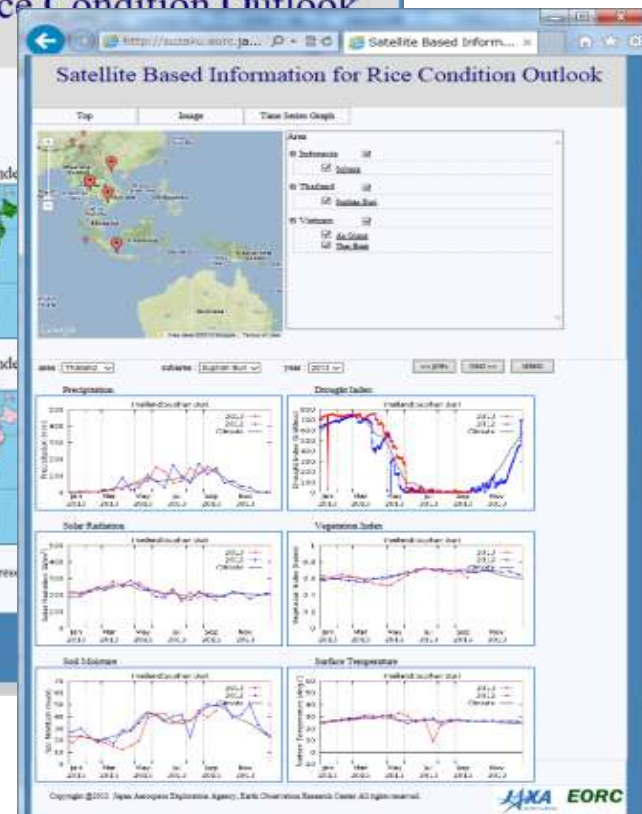
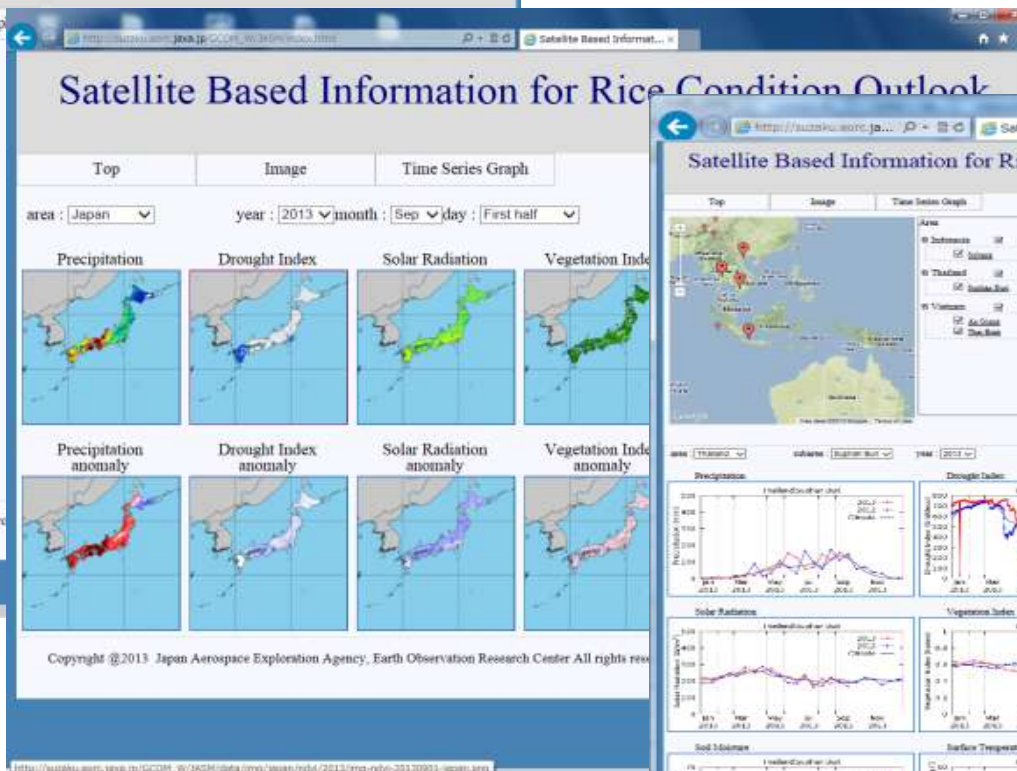
- ❖ Each data will be updated twice a month (15th, 31th day of month).
- ❖ Users can access and get latest data any time.



Top

Spatial Distribution

Time-Series

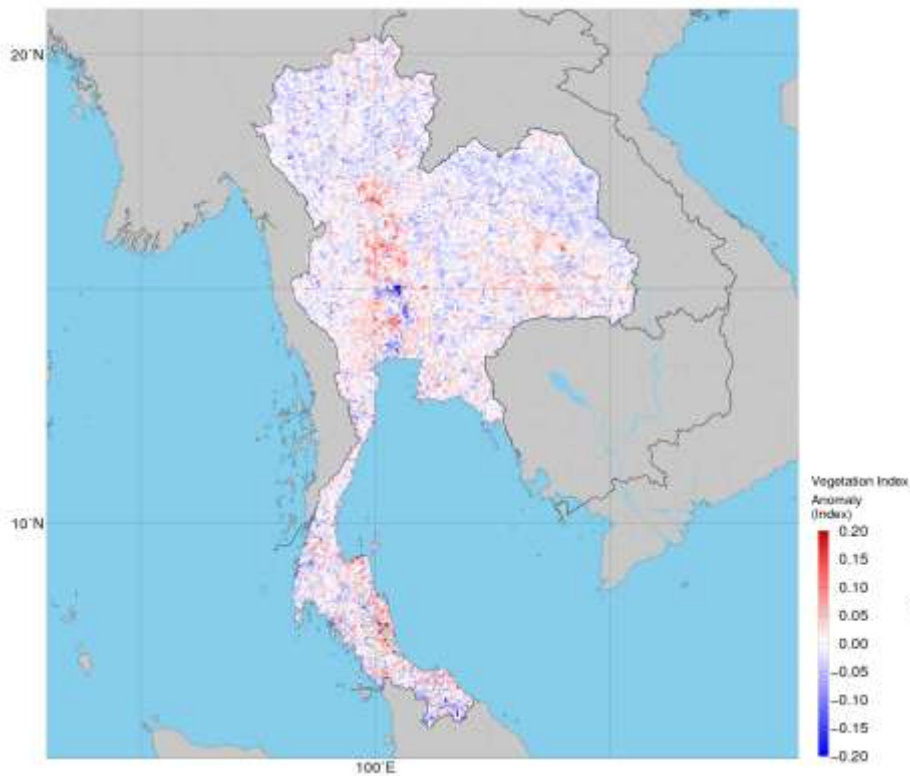


[http://suzaku.eorc.jaxa.jp/GCOM\\_W/JASM/index.html](http://suzaku.eorc.jaxa.jp/GCOM_W/JASM/index.html)

