

# Asia-RiCE Highlights

(Asian Rice crop estimation & monitoring)

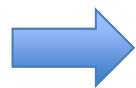
**Thuy Le Toan**  
**CESBIO, Toulouse, France**

**On behalf of the GEOGLAM Asia-RiCE team**  
**13/01/2016**



# Importance of rice monitoring in SE Asia

- ❑ Rice is the staple food for more than half of humanity - with 90% of the world crop grown and consumed in Asia.
- ❑ South/Southeast Asia accounts for more than 25% of the global population. Also, countries in the region have the highest population growth rate.
- ❑ This population growth together with the approaching limits of land use and enhanced climate change impacts in the region, are impacting:
  - food security, tensions in rice markets
  - people livelihood
  - land use policies
  - water resources
  - carbon cycle, biodiversity...



Accurate and timely information is needed for rice monitoring, and **satellite remote sensing** can meet requirements at local to global scales



# Regional Cooperation for Rice Crop Monitoring Using Space Technology in Asia



Team members of Asia-RiCE,  
lead by JAXA (Dr. Shin-Ichi Sobue)

<http://www.asia-rice.org>

# Asia-RiCE Home Page – www.asia-rice.org

**Asia-RiCE**  
Crop Estimation and Monitoring

**GEOGLAM**  
Global Agricultural Monitoring

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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 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. 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.

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 cultural impacts of these factors. Satellite remote sensing can support this long term monitoring requirement at regional and global scales.

**Objectives**

Asia-RiCE describes a work plan for the definition 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.

## Asia-RiCE target products

ID	Target Agricultural Products
P1	Rice Crop Area Estimates/Maps
P2	Crop Calendars/Crop Growth Status
P3	Crop Damage Assessment
P4	Agro-meteorological Information Products
P5	Production Estimation and Forecasting

# Asia-Rice Phasing

## Phase 1 (from 2013).

Development of provincial-level  
rice crop area estimations.

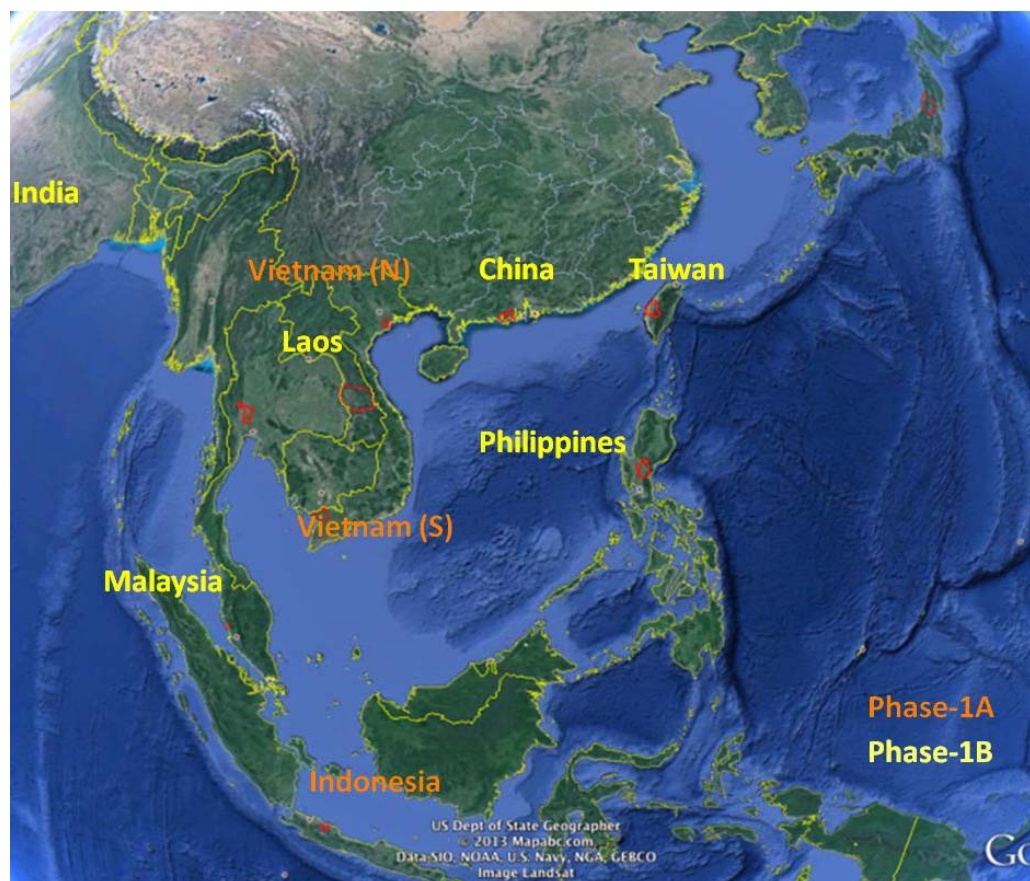
Technical demonstration sites  
(100x100km)

Phase 1A: Indonesia, Vietnam,  
Thailand

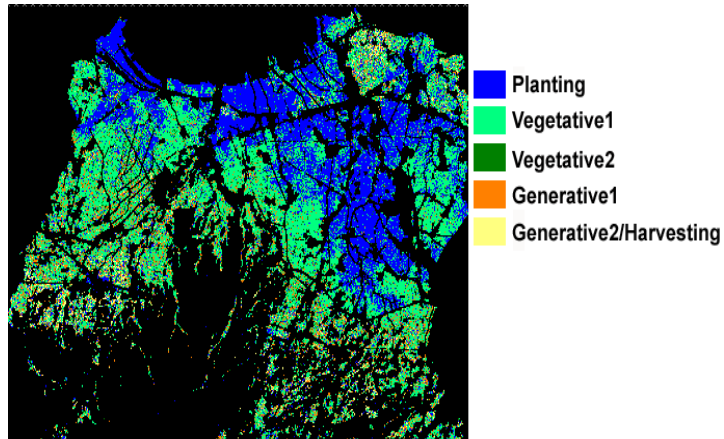
Phase 1B: 1A + Japan, Malaysia,  
Taiwan , Philippines

## Phase 2 (tbd)

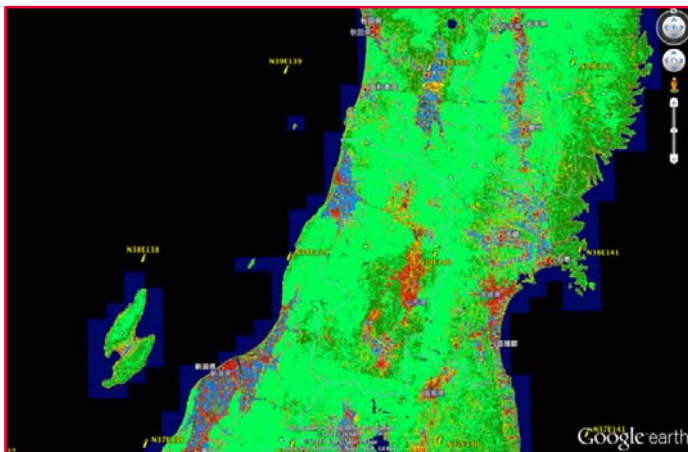
Whole country (“wall-to-wall”)  
rice crop area estimates



