ALOS Kyoto & Carbon Initiative 22snd Science Team meeting (KC#22)

Asia-RiCE: Rice Crop Estimation and Monitoring (the role of PALSAR-2)

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On behalf of the GEOGLAM Asia-RiCE team

Feb 16, 2016
at RESTEC HQ, Tokyo

GEOGLAM
Global Agricultural Monitoring

Asia-RiCE

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Background of Asia-RiCE

Background of GEOGLAM/Asia-RiCE

G20 FRANCE summit 2011 :

- **The G20 Agriculture Ministers agreed on an "Action Plan on food price volatility and agriculture" in June 2011.**
- **The action plan was submitted at a Summit in November 2011.**
- **In order to improve crop production projections and weather forecasting, the use of modern tools was promoted, in particular remote sensing.**

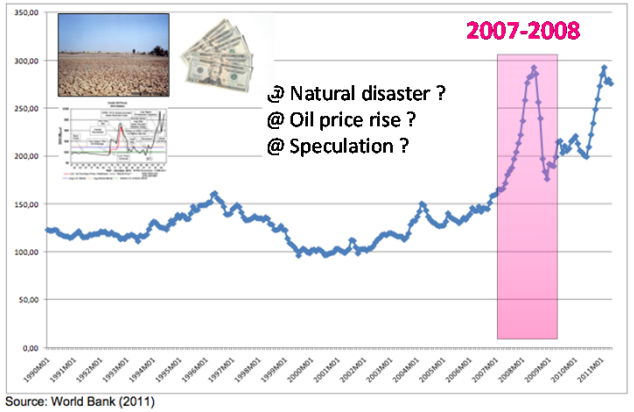


Figure 1: Food Price Index, monthly, January 1990–May 2011 (2000 = 100)

Source: World Bank (2011)

Part of the G20 Head of States Declaration:

44. We commit to improve market information and transparency in order to make international markets for agricultural commodities more effective. To that end, we launched:

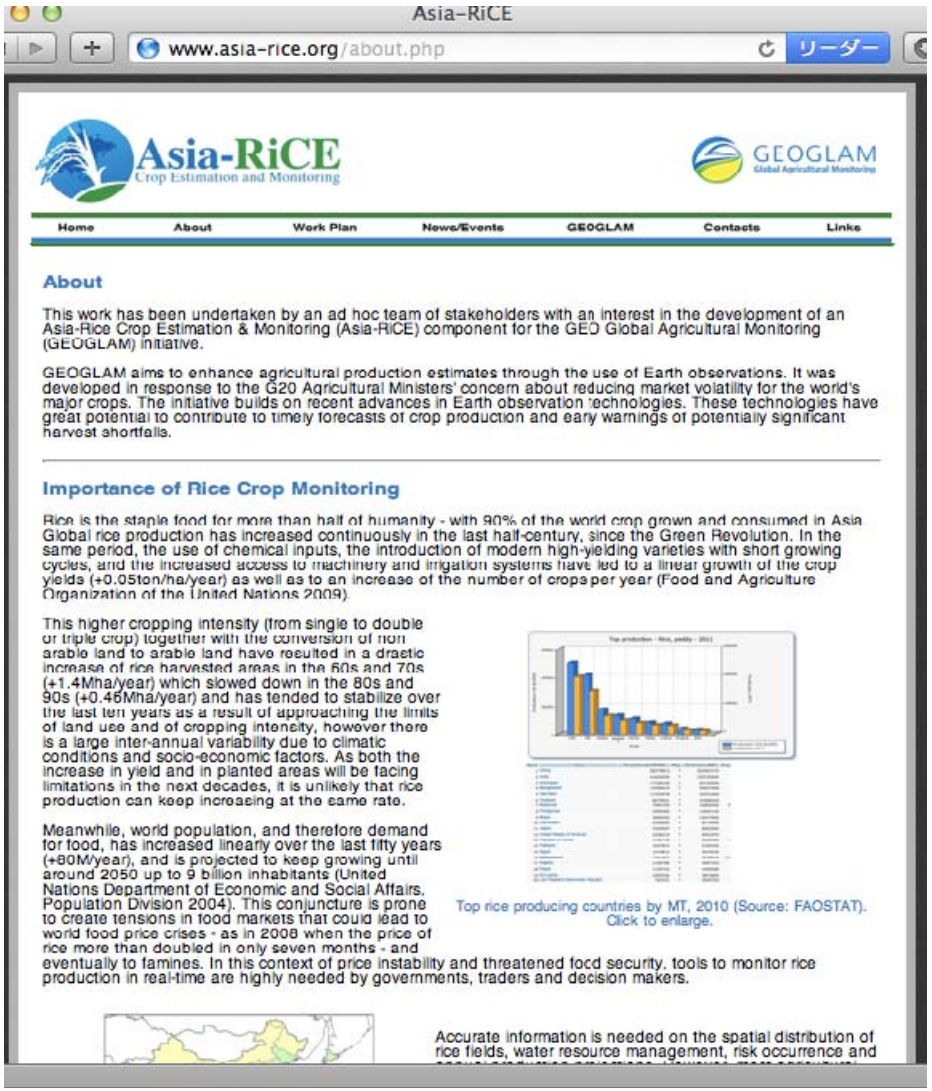
- The **"Agricultural Market Information System" (AMIS)** in Rome on September 15, 2011, to improve information on markets. It will enhance the quality, ….

- The **"Global Agricultural Geo-monitoring Initiative" (GEO GLAM)** in Geneva on September 22-23, 2011. This initiative will coordinate satellite monitoring observation systems in different regions of the world in order to enhance crop production projections and weather forecasting data.

Background of GEOGLAM/Asia-RiCE

- The GEO GLAM serves as a useful input for the AMIS. (four type of commodity crops – wheat, maize, rice, and soybeans)
- Since rice is the main commodity crop in Asia, Japan Aerospace Exploration Agency (JAXA) proposes and leads the Asian Rice Crop Estimation & Monitoring project (Asia-RiCE) for GEO GLAM.
- Asia-RiCE is a collaborative effort between a number of Asian organizations.

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



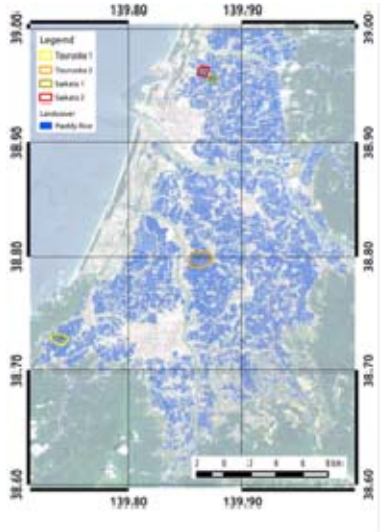
For more information, please visit our home page.

Plan of Asia-RiCE

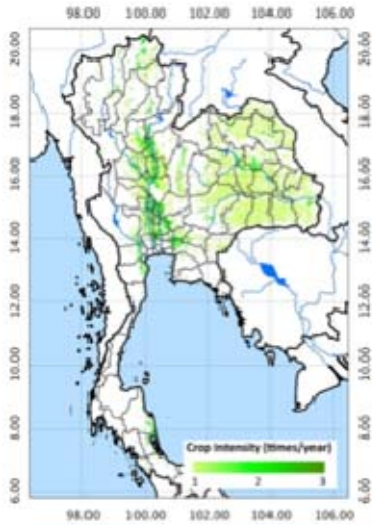
Asia-RiCE Target Agricultural Products

ID	Product
P1	**Rice Planting Area Estimates and Mapping**
P2	**Crop Calendars/Crop Growth Status**
P3	**Crop Damage Assessment**
P4	**Agro-meteorological Information Products**
P5	**Production Estimation and Forecasting**