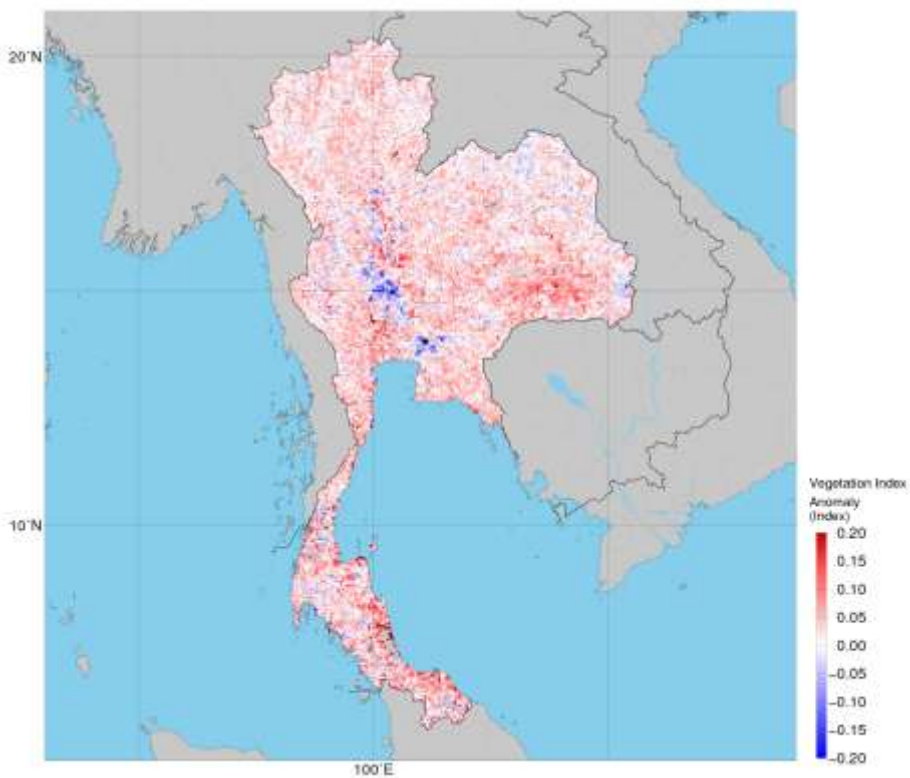
## Thailand's rice growing report for November 2013

In November, mostly of rice are in the harvesting stage especially, in the Northern and North-Eastern region. The yield is increased slightly from last year due to sufficient rainfall and favorable weather. Although there are some damage caused by flooding in the North-Eastern and Central region. The areas were affected by flood, now are recovered and there is enough water for the next crop cultivation.