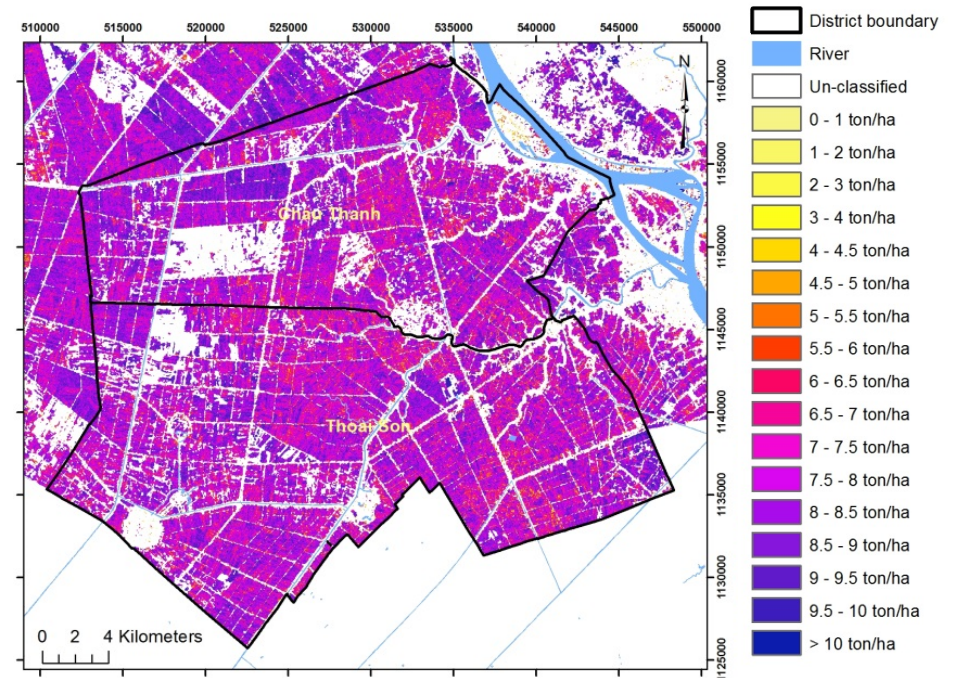
## Radarsat-2 rice status in Indonesia



**Rice Phenological Stages Classification  
29 July 2014 (Subang Area, West Java)  
by MOA, LAPAN with JAXA**



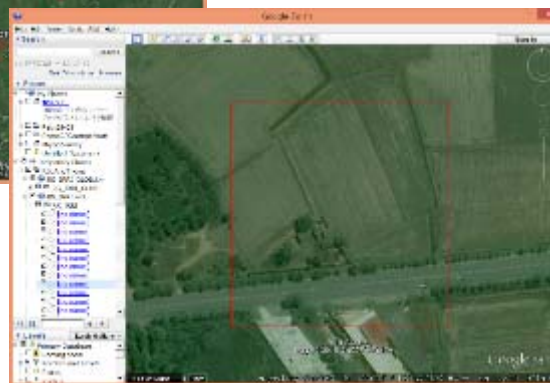
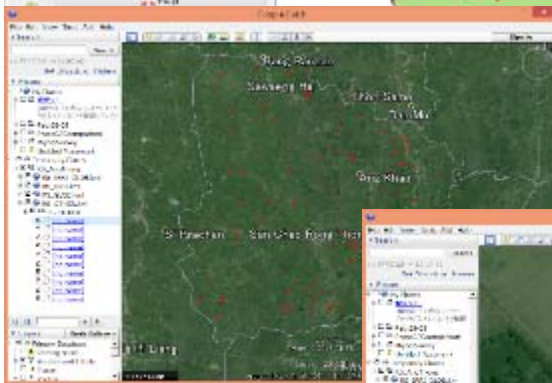
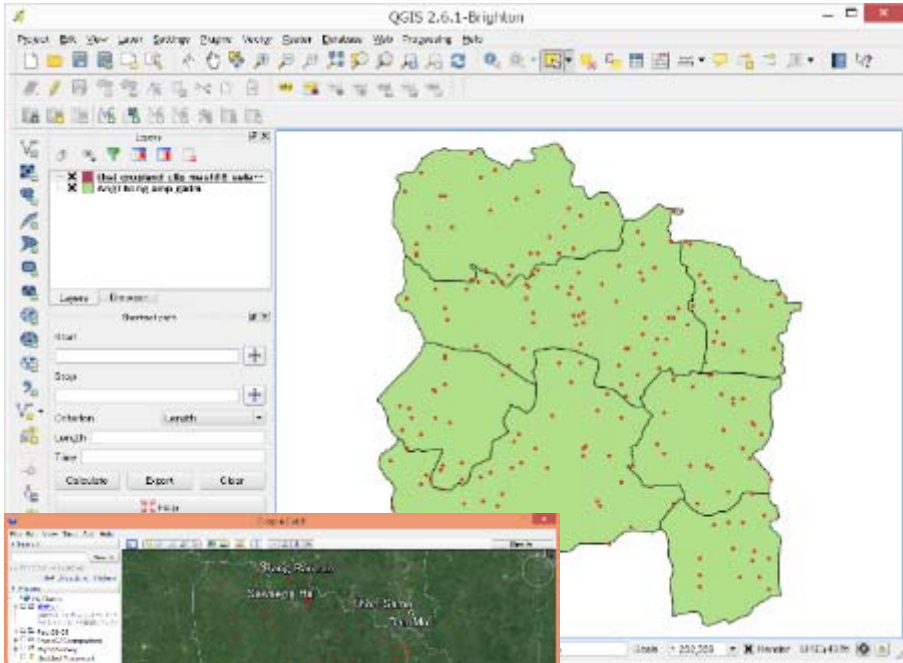
## Rice yield estimation using Radarsat-2 data in An Giang (Vietnam)



**Rice and Land Use mapping in Japan  
using ALOS by JAXA**

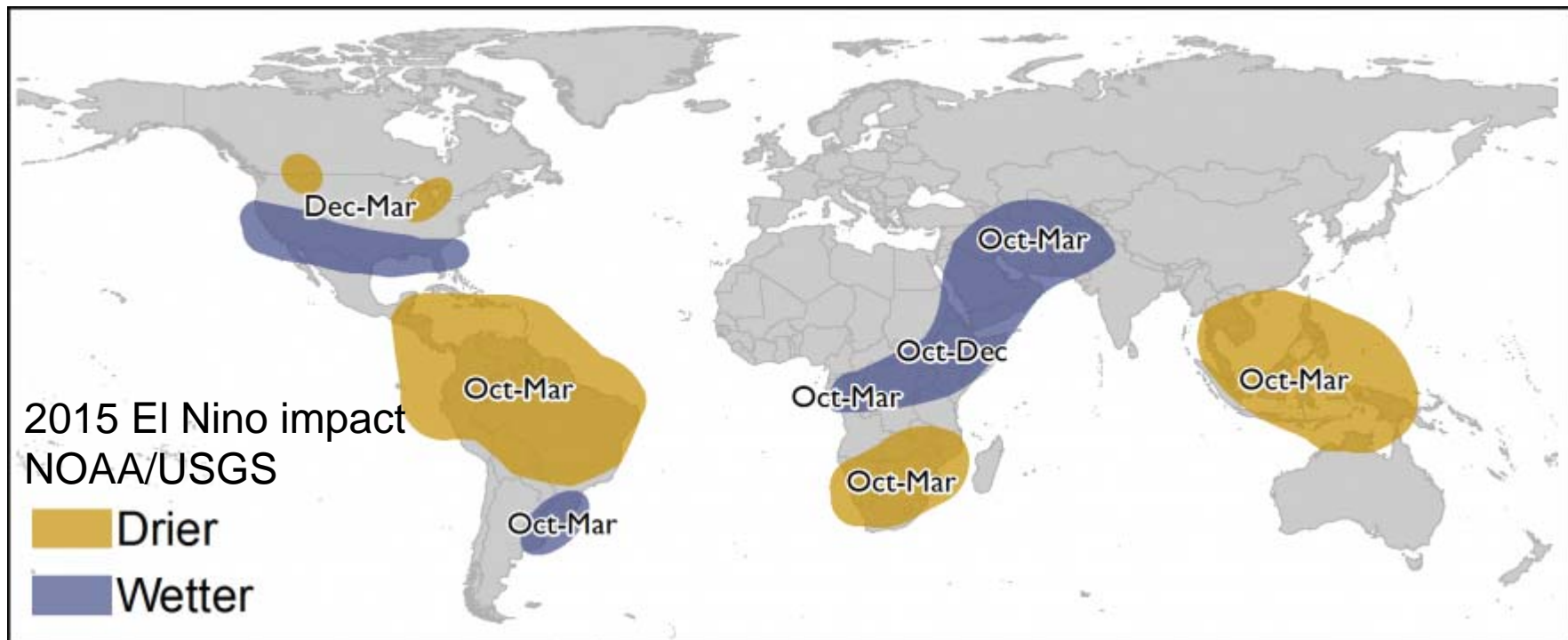
# Related Project: ADB RCDTA 8369: Data Collection Methods for Agricultural and Rural Statistics