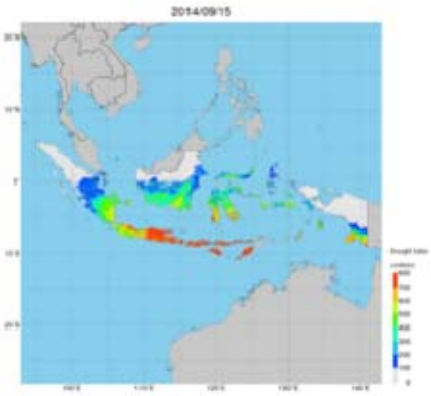
Example of Products



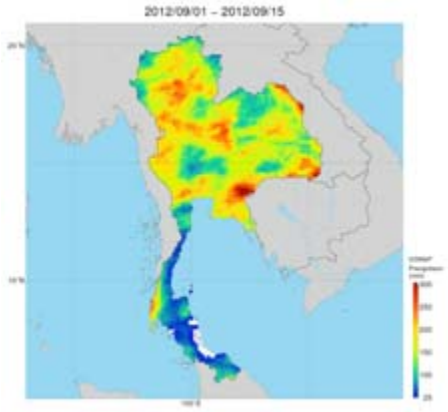
P1: Planted Area



P2: Crop Calendar



P3: Drought Warning



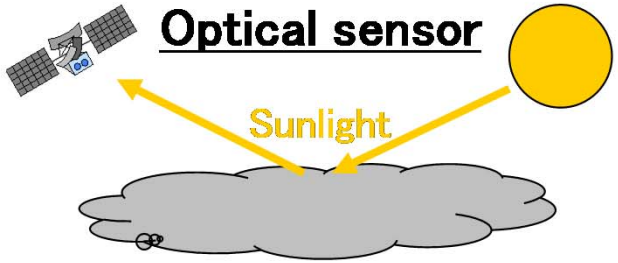
P4: Precipitation

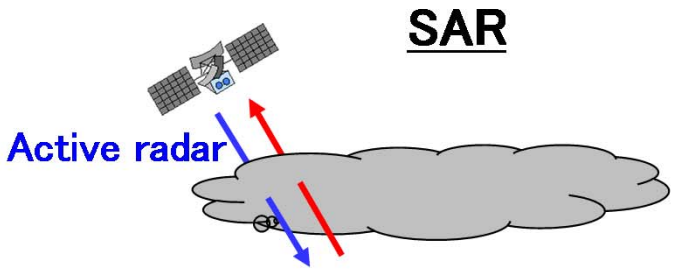
Asia-RiCE Work Plan http://www.asia-rice.org/files/workplan.pdf

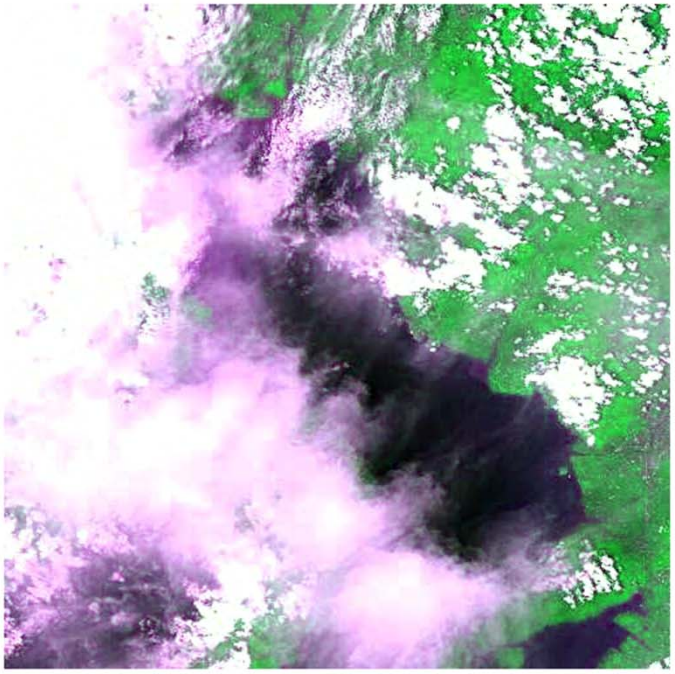
Asia-RiCE Crop Estimation and Monitoring

Advantage of synthetic aperture radar (SAR)

SAR is useful in Asian countries which have a lot of cloud, since microwave can penetrate the cloud.

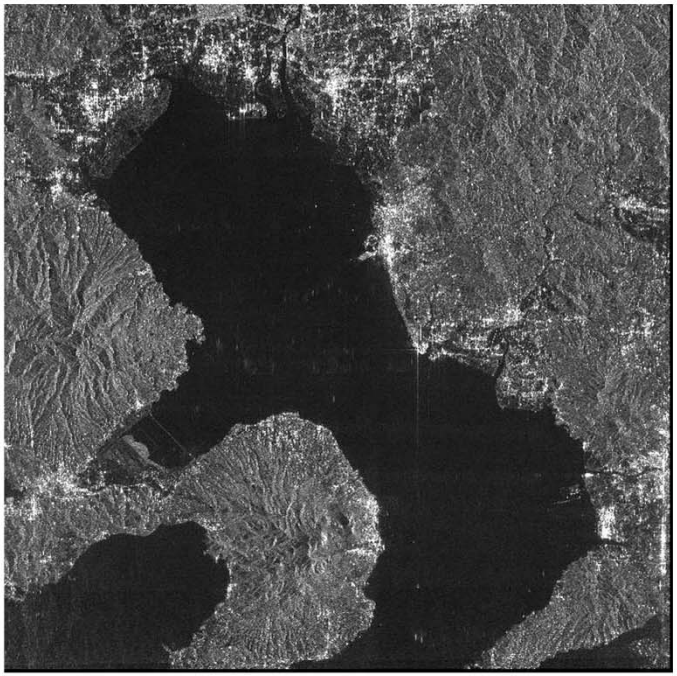






ALOS AVNIR-2 : The cloud covers the ground in the optical sensor image.

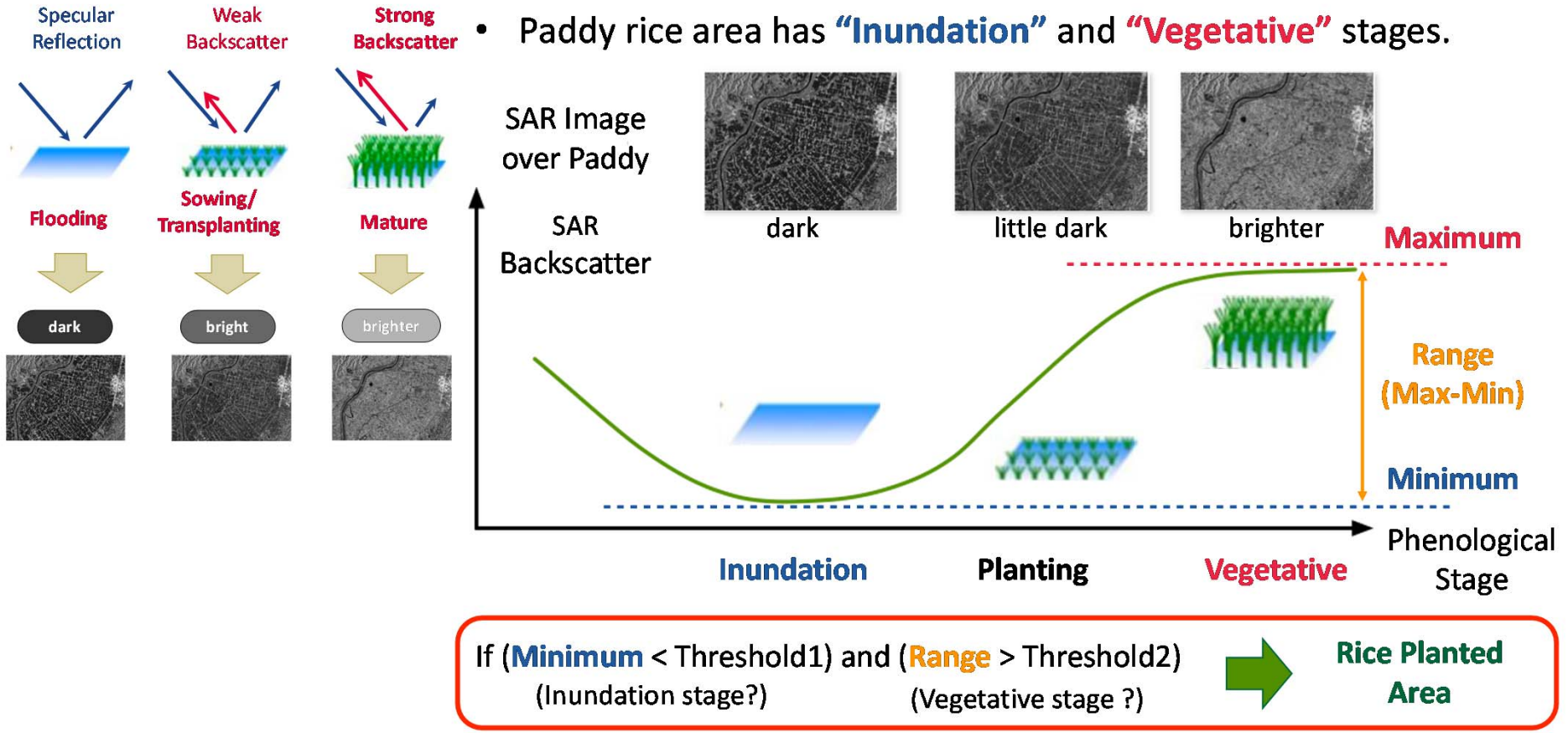
Observed simultaneously



ALOS PALSAR : SAR can observe the ground under the cloud.