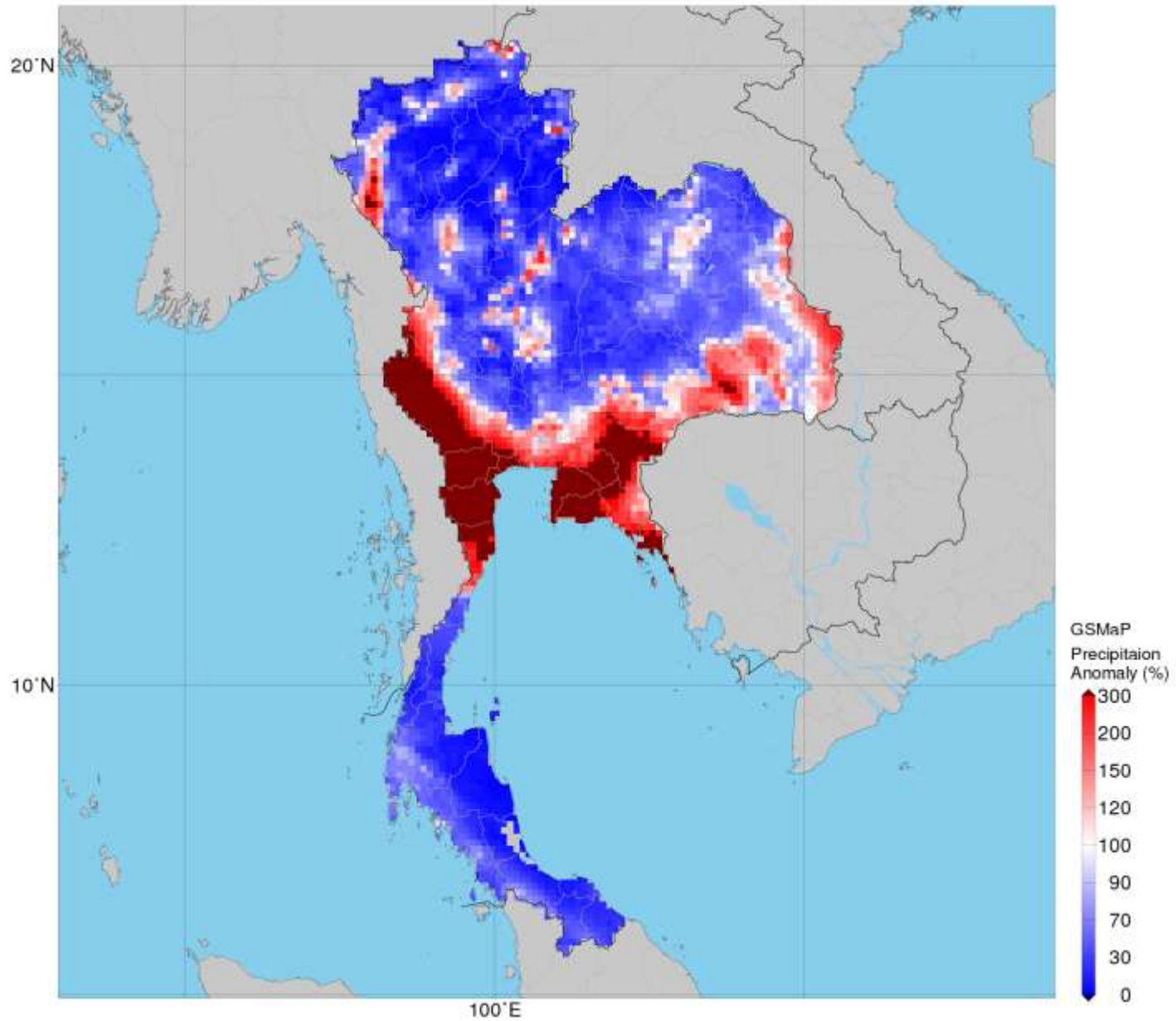
2012/11/01 – 2012/11/15



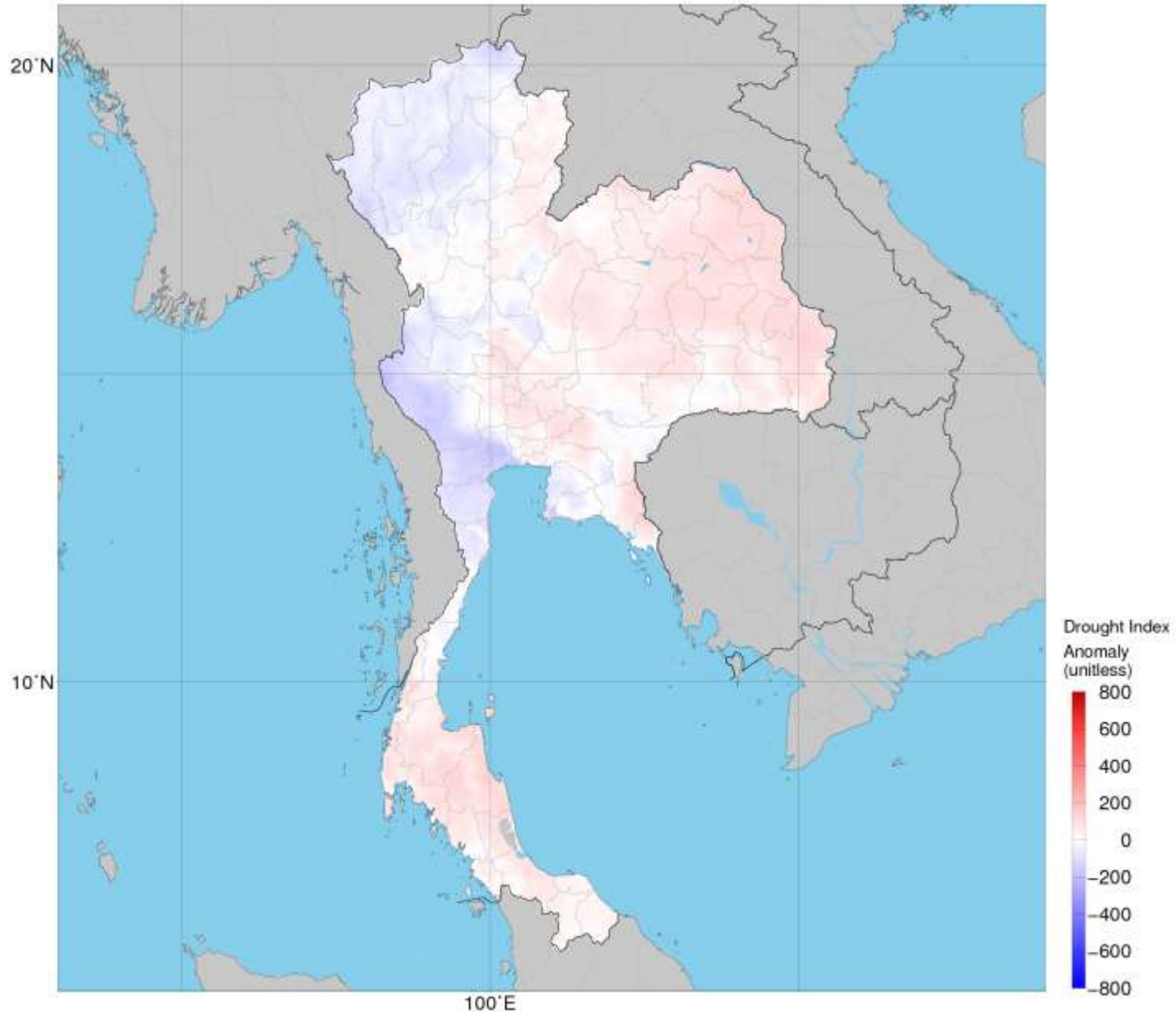
2013/11/01 – 2013/11/15



2013/11/01 – 2013/11/15



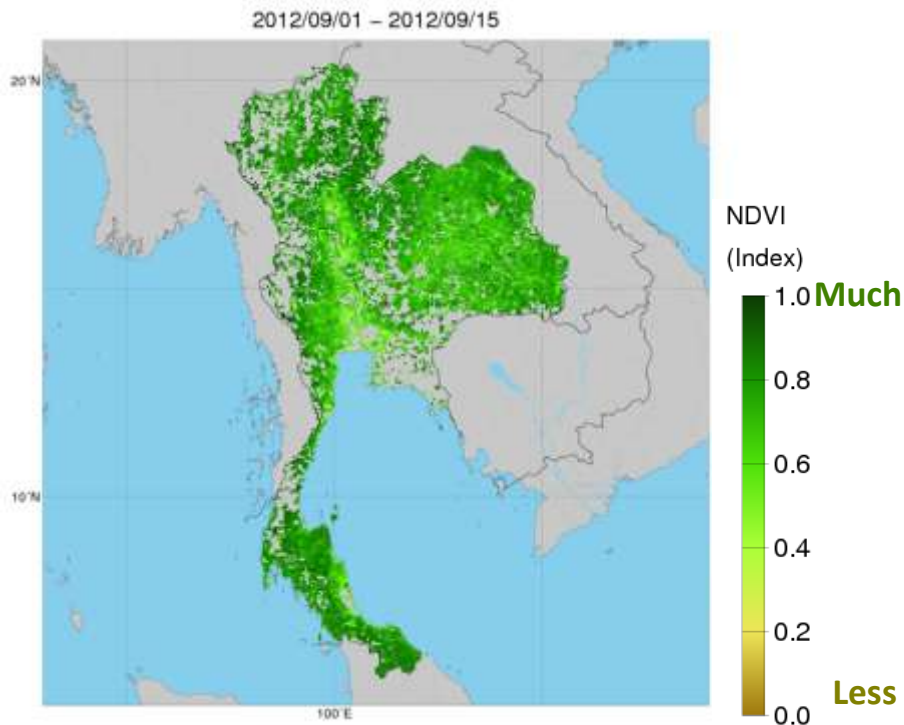
2013/11/15



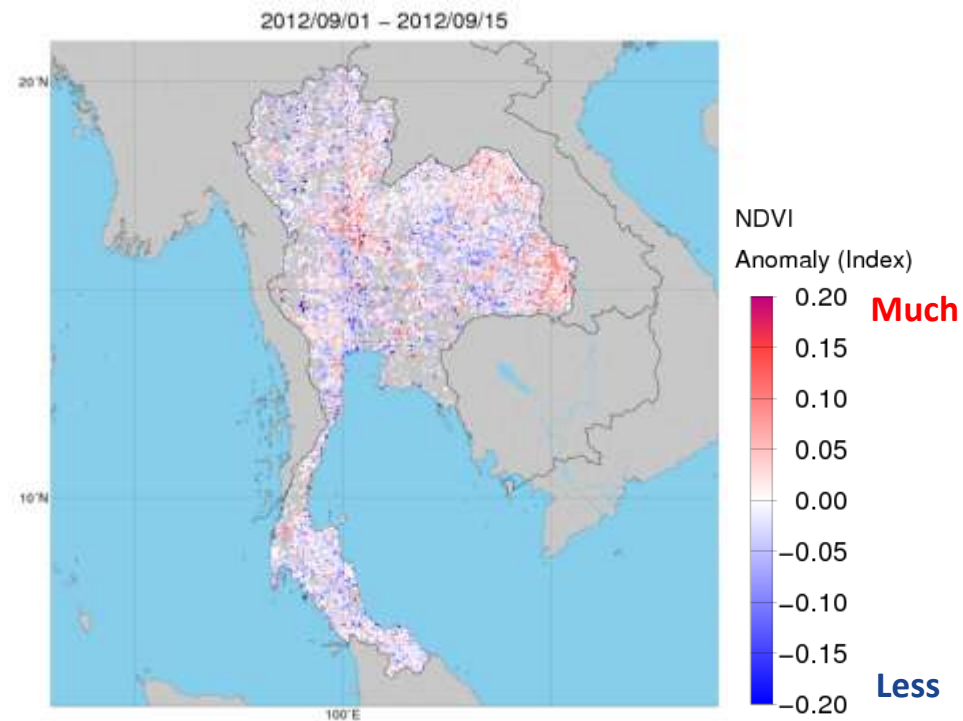
# Vegetation Index

- ❖ NDVI is not agro-meteorological parameter, but the index to indicate the amount of leaves.
- ❖ High NDVI means much vegetative and less NDVI means less vegetative.