Field survey training for validation of planted area and growing stage with iPad and GIS software. (random sampling 120 points - paddy and non paddy area)



## R&D Toward operational rice monitoring using Sentinel-1

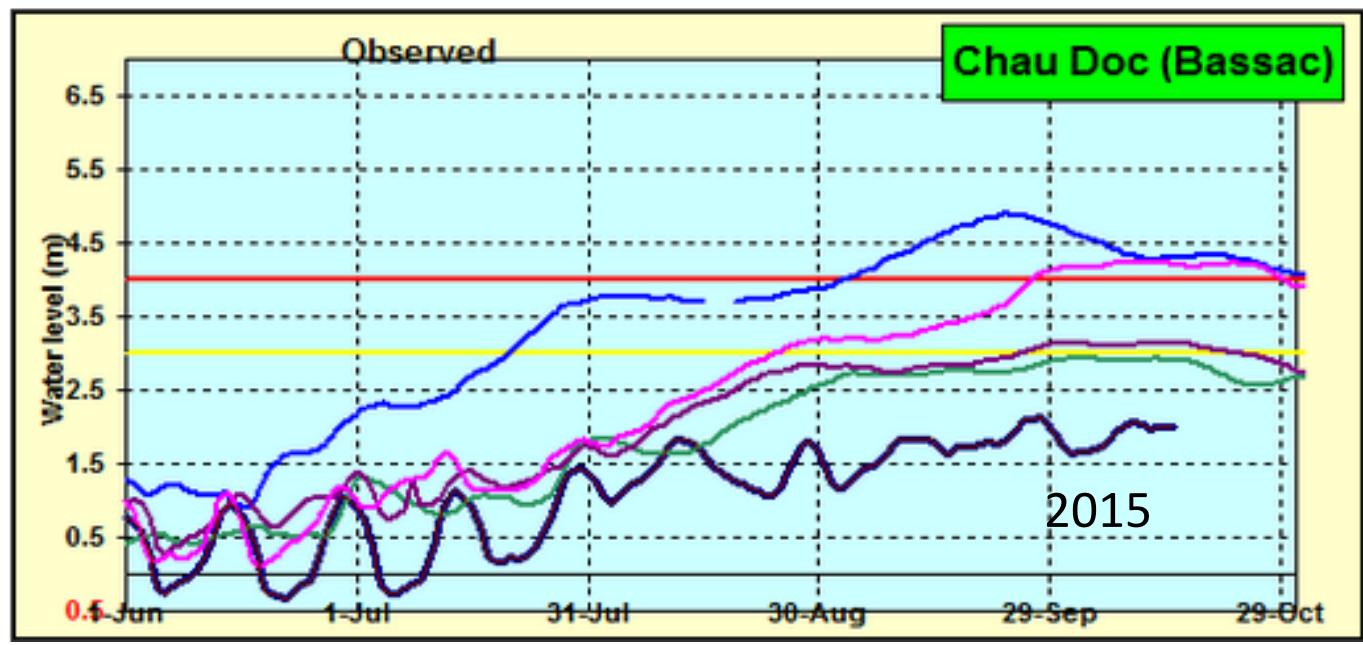
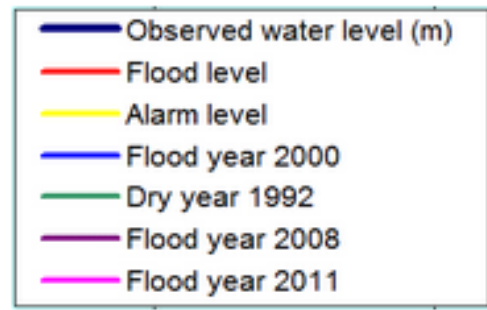
Need development to meet user requirement:  
Example: water management adapted to climate conditions ?



