K&C Phase 4 – Brief project essentials

Asia-RiCE: Rice Crop Estimation and Monitoring

Shin-ichi Sobue
Remote Sensing Technology Center of Japan

Science Team meeting #21 – Phase 4 Kick-off
Kyoto Research Park, Kyoto, Japan, December 5, 2014

ALOS

K&C Initiative
An international science collaboration led by JAXA

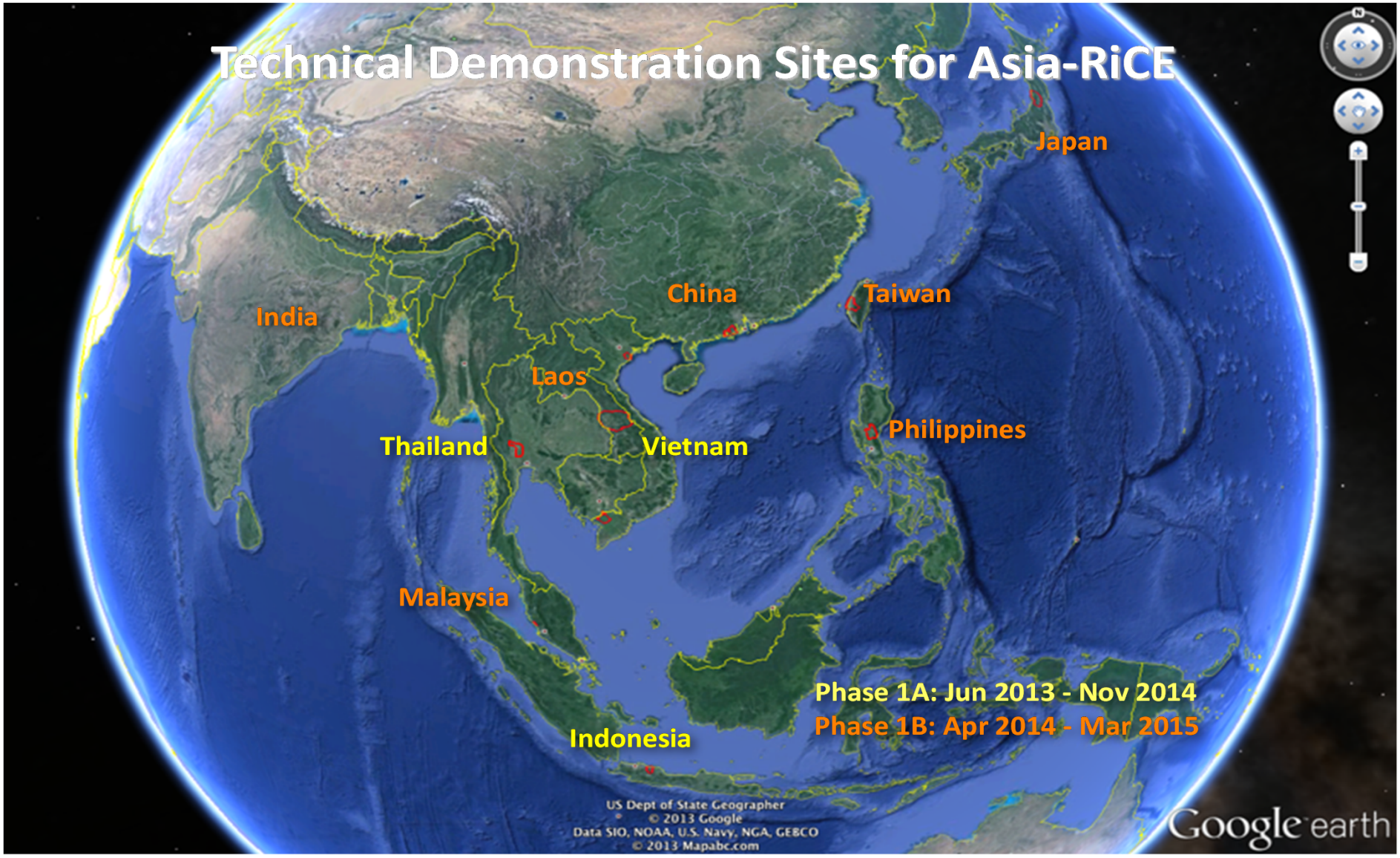
Regional Cooperation for rice crop monitoring using space technology in Asia

Project outline and objectives

To develop the Asian rice crop estimation and monitoring. It is a component of the GEO Global Agricultural Monitoring (GEOGLAM) initiative to enhance regional and global agricultural production estimates through the use of Earth observations.

About 100 × 100 km/single province Technical Demonstration Sites (TDS) in Asia-RiCE members' countries. There are currently 10 Asia-RiCE TDS in 9 countries in Asia.

ALOS-2 ScanSAR and other data over all Phase 1 TDSs is a key to estimate of rice crop area and production estimates