## Current Condition



## Anomaly





# Assessment Source for Rice Growth Outlook

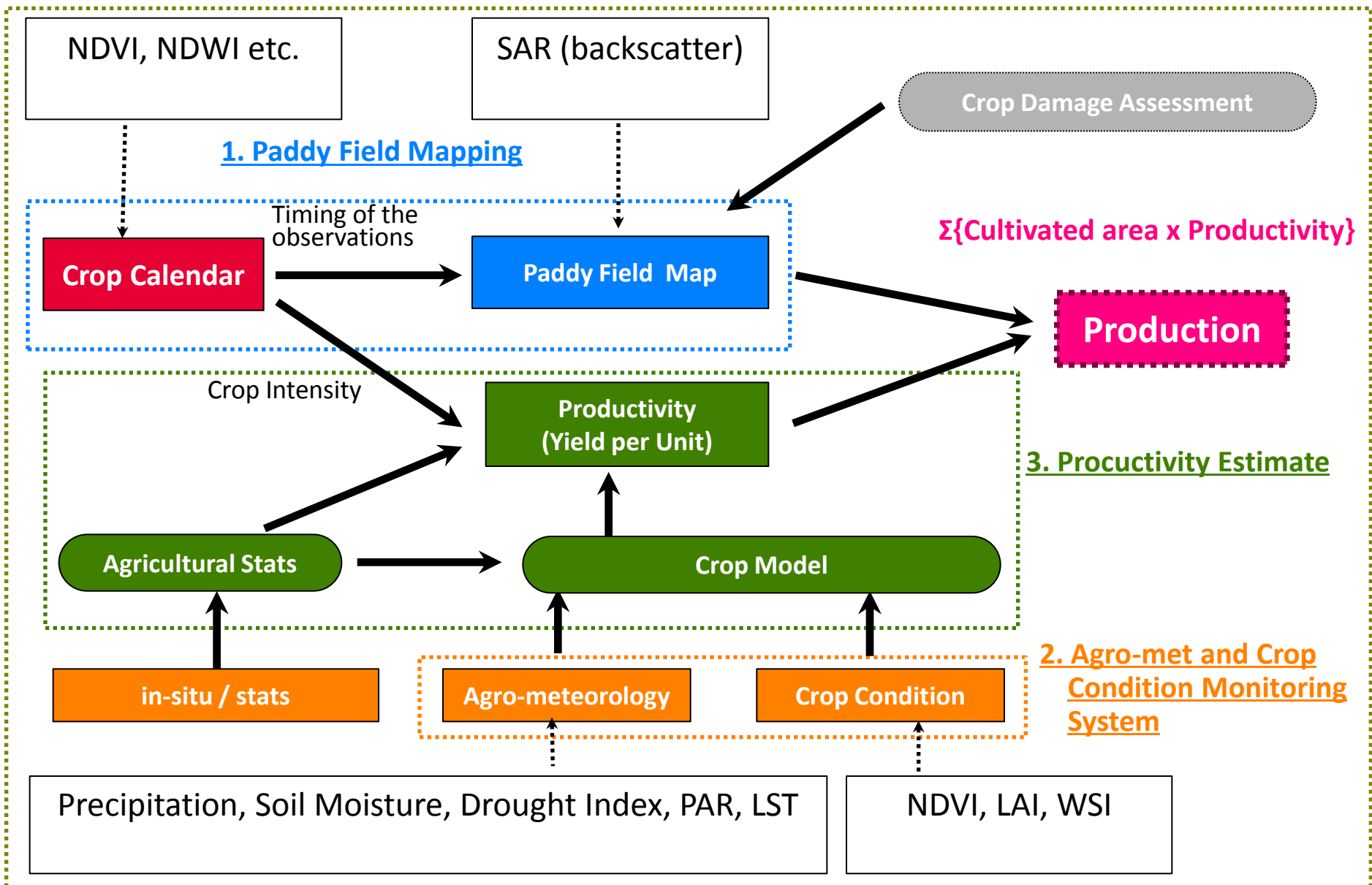
- ❖ Satellite observation provides “Current Condition” and “Anomaly” information and they are updated every 15 days (twice a month).
- > Add more available data to validate and/or extend parameters DB

Parameters	Interval	Spatial Resolution	Data Period (anomaly calc.)	Satellite Data Source
<b>Precipitation</b>	Cumulative (15-day)	10 km	2002- (2002-2012)	GSMaP (GCOM-W1, TRMM, MTSAT etc.)
<b>Solar Radiation</b>	15-day Average	5 km	2007- (2007-2012)	MODIS
<b>Land Surface Temperature</b>	15-day Average	5 km	2002- (2002-2012)	MODIS
<b>Soil Moisture</b>	15-day Average	50 km	2002- (2002-2012)	AMSR-E, WINDSAT
<b>Drought Index</b>	15th /31[30]th day of month	10 km	2003- (2003-2012)	GSMaP, MTSAT
<b>Vegetation Index</b>	15th /31[30]th day of month	5 km	2009- (2009-2012)	MODIS

**Example of rice crop area estimation  
using SAR under the cooperation of  
Japan and Thailand**

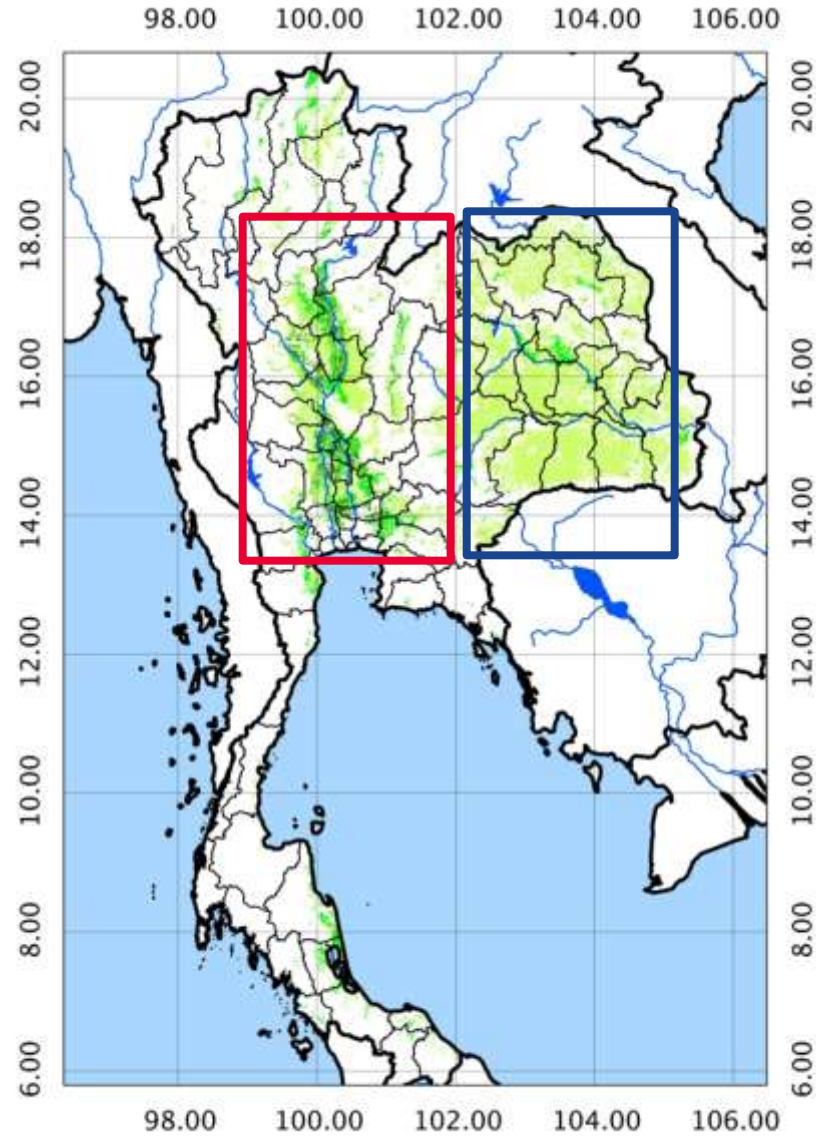
# Framework for Rice Crop Monitoring System