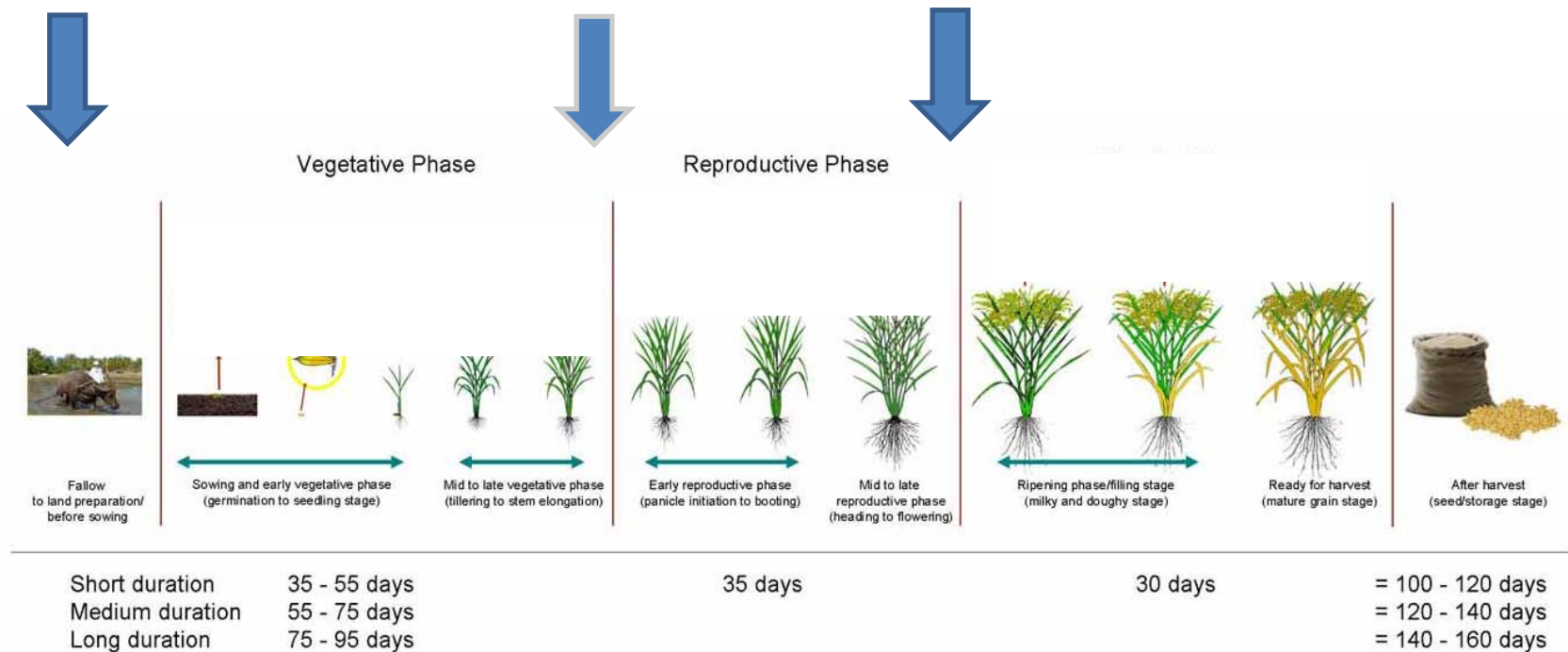


# Mekong River Committee Report (2015)

## Observed water level this season



# Key rice phenological stages where water shortage is critical



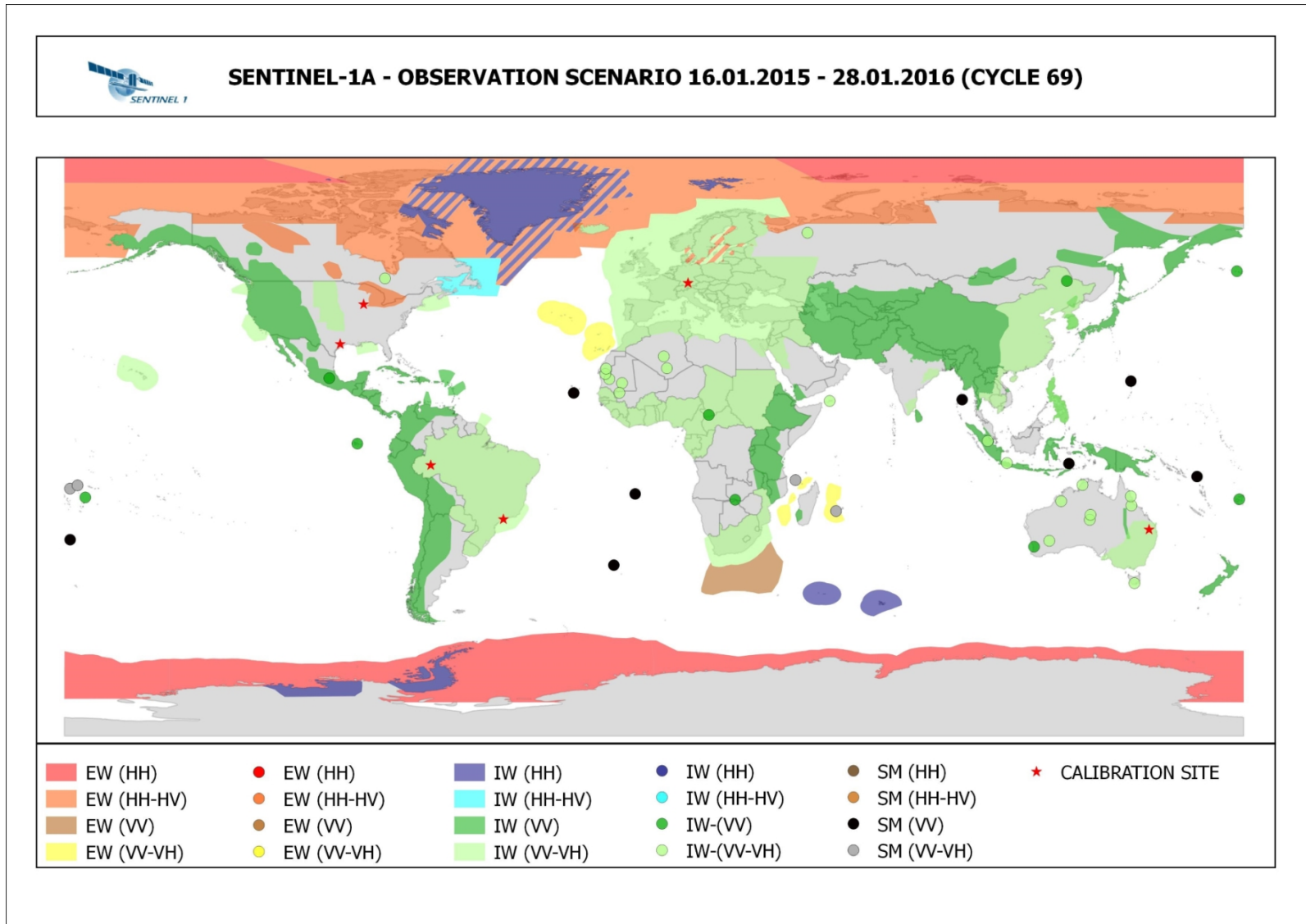
The rice varieties grown in Southeast Asia are highly sensitive to drought stress, with the greatest losses occurring when the crops are in the flowering or reproductive growth stages.

# Vietnam rice growing calendar

Vietnam	Season	Type of rice		Status	Months												
		Wet season	Dry season		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
North	Winter-Spring		•	Seeding	Green	Green								Green	Green	Green	
				Harvesting		Yellow	Yellow	Yellow	Yellow	Yellow							
	Summer-Autumn	•		Seeding					Green	Green	Green	Green	Green	Green	Green		
				Harvesting	Yellow	Yellow	Yellow	Yellow									Yellow
	Summer	•		Seeding					Green	Green	Green	Green	Green				
				Harvesting									Yellow	Yellow	Yellow		
South	Winter-Spring	•	•	Seeding	Green									Green	Green	Green	
				Harvesting			Yellow	Yellow	Yellow	Yellow							
	Summer-Autumn	•		Seeding			Green	Green	Green	Green							
				Harvesting					Yellow	Yellow	Yellow	Yellow					
	Summer	•		Seeding						Green	Green	Green	Green				
				Harvesting												Yellow	Yellow
	Autumn-Winter	•		Seeding								Green	Green				
				Harvesting	Yellow												Yellow
				Note:	Seeding	Green											
					Harvesting	Yellow											