Basic concept for identifying rice planted area

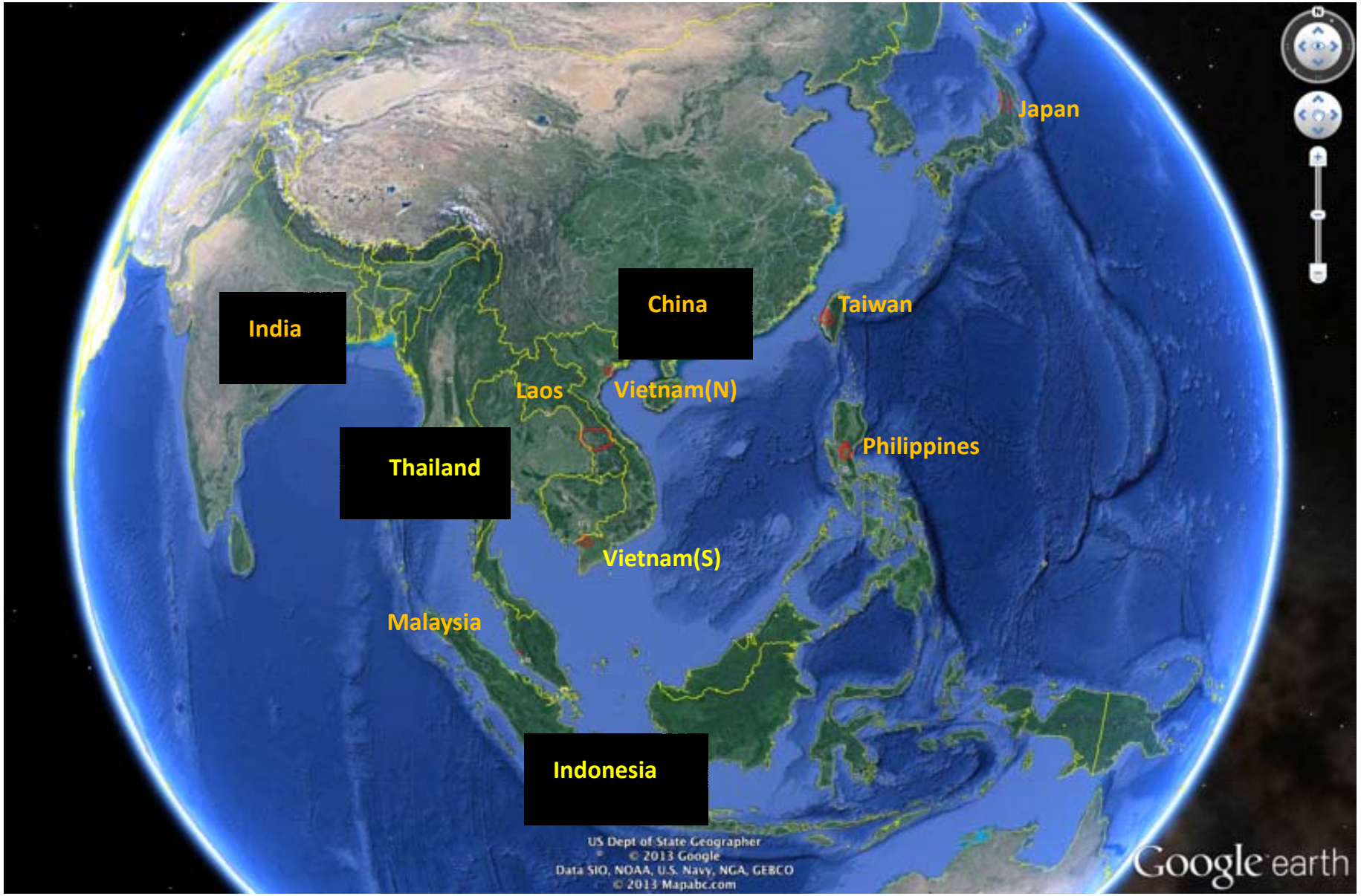
Rice area can be identified by analyzing characteristics which is the change of backscatter at rice field.
The area where is dark in planting stage and becomes brighter in vegetative stage is paddy field.



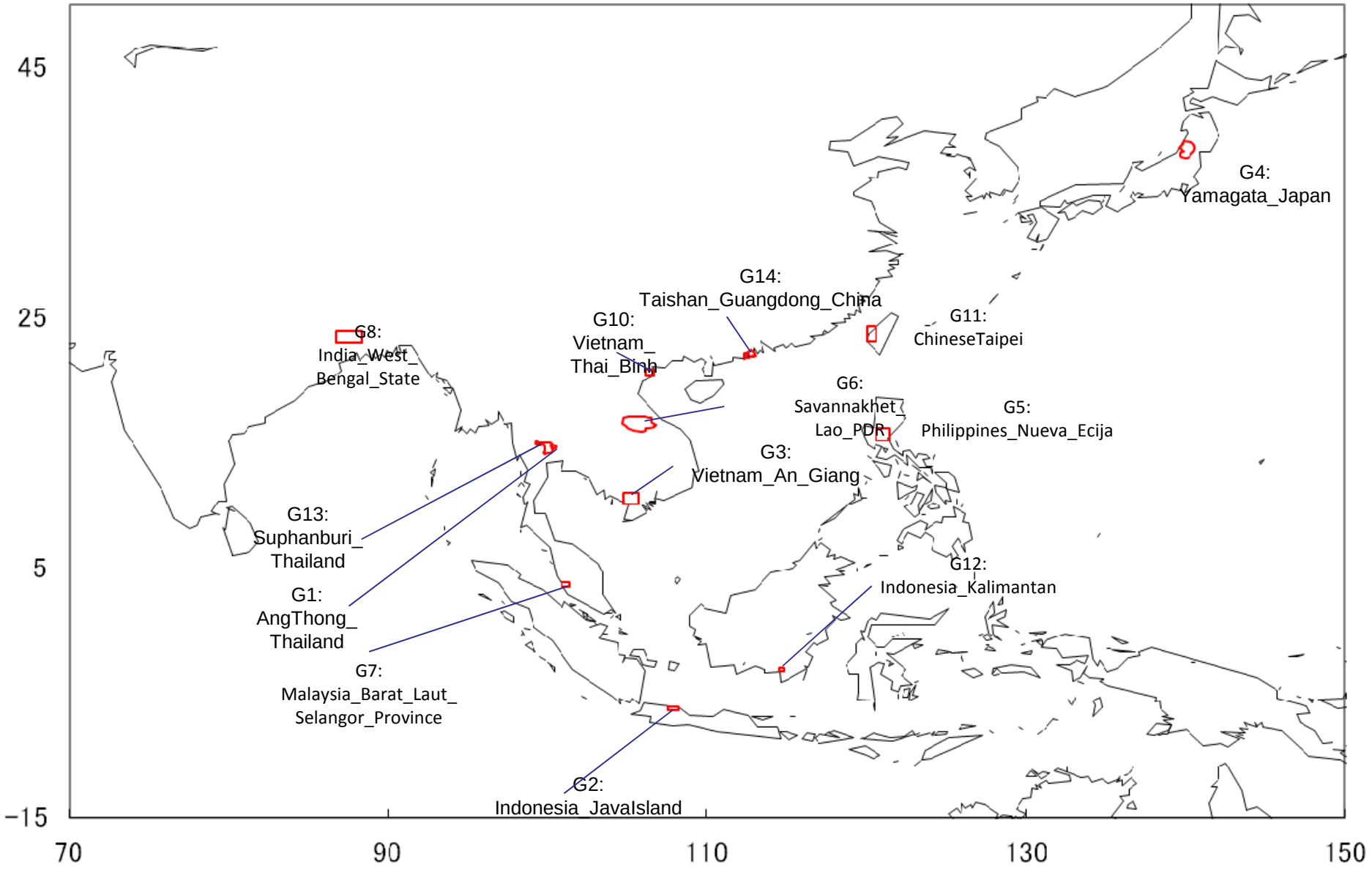
Asia-RiCE Team Phasing

Phase	Target Countries	2013	2014	2015	2016
Phase1A (Province level)	Indonesia, Vietnam(S), Thailand				
Phase1B (Province level)	Japan, Chinese Taipei, Malaysia, Myanmar, Cambodia,…				
Phase2 (Country level)	Indonesia, Vietnam(S), …				
Related activity (ADB)	Philippines, Thailand, Lao PDR, Vietnam(N)				
PALSAR-2 data available					