## 4. Dissemination System

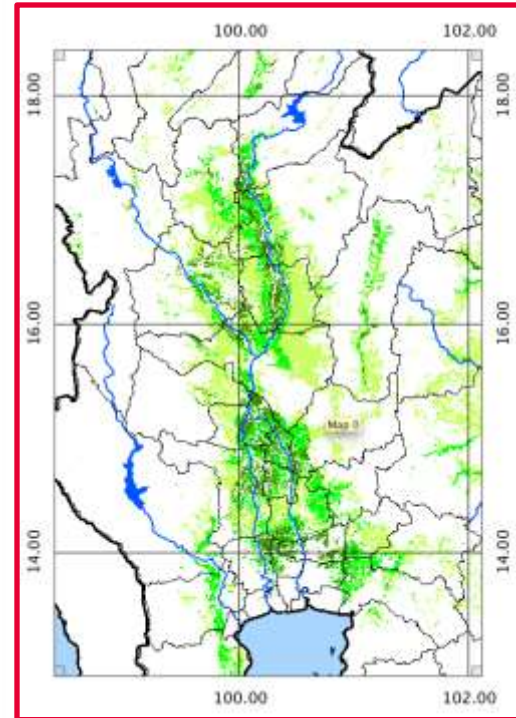


# Rice Crop Calendar from time-series MODIS Data by Oyoshi

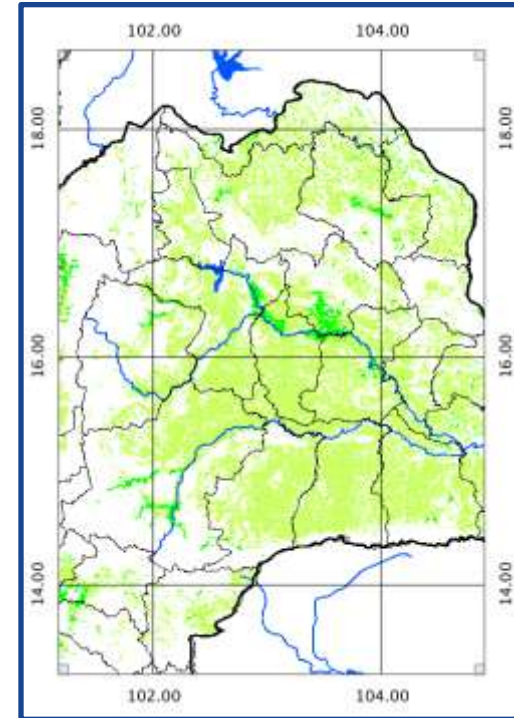
## Crop Intensity Map



## Along the Chao Phraya River



## Northeastern



## Irrigated Area

## Rein-fed Area

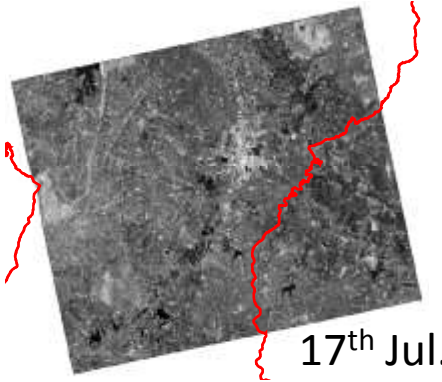
Crop Intensity (times/year)



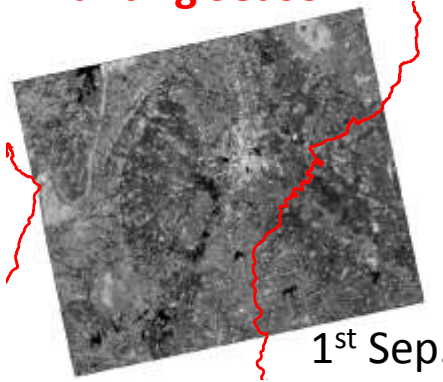
# Basic Concept of crop area detection

Planting Season

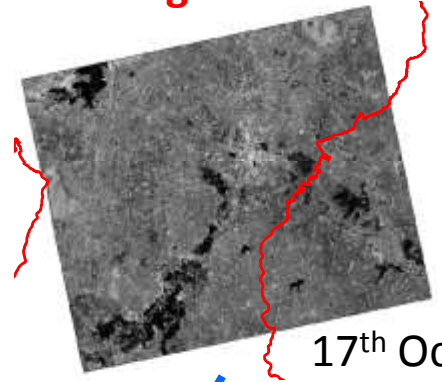
Growing Season



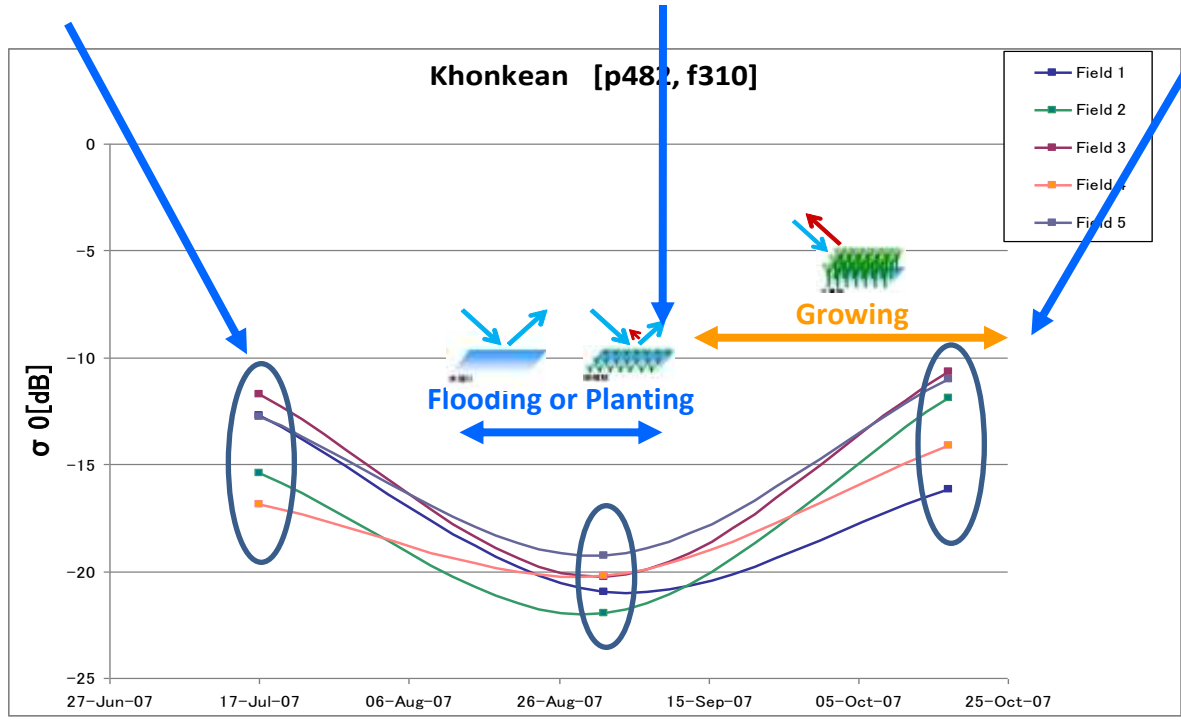
17<sup>th</sup> Jul.