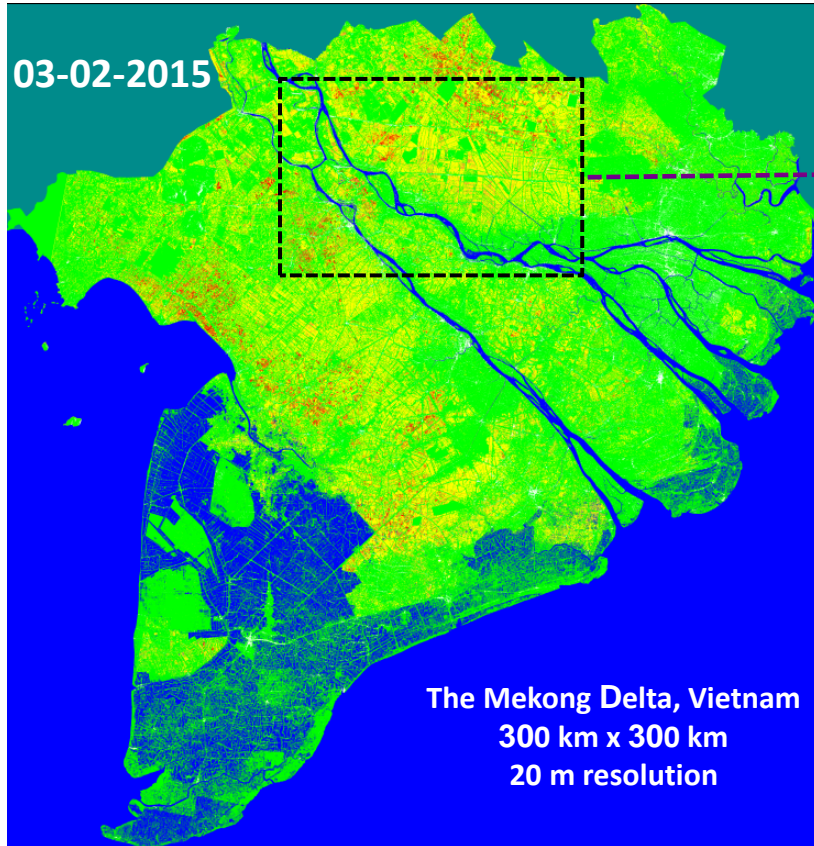


# Sentinel-1A acquires data every 12 days (6 days with Sentinel 1B)

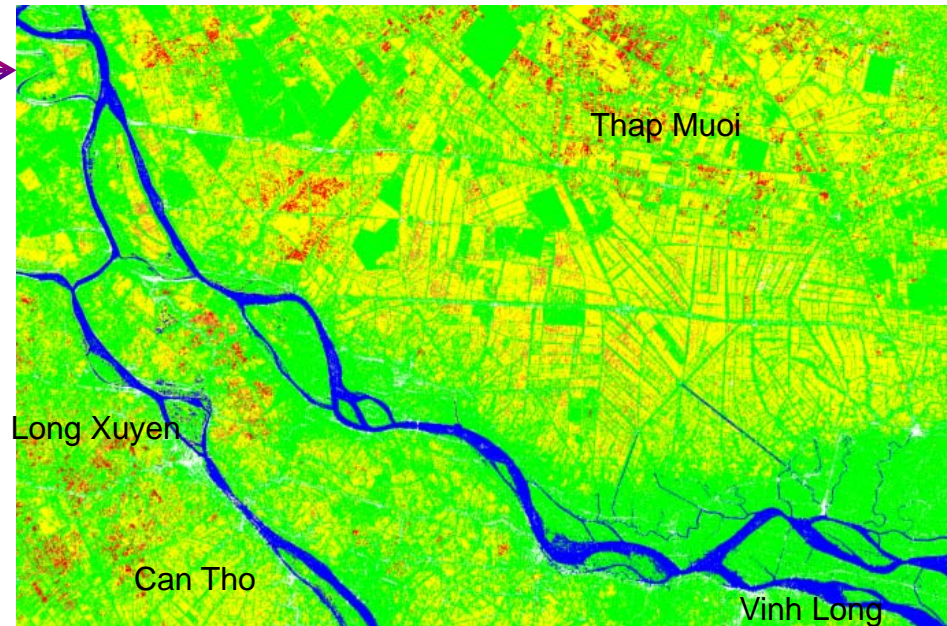


# Rice monitoring using Sentinel-1A data

Monitoring of Winter-Spring rice



100 km x 70 km, 20 m resolution

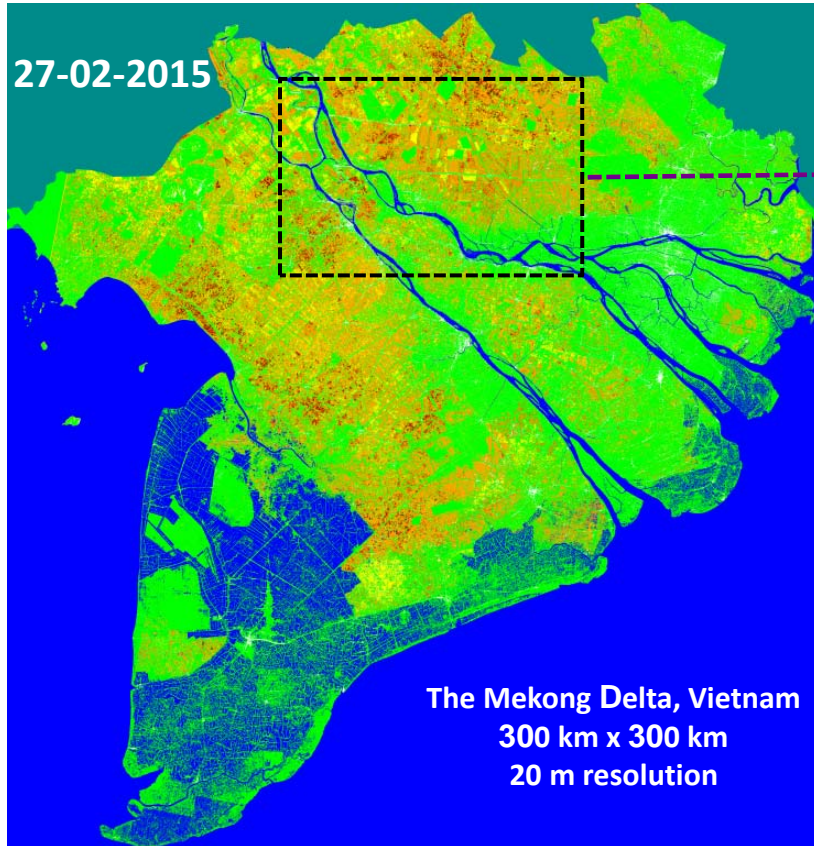


- |  |   |
|--|---|
|  | Rice: early stage   |
|  | Rice: tillering stage   |
|  | Rice: reproductive stage                                      |
|  | Rice: maturity stage  |
|  | Non rice (forest, other LULC)                                 |
|  | Land water/ sea / land outside the Vietnam Mekong river delta |