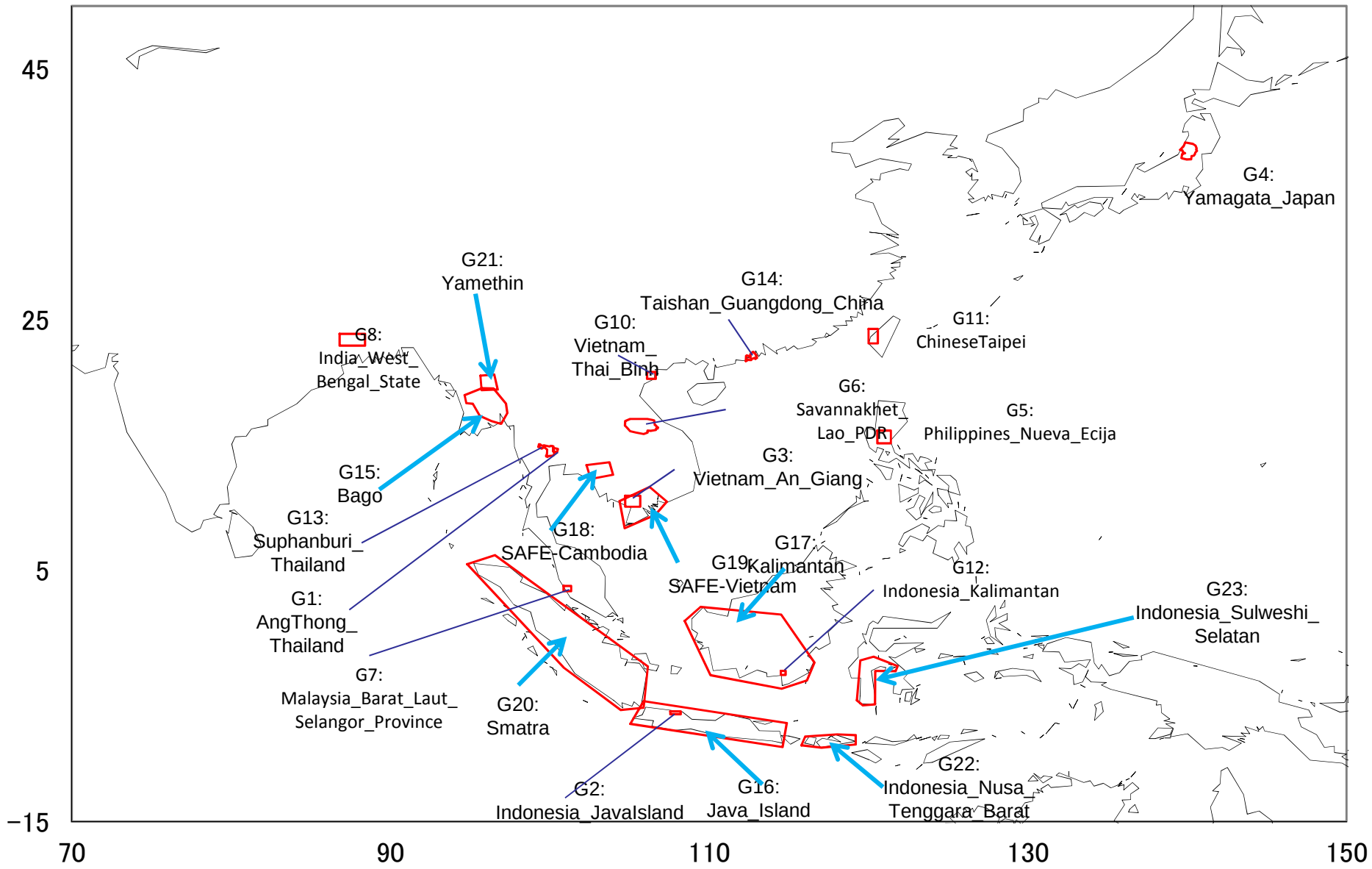
Asia-RiCE Technical Demonstration Sites



PALSAR-2 observation request in 2015 for Asia-RiCE Technical Demonstration Sites



PALSAR-2 observation request in 2016 for Asia-RiCE Technical Demonstration Sites



PALSAR-2 data available status on Asia-RiCE study sites

PALSAR-2 observation area in 2015

Indonesia
Subang

Japan
Yamagata

Vietnam(S)
An Giang

Chinese Taipei

Thailand
Sphan Buri

Malaysia
Barat Laut Selango

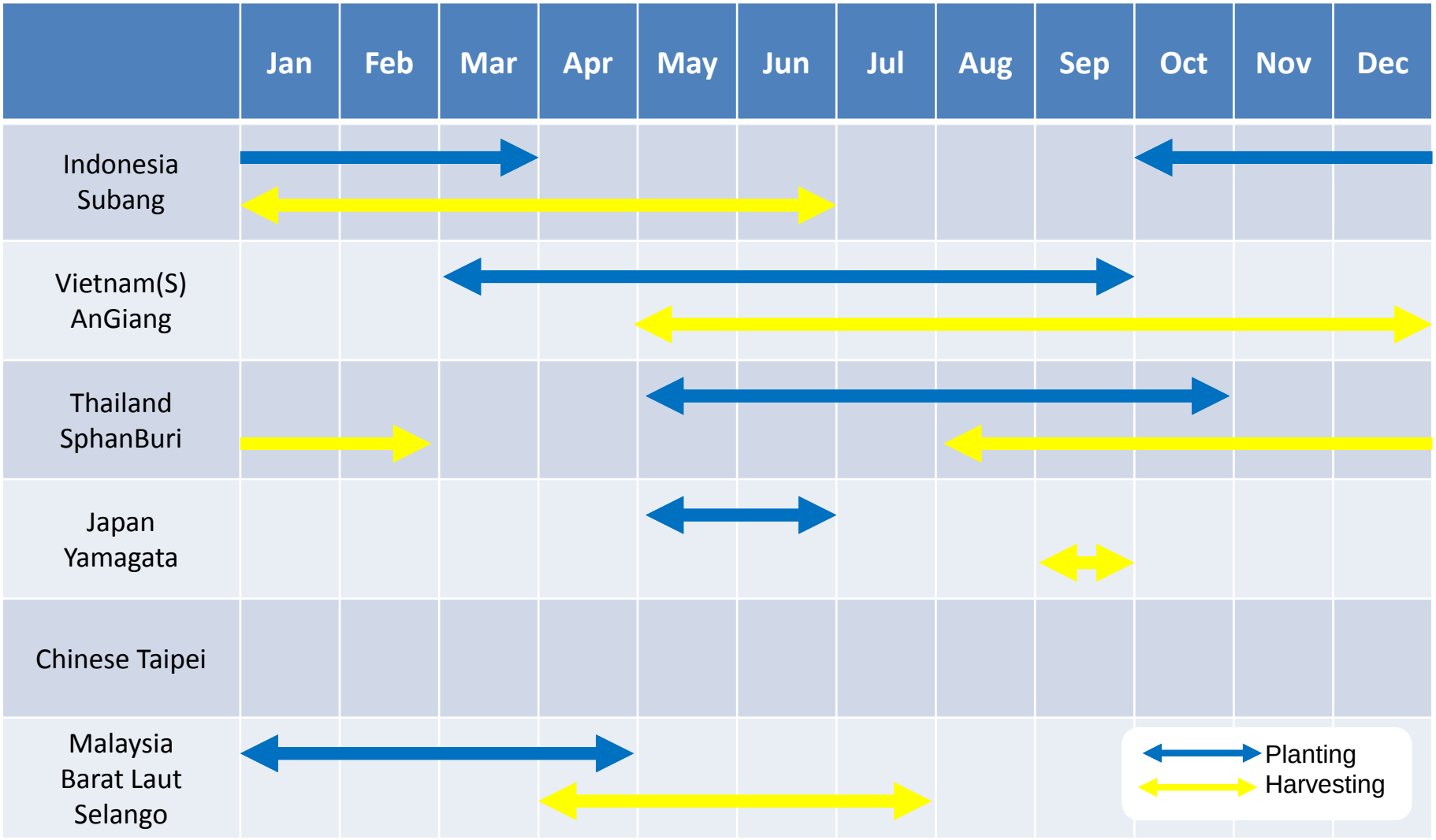
PALSAR-2 observation status

Indonesia	Vietnam(S)	Thailand	Japan	Chinese Taipei	Malaysia
Oct-Jun	Mar-Dec	May-Feb	May-Sep		Jan-Jul
ScanSAR	ScanSAR	ScanSAR	Ultra Fine	ScanSAR	ScanSAR
Path 32 2014; 08/14 09/11 10/23 12/04 2015; 01/15 02/26 04/09 GAP> 07/3 08/13 08/27 10/22 12/03 2016; 01/14	Path 35 2014; 12/05 2015; 01/16 04/10 05/22 07/03 08/14 08/28 10/23 GAP> 2016;	Path 38 2014; 12/06 2015; 01/17 02/28 04/11 07/04 08/01 10/24 12/05 2016; GAP>	Path 18 2014; 10/09 2015; 05/07 05/21 06/04 06/18 07/02 07/16 08/13 10/22 2016; 01/14	Path 27 2014; 09/14 10/26 2015; 04/12 05/10 05/24 GAP> 08/30 10/25 12/20 2016; 01/31	Path 37 2014; 09/08 10/20 2015; 01/12 04/06 05/18 GAP> 2016;

Red color is data available for main rice from planting to harvest in the average year.