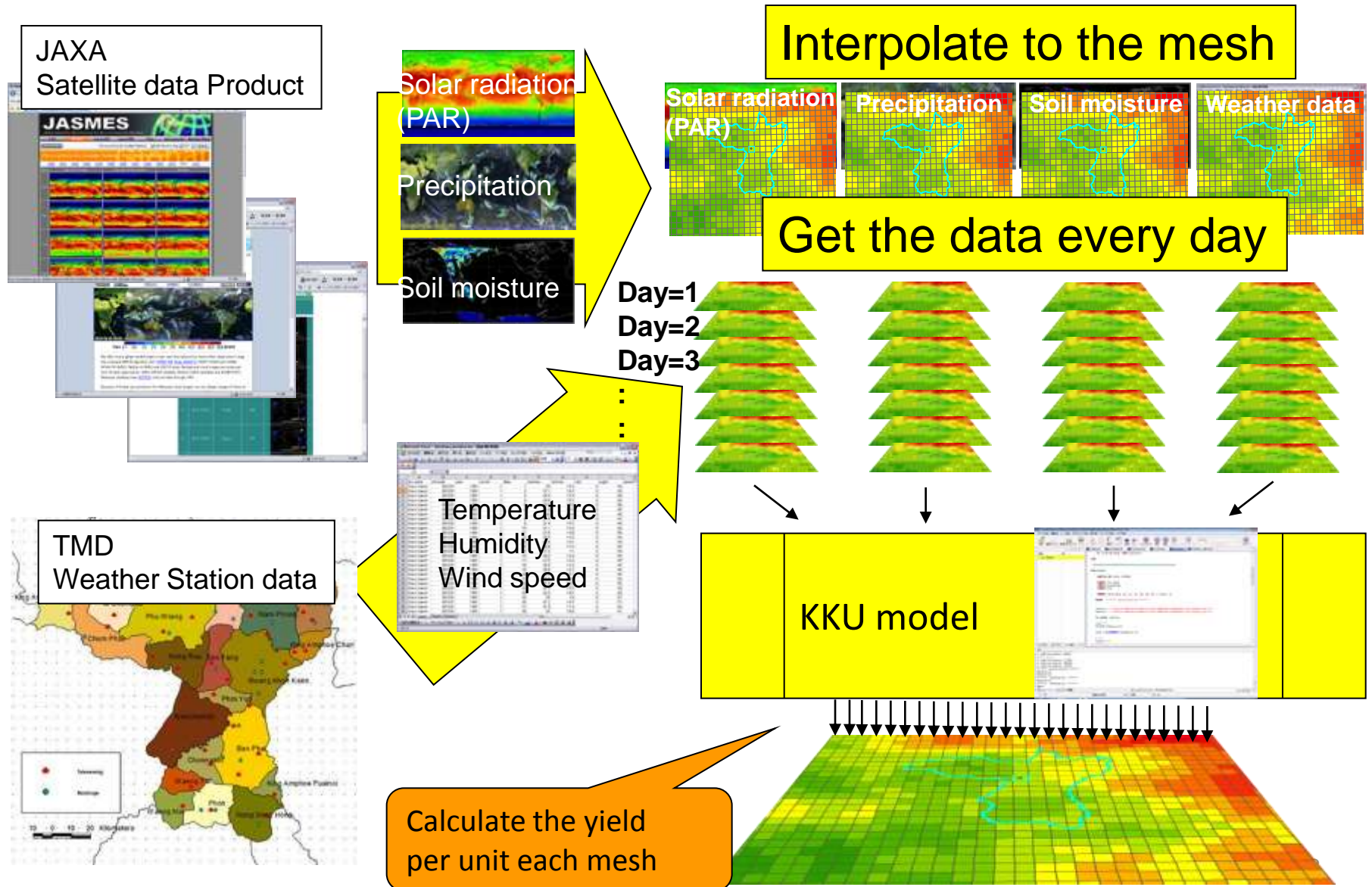
1<sup>st</sup> Sep.



17<sup>th</sup> Oct.



# Procedure of Yield per Unit Estimation by Crop Model



# Automatic Wether Station (AWS) with Camera

## ❖ Functions

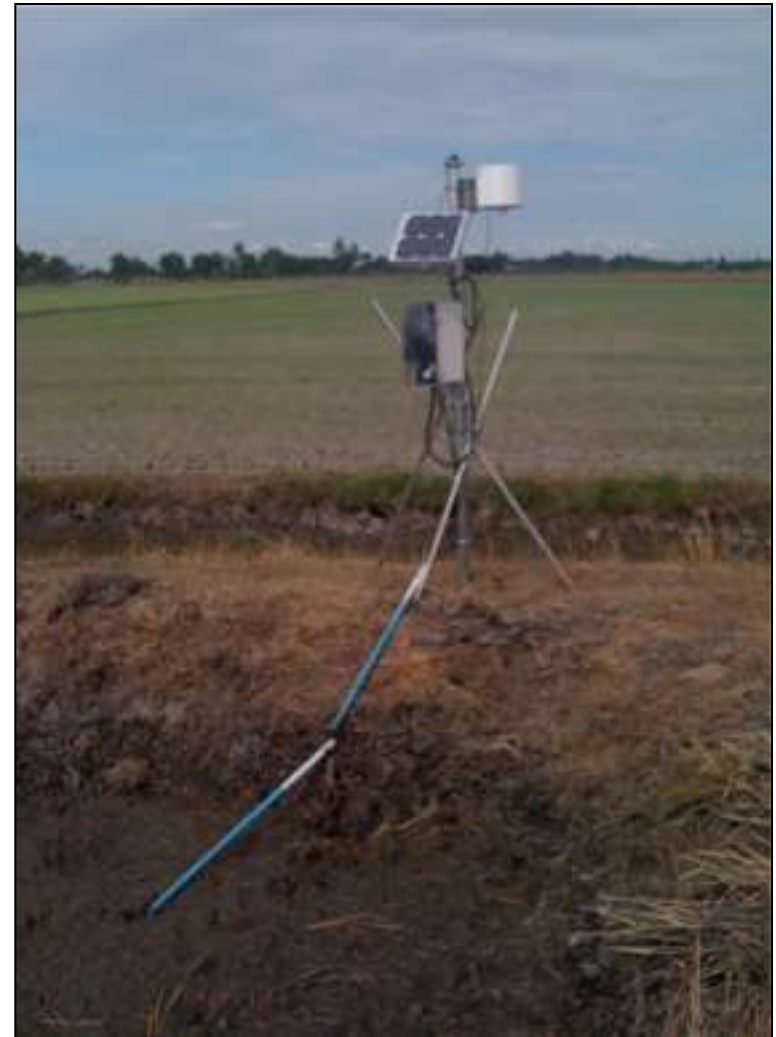
- Automatic data collection
- Wireless communication (daily)
- Powered by solar panel