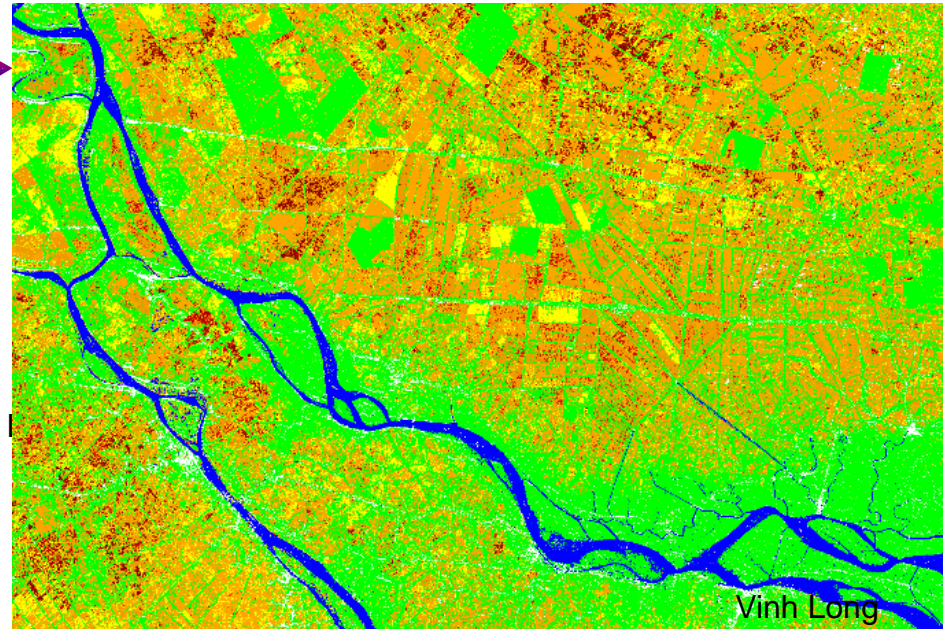








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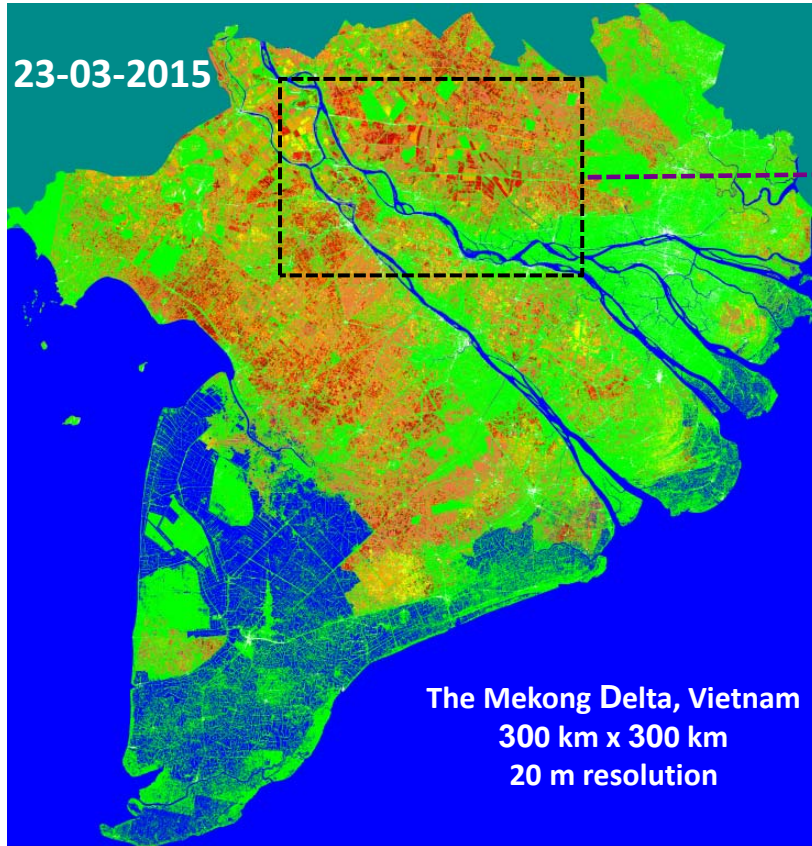


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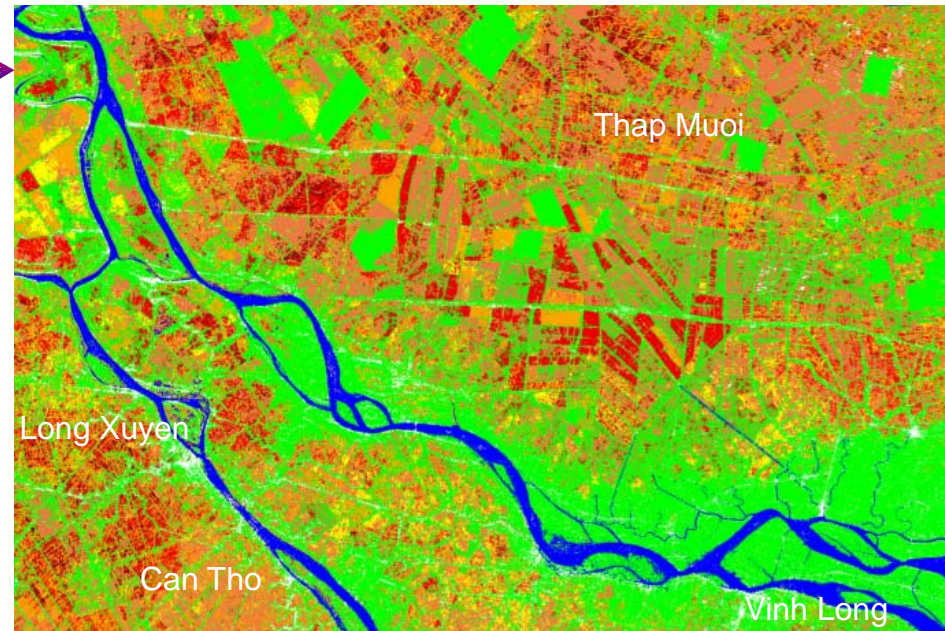


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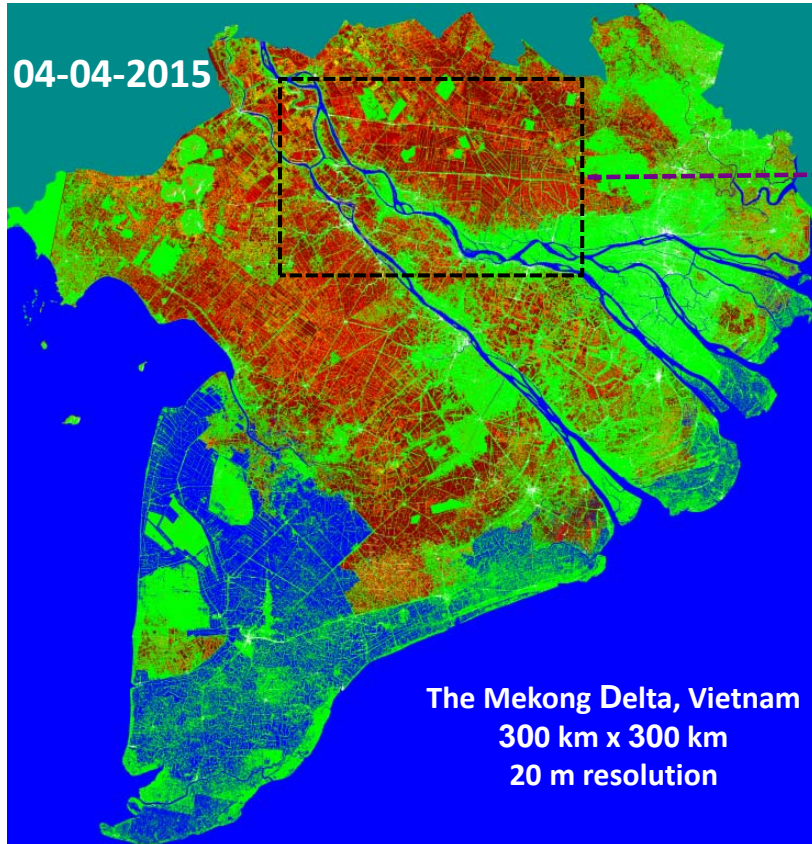