There are some GAPs. Ideally, the observations are required at least every month.

Crop Calendar for main rice in rainy season



In ASEAN countries, we have to monitor the situation every month,
since planting situation is dramatically changed by depending on water condition.

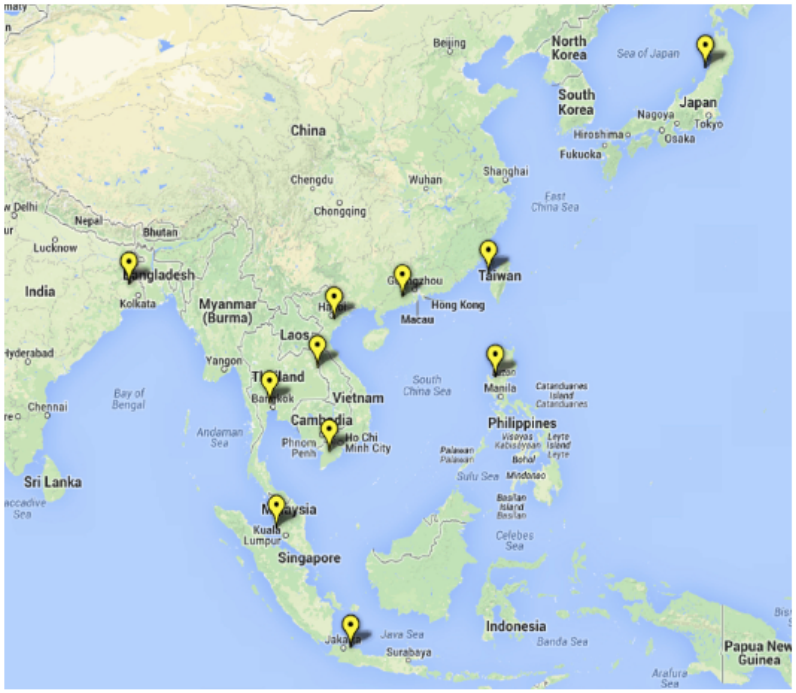
Data distribution system for Asia-RiCE KC4

K&C4 ALOS-2 PALSAR2 Data Distribution System for Asia-RiCE

Description

This is a online ALOS-2 PALSAR-2, Japanese Synthetic Aparture Radar (SAR), data distribution system for implementing the Asian Rice Crop Estimation and Monitoring (Asia-RiCE) as a component of the GEO Global Agricultural Monitoring (GEOGLAM). ALOS-2 data are provided by JAXA under the framework of Kyoto & Carbon4 (K&C4) Initiative.

Asia-RiCE Technical Demonstration Sites (Asia-RiCE TDS)



Asia-RiCE
Crop Estimation and Monitoring

-Chinese Taipei
-India
-Indonesia
-Japan
-Lao P.D.R.
-Malaysia
-Philippines
-Thailand
-Vietnam_North
-Vietnam_South
-Argentina (GEOGLAM JECAM Site)

ALOS-2 Related Links

-ALOS Research and Application Project of JAXA/EORC
-Product/Data Format Info.
-Calibration Info.

Last update : September 03 2015 07:29:34
Managed by Earth Observation Research Center (EORC), Japan Aerospace Exploration Agency (JAXA)

- Since AUIG-2 account is provided for PI only, we have to distribute data to CI after getting the products by AUIG-2.
- We developed a web system to distribute PALSAR-2 data to CI.
- The system requires ID & password so that CI can't get other country's data.

Data distribution system for Asia-RiCE KC4

K&C4 ALOS-2 PALSAR2 Data Distribution System for Asia-RiCE

Important Notice for ALOS-2 Data Users under the K&C4 Initiative

Data Policy(K&C4 Agreement:Article.7 Provision and Rights of Earth Observation Satellite Data by JAXA)

-With respect to the handling of Earth Observation Satellite Data provided by JAXA, the Research Organization shall comply with the conditions below and instruction of JAXA;

(1) The Research Organization shall use the provided the Earth Observation Satellite Data solely for the purpose of implementation of the Agreement;
(2) It is prohibited to disclosure, re-distribution and duplication to a third party of the Earth Observation Satellite Data, except for the PI, CI, and a party agreed by JAXA of such disclosure, re-distribution and duplication. However, RO can duplicate the Earth Observation Satellite Date for creating a backup;
(3) The RO shall return, dispose, or otherwise appropriately keep the Earth Observation Satellite Data (including the duplicated data) in accordance with the instruction of JAXA upon the termination of this Agreement.

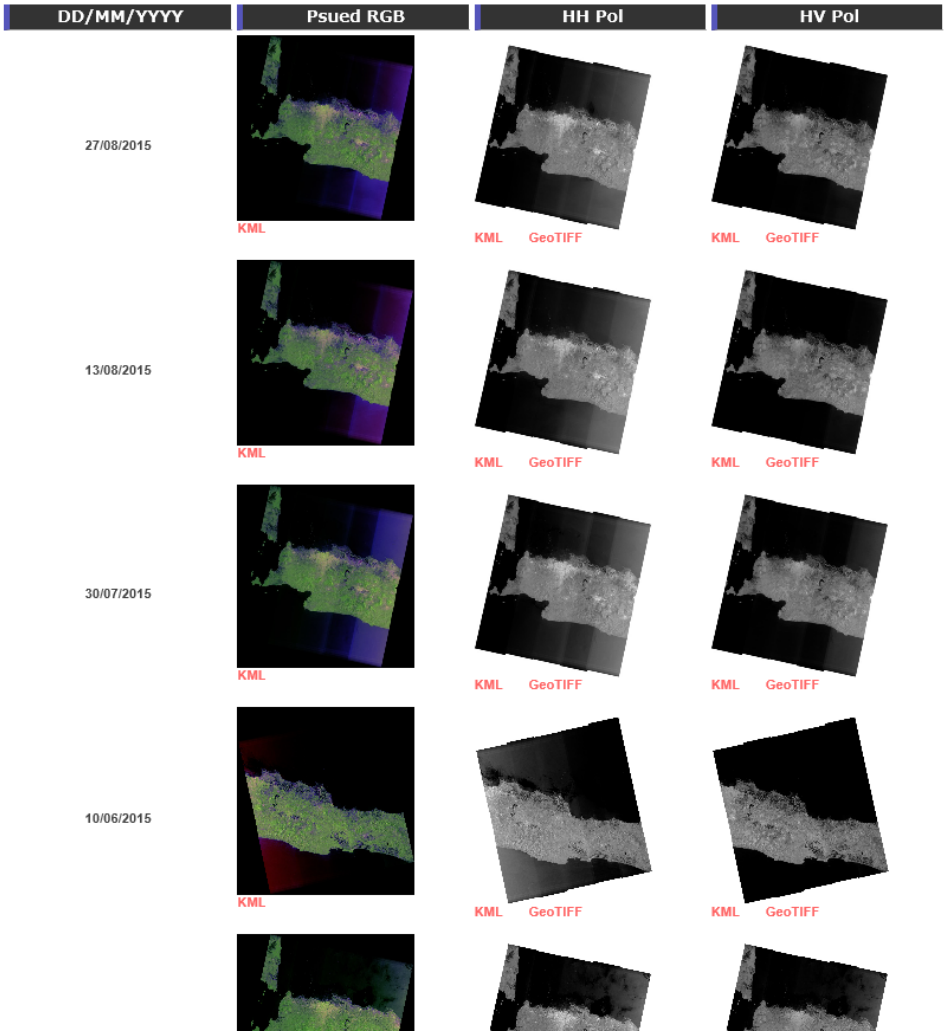
See whole K&C4 Agreement
See Application form and Co-Investigators List

Data Description

Product Level: 2.1
- Orthorectified by using digital elevation model (SRTM90)
- Geoid Model: EGM96
- Resampling Method: Nearest Neighbor (NN)
- GeoTiFF Format (16-bit, Unsigned Int)

Brightness gaps between the scans of level 2.1 ScanSAR products
Brightness gaps between the scans are currently seen in some WD1 (wide area observation 350km) level 2.1 products. Calibration and pre-processing software developpment to remove the gaps and refine the ALOS-2 product are underway.