## ❖ Meteorological sensor

- Air Temperature
- Precipitation (rain gauge)
- Radiation
- Wind direction and velocity

## ❖ Image sensor

- CMOS camera (120 M pix)



[Prof. Mizoguchi, U.Tokyo]

# Paddy Fields for the Validation in Asia-RiCE





# AWS in Tsuruoka, Yamagata, Japan



**14 Jun 2013**



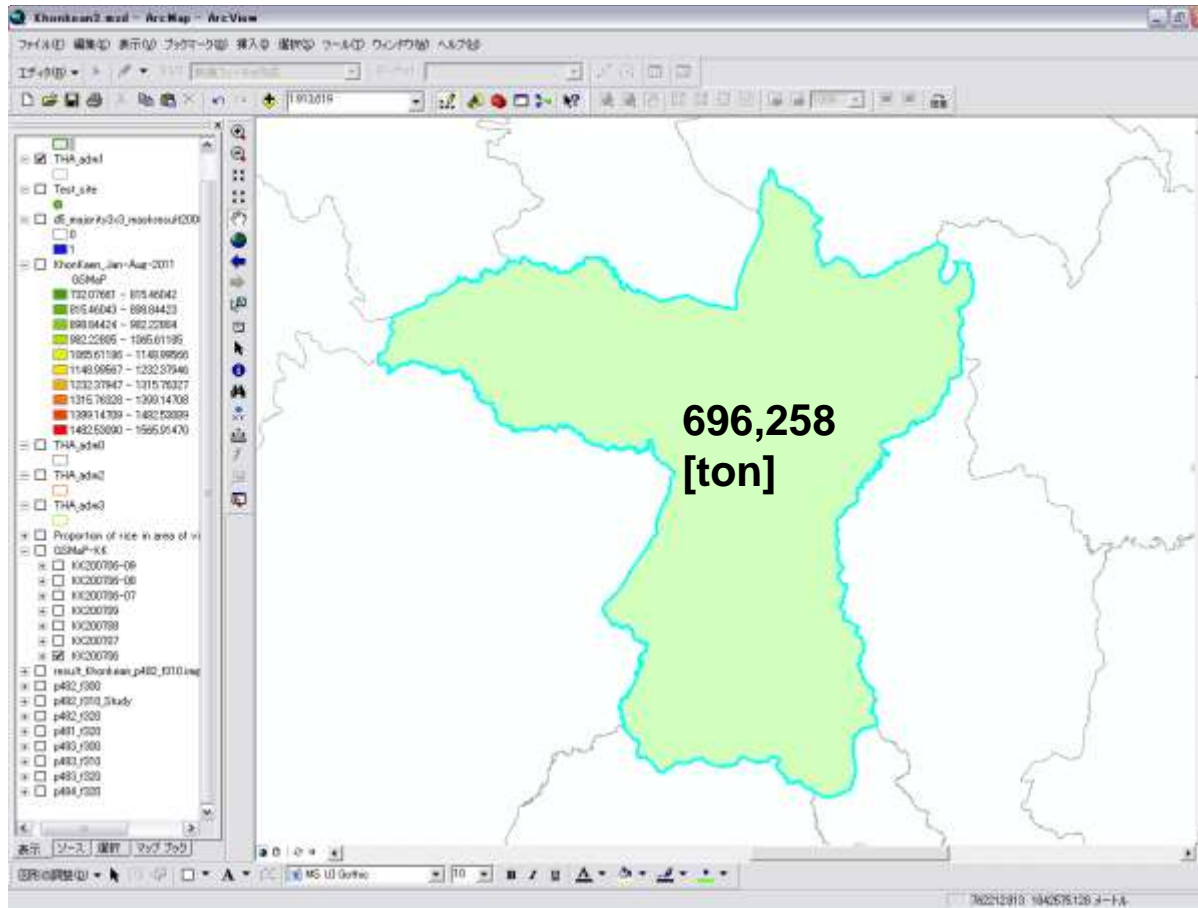
**27 Jun 2013**



**09 Jul 2013**



# Procedure of rice crop yield estimation by acreage and yield per unit



**Acreage**

\*

**Yield per unit**

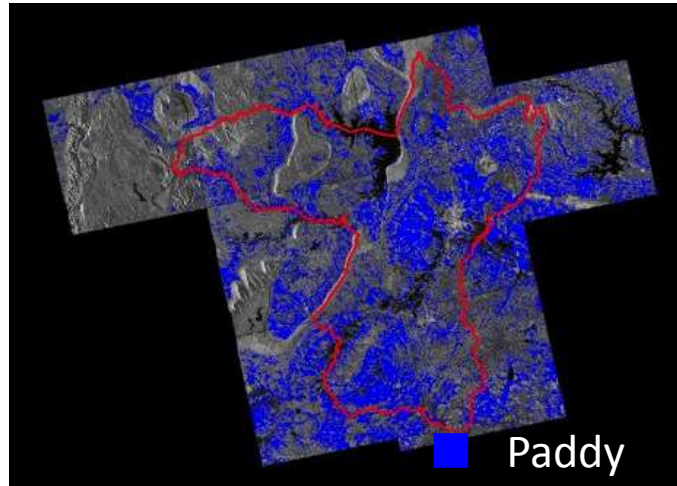


**Yield**

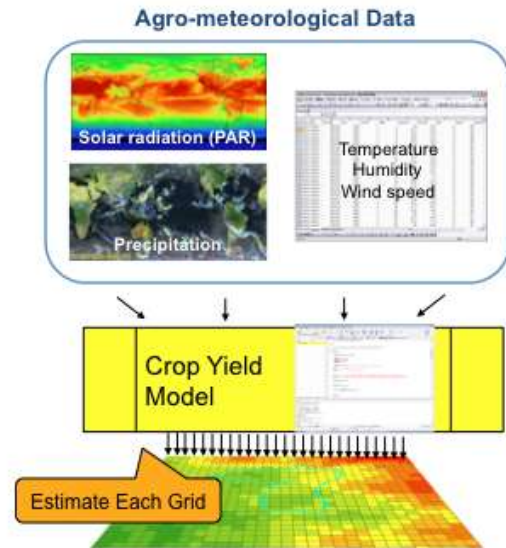
# Rice Yield Estimation in Khon Kaen, Thailand

$$\text{Yield} = (\text{Paddy Area}) \times (\text{YPU : Yield per Unit})$$

**Paddy Field Map**



**YPU Estimation by Crop Model**



**Result of Yield Estimation**

	Acreage [m2]	Yield per unit [g/m2]	Yield [ton]
Result of estimation	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%

The results are highly consistent with the validation data with the accuracy of 80%.