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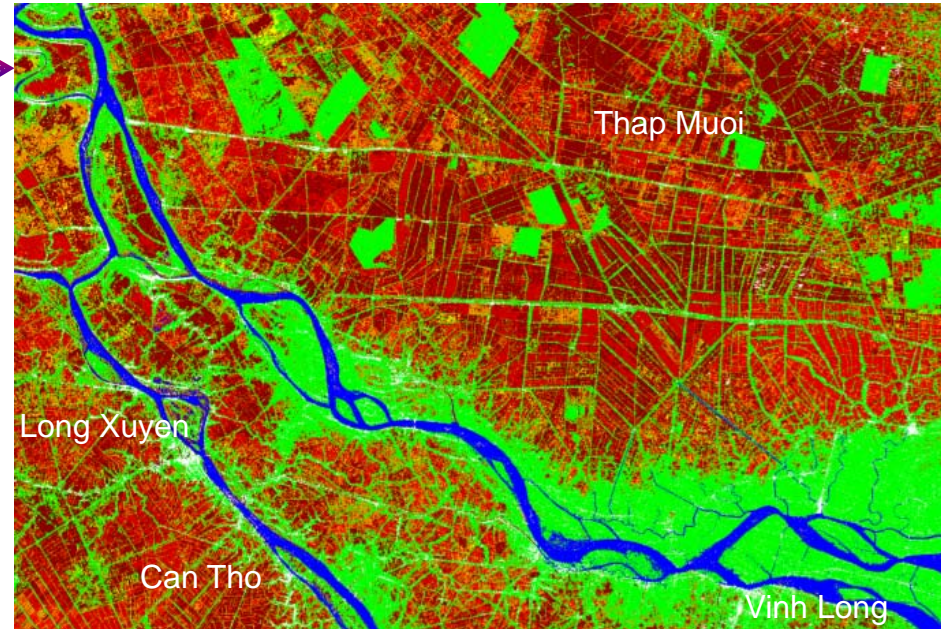


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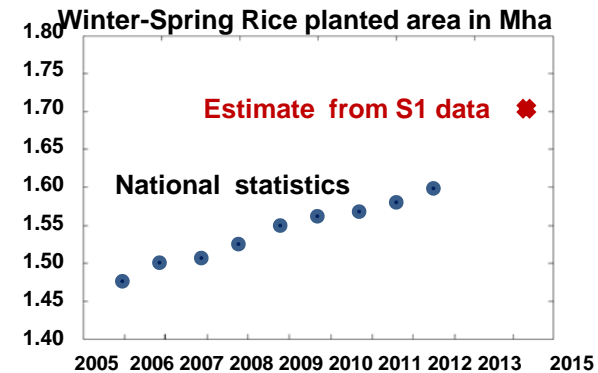
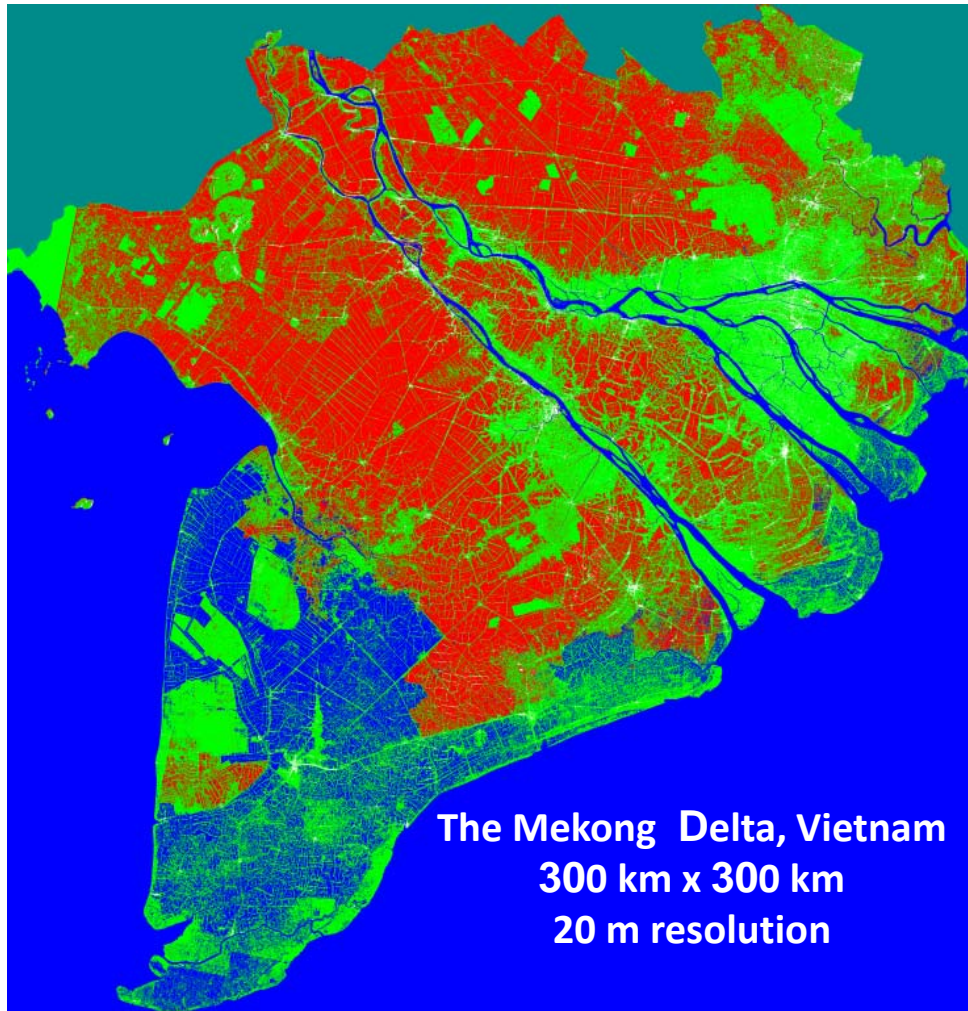