About Data Processing Levels
About ALOS-2 Satellite



- CI can download the data with this system.
- CI must observe the data policy according to K&C4 agreement.
- Product level 2.1 is provided.
- The product has brightness gaps between the scans now.

Rice planted area/production estimation software (INAHOR)

Rice planted area/production estimation software

RESTEC developed a software named INAHOR which can estimate rice planted area and production using SAR data under contract with JAXA, In order to standardize a methodology for monitoring rice using satellite data in Asian countries.

INAHOR :

INternational Asian Harvest mOnitoring system for Rice
(and “INAHO” also means “rice year” in Japanese)

The main functions :

- Providing a rice planted area map (including the growing stages classification)
- Providing a rice planted area and production (need yield information)

Input satellite data :

Time-series SAR data (ALOS PALSAR,
ALOS-2 PALSAR-2, RADARSAT-2, Sentinael-1)

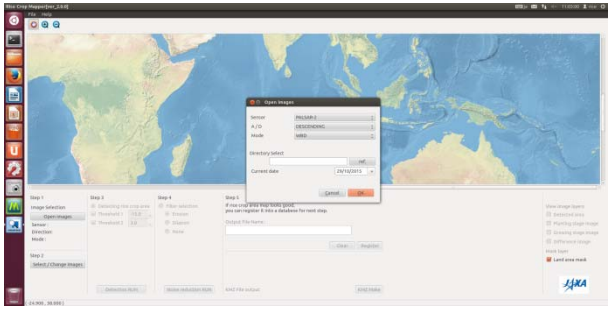
Rice planted area/production estimation software

Significant feature in the design of INAHOR :

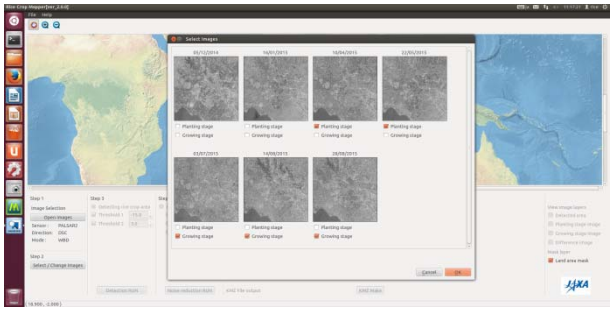
The software was designed for a local officer so that they can get easily the useful information from satellite data.

You can get the rice mapping result, only 5 steps, from open the data until save the result.

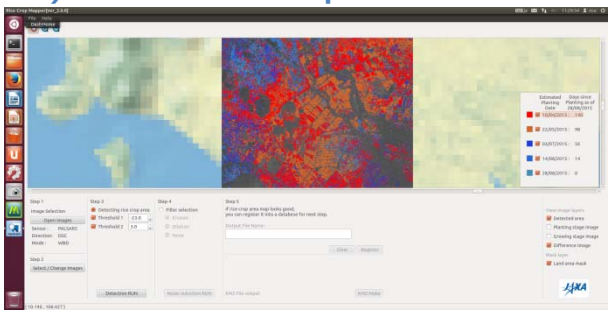
1) Select satellite data



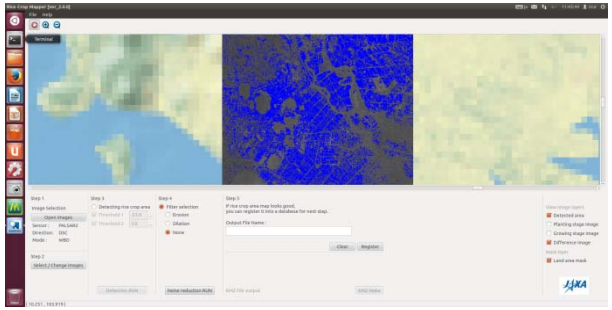
2) Select image data



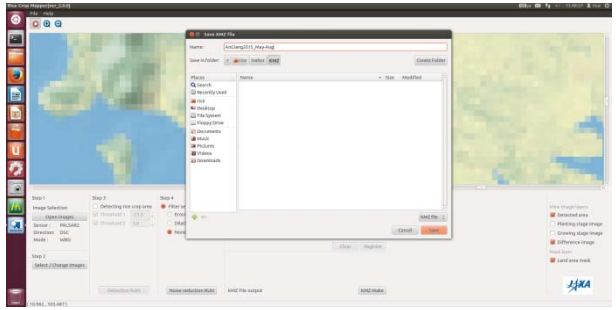
3) Detect rice planted area



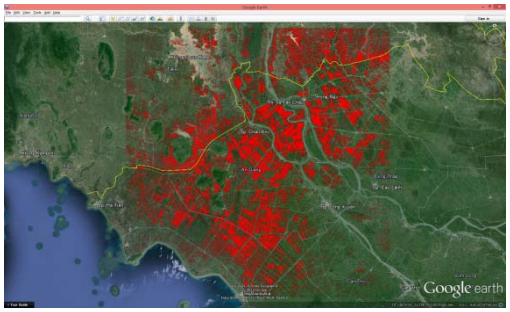
4) Binarization



5) Save the result



Export to KMZ



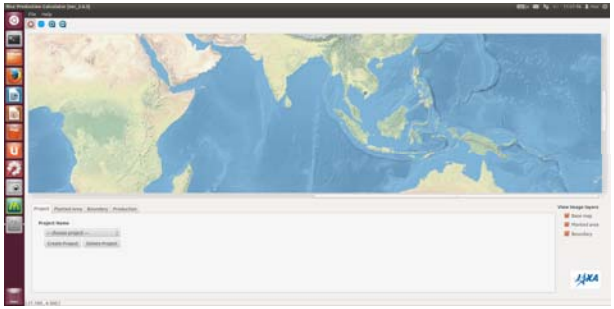
Rice planted area/production estimation software

Significant feature in the design of INAHOR :

After rice crop mapping, you can get the planted area and the production easily.

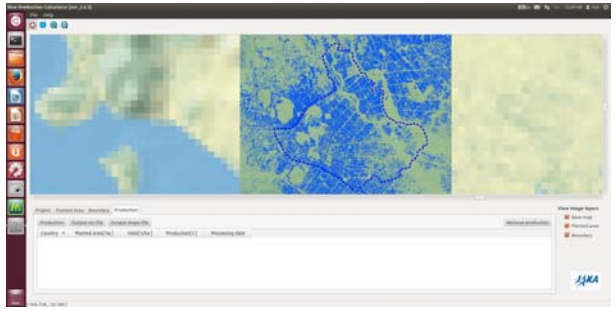
The calculating procedures are 5 step only as well.