# INAHOR : Rice Production Estimate Software

## ❖ International Asian Harvest mOnitoring system for Rice

- ▶ Run on Linux (Ubuntu, CentOS etc.)
- ▶ GUI based user-friendly software

## ❖ Input Data

- ▶ **SAR data** (Planting/Vegetative season)
- ▶ GeoTiff Format



## ❖ Basic Functions

- ▶ Mapping of rice planted area
- ▶ Calculation of rice planted area (provincial)
- ▶ Calculation of rice production with yield data (provincial)

# INAHOR rice crop area and yield estimation system using SAR

Rice Crop Mapper [ver\_1.0.0] 12:16 AM rehost

Files

Image Select

30/04/2012	17/06/2012	11/07/2012	04/08/2012
<input checked="" type="checkbox"/> Planting season <input type="checkbox"/> Growing season	<input checked="" type="checkbox"/> Planting season <input type="checkbox"/> Growing season	<input checked="" type="checkbox"/> Planting season <input checked="" type="checkbox"/> Growing season	<input type="checkbox"/> Planting season <input checked="" type="checkbox"/> Growing season

28/08/2012	21/09/2012	15/10/2012	08/11/2012
<input type="checkbox"/> Planting season <input checked="" type="checkbox"/> Growing season	<input type="checkbox"/> Planting season <input type="checkbox"/> Growing season	<input type="checkbox"/> Planting season <input type="checkbox"/> Growing season	<input type="checkbox"/> Planting season <input type="checkbox"/> Growing season

Image Select: Area Select, Sensor: RS2, Direction: ASC, Mode: FQ

View Layer: Classification, Max-Min Value, Maximum Value, Minimum Value

Image Select

Cancel OK

Comment

Clear Register

RUN

(116.100, -11.700)

# INAHOR paddy field estimation using temporal series SAR data

Rice Crop Mapper [ver\_1.0.0] 12:18 AM rehost

Files




Image Select: Area Select, Sensor: RS2, Direction: ASC, Mode: FQ

View Layer:  Classification,  Max - Min Value,  Maximum Value,  Minimum Value

Processing: Threshold 1: -16.00, Threshold 2: 8.00, Threshold 3: 3.00

Morphology:  Erosion -> Dilatation,  Dilatation -> Erosion,  No Execute

Output File Name: RCM\_Result\_RS2-ASC-FQ-20130711001840.tif

Comment: RADARSAT2|HH|FINE\_QUAD\_POL|ASCENDING|30/04/2012-28/08/2012

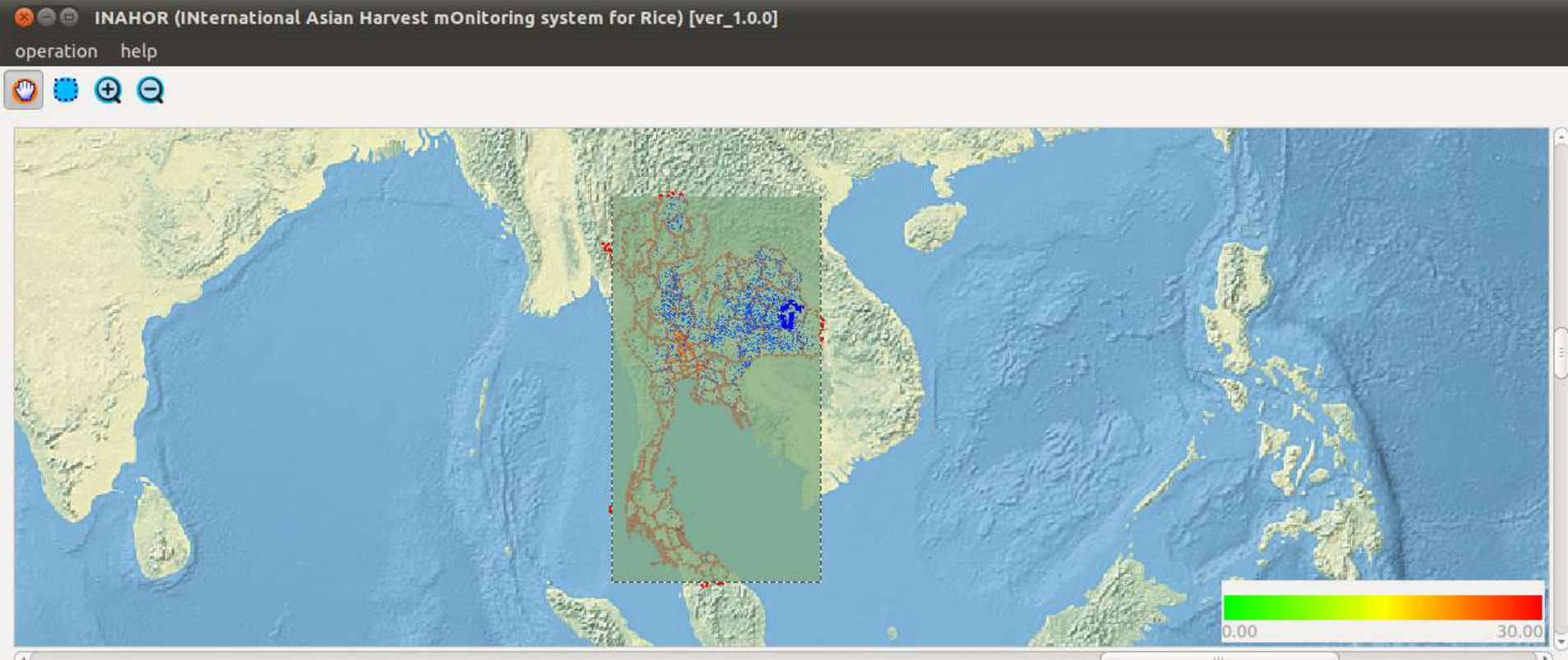
RUN

( 100.559 , 14.365 )

Clear Register

# INAHOR paddy field estimation result

INAHOR (INternational Asian Harvest mONitoring system for Rice) [ver\_1.0.0]  
operation help



**Analysis Project**  
test04  
New Project Delete Project

**Processing**  
detect prediction  
algorithm: KKU statistics

**Planted Area** **AOI** **production**  
open shape file... edit... remove AOI

polygon name	yield	create date
Chai Nat	11,22	21/03/2013 02:46:11
Chaiyaphum	11,22	21/03/2013 02:46:11
Chanthaburi	11,22	21/03/2013 02:46:11
Chiang Mai	11,22	21/03/2013 02:46:11
Chiang Rai	11,22	21/03/2013 02:46:11
Chon Buri	11,22	21/03/2013 02:46:11

**View Layer**  
 base map  
 Planted Area  
 AOI  
 production

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## Next Steps

- Face-to-face meeting at APRSAF in Hanoi in Dec. 2013
- Next SAFE workshop in KL in next Apr. (with AFSIS meeting with adding new countries for outlook) and ACRS in Myanmar in next Oct. (face-to-face meeting)
- Address resource support for AMIS rice outlook/ forecasting and crop area and yield estimation to sustainable operation
- Publication of Technical Demonstrator results
  - Refinement of requirements
- Submit RAs to space agencies including JAXA, ASI, ...
- Update to Asia-RiCE Work Plan for 2014
  - New Technical Demonstrators?
  - New sensors? - including Himawari 8-9
  - Integration of new activities