**innovators**  
georice

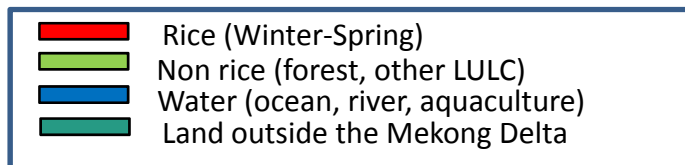


# Rice monitoring using Sentinel-1A data

## Map of Winter-Spring Rice (January-April) 2015



Estimated Winter-Spring planted area in 2015:  
1.704 Mha

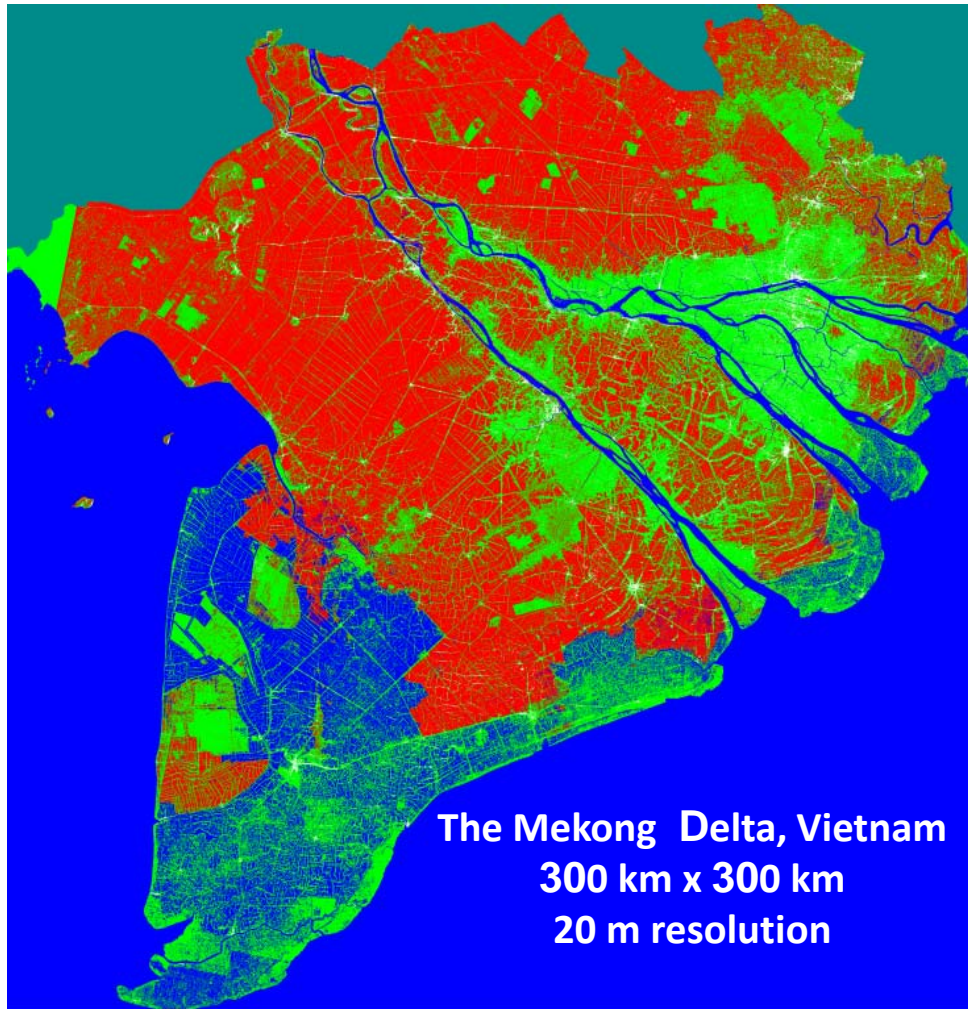


IW S1 Data: 10 January, 03 February, 27 February,  
11 March, 23 March, 04 April, 16 April 2015



# Rice monitoring using Sentinel-1A data

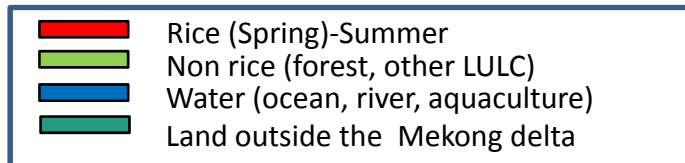
## Map of Spring-Summer Rice (April-July) 2015



**Mapping result obtained by 21 July 2015**

IW S1 Data: 28 April, 10 May, 16 May,  
15 June, 9 July, 21 July 2015

**Estimated Spring-Summer planted area in 2015:  
2.14 Mha**





## **Preliminary result of country-wide rice mapping with Sentinel 1A**

### **Rice season**

July - October 2015 (Thu-Dong)  
(the least important season in Mekong delta)

### **Data**

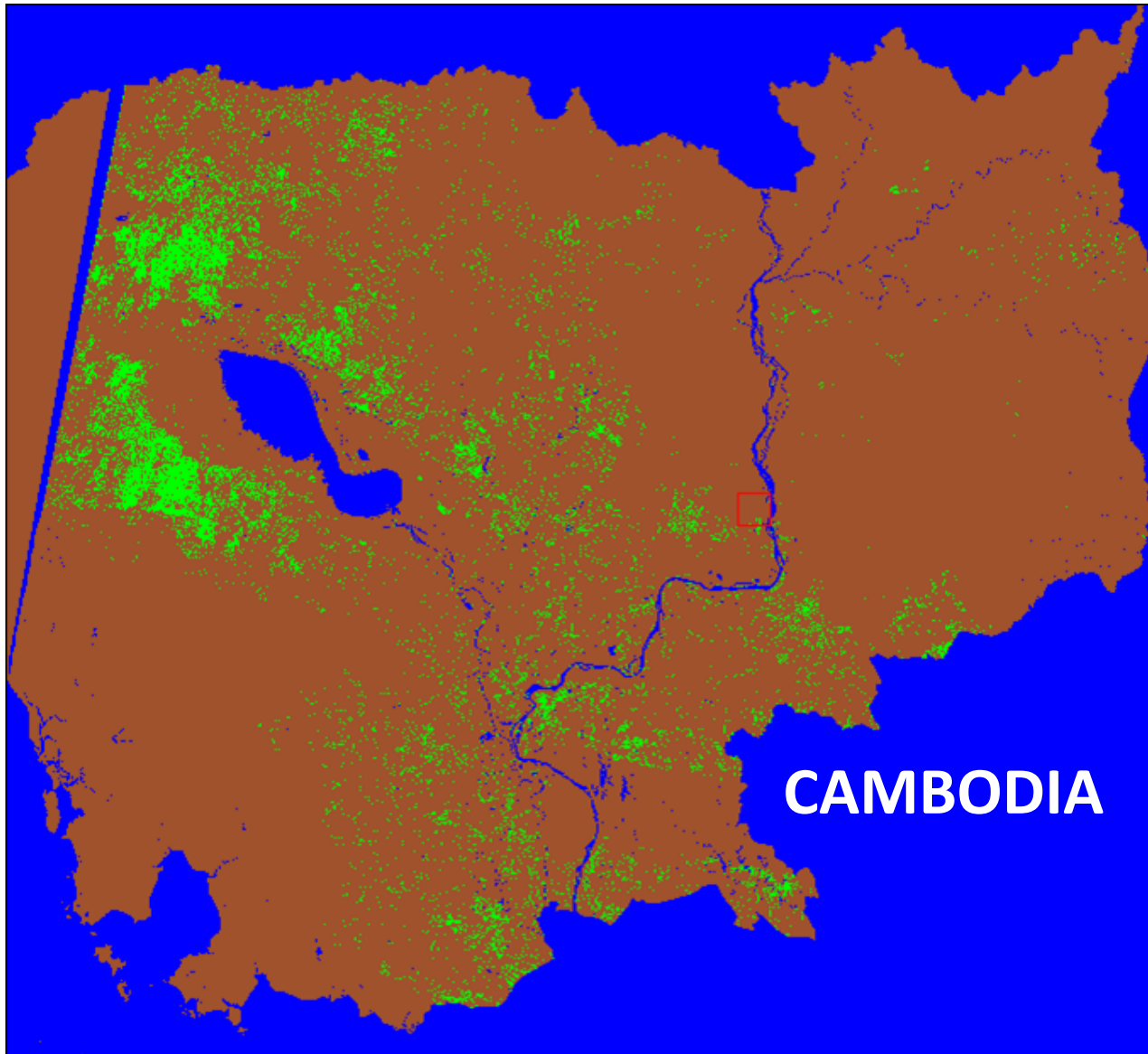
- 4 IW Strip data, 300 km wide
- 5 dates for a given strip, every 24 days, the acquisition dates differ among strips of from 2 to 7 days)

### **Result**

Rice map at 40 m  
Validation: on going

### **On going Improvement**

- Data every 12 days for Mekong Delta and Red River delta
- 20 m resolution



## Preliminary result of country-wide rice mapping with Sentinel 1A

**Rice season:** July -October 2015

**Data:**

- 3 IW Strip data of 300 km wide
- 4 dates for a given strip, every 24 days, the acquisition dates differ among strip of from 4 to 5 days)

**Result:** Rice map at 40 m

**On going Improvement :**

- Data every 12 days
- 20 m resolution



**Feasibility demonstrated, however, still a long way to go**

## **Asia-RiCE actions to promote satellite data usage**

- ❖ **Understand the user requirements**
- ❖ **Secure observation, continued and easy data access:** Share observation / acquisition plan of multiple satellites for rice growing and production estimation (especially for country scale)
- ❖ **Promote sharing of EO data, methods and related information** (especially ground based data and LULCC / rice crop mask, rice crop calendar, etc.). Organise training and workshops
- ❖ **Promote regional coordination** : need institutional support such as from ADB, UN-ESCAP, MRC, cooperation with JECAM, AFSIS, ESCAP, APRSAF, SERVIR MEKONG, etc. and contribution/endorsement from national monitoring systems