1) Launch calculator

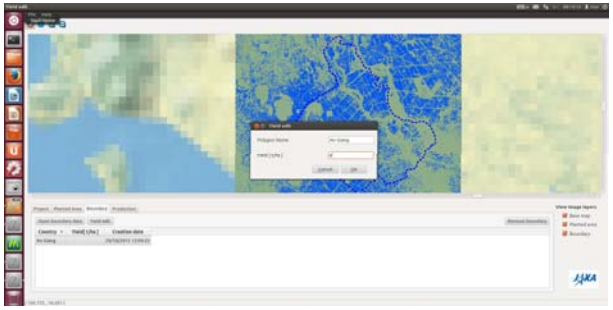


2) Load the rice map

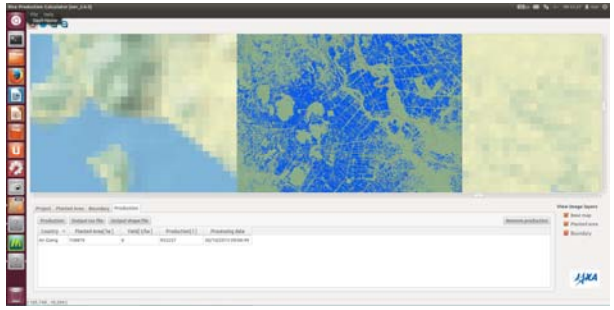
3) Load a boudary



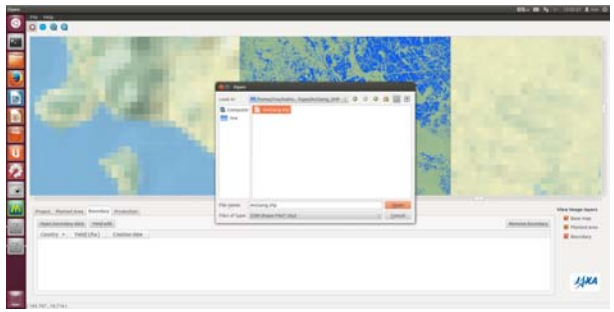
4) Input yield data



5) Calculate area & production



Export to shp and csv

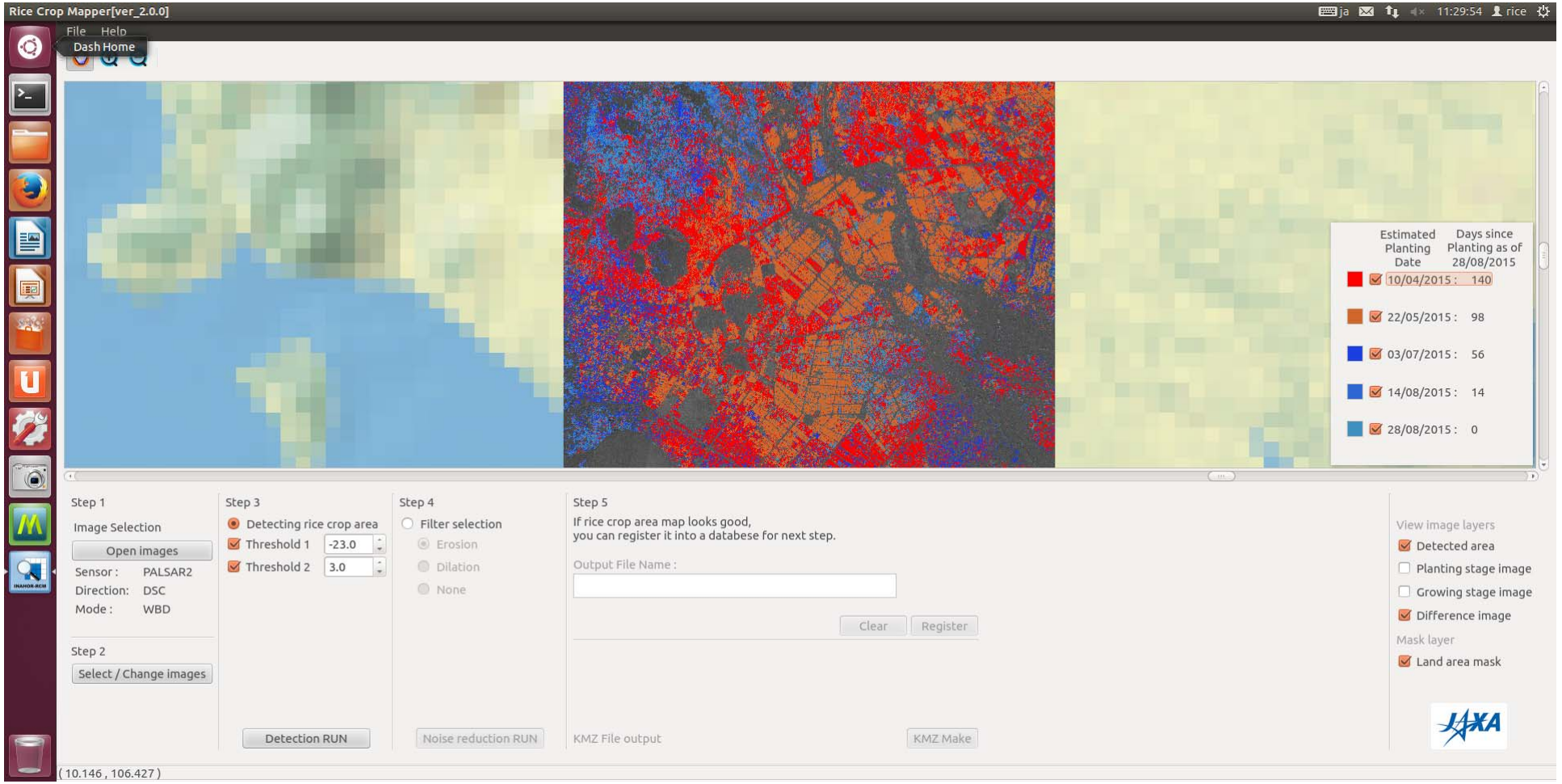


The initial validation status

Example of the rice planted area estimation result at An Giang in southern Vietnam

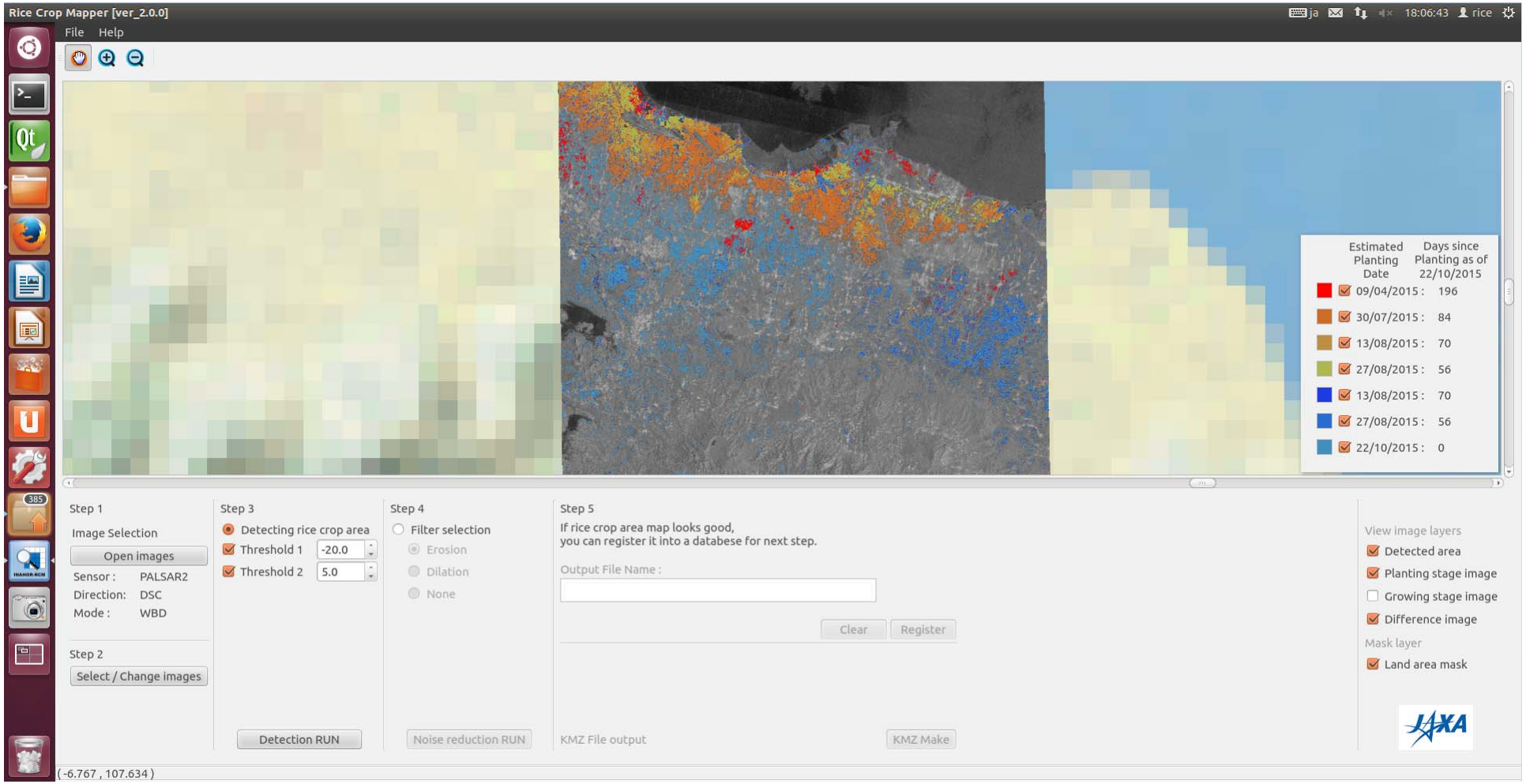
- Red area is planted area where the estimated planting date was on Apr. (140 days since planting)
- Orange area is planted area where the estimated planting date was on May. (98 days since planting)
- Blue color group is inundation area where can be estimated as planting or preparation stage.

The result of roughly validation was good with just looking by local staff.

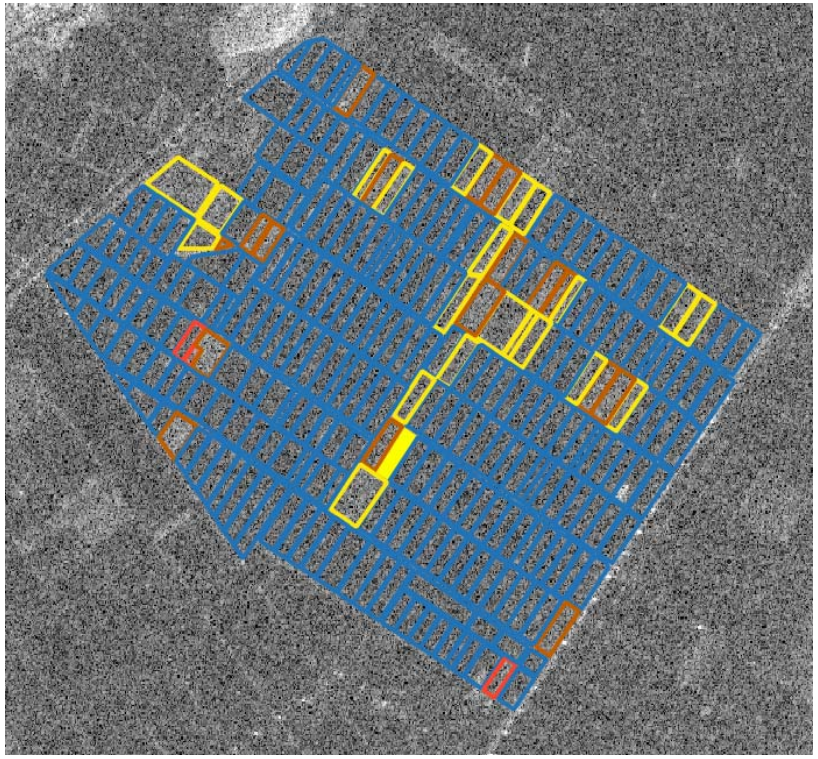


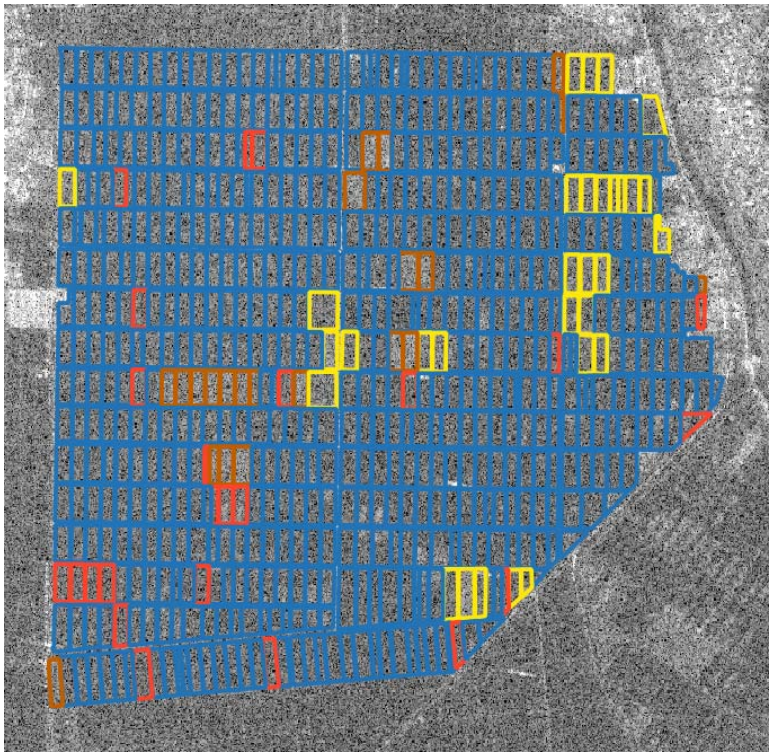
Example of the rice planted area estimation result at Subang in Indonesia

In this site, the planting starts from the mountain side to the sea side in order.
The change of growing stages can be seen on the estimation result below.
The result of roughly validation was good with just looking by local staff.



Example of the initial validation result at Yamagata in Japan





	GT: Rice	GT: Non-Rice	Total
INAHOR: Rice	813	39	852
INAHOR: Non-Rice	27	53	80
Total	840	92	932

The total accuracy is 92% = (813+53)/932*100. But rice fields are too much to get actual accuracy. Most of error for “Non-Rice” were soybeans.

Reference

Soybeans

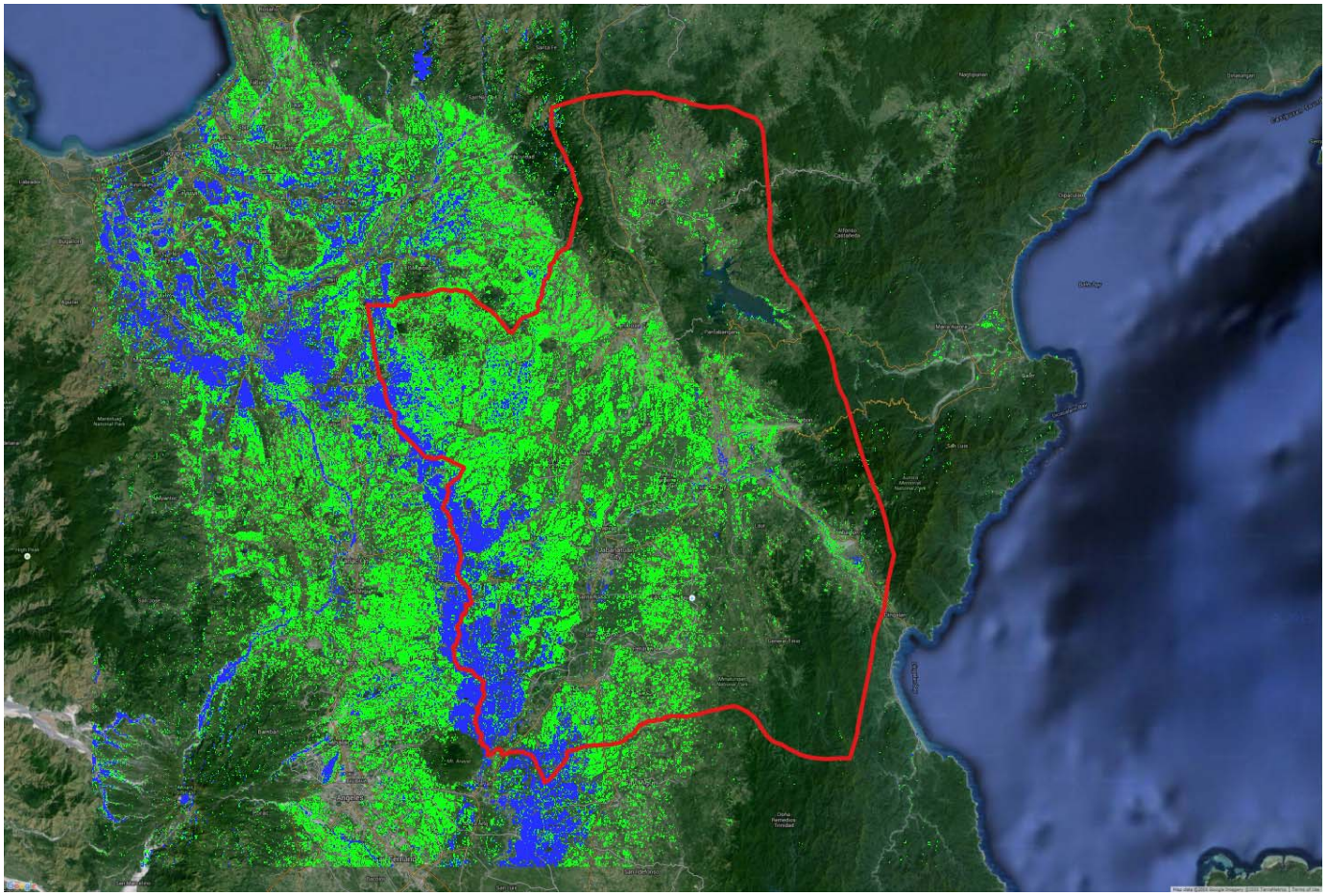


Rice



According to the other projects with Ministry of Agriculture, Forestry and Fisheries, the change of soybeans is very similar to rice in HH polarization. There's a possibility soybeans can be identified by using HV polarization. Now the method is been validating in that project.

“Koppu” Flood damaged assessment at Nueva Ecija in the Philippines



Last Oct., typhoon “Koppu” attacked Nueva Ecija where was study site of ADB project in the Philippines.
We made the flood damaged assessment map by using INAHOR, and provided it to the government of the Philippines.

Summary

Summary

- Asia-RiCE team is tackling to develop target products (P1, P2, P3, P4, P5) by using PALSAR-2 data in each country.
- Now we are trying initial analysis for last season rice and initial validation.
- The result of roughly validation was good.
- We will continue to validate the result by using field survey data.
- Myanmar and Cambodia are joining us in this season.
- The target area in Indonesia and Vietnam will be expanded to country (half) level from provincial level.
- Validations in the Philippines, Vietnam, Thailand and Lao PDR are going on in ADB Project.
- For observation, ideally, it is required at least every month, in order to monitor the planting situation which is dramatically changed by depending on water condition, in ASEAN countries.

Thank you for your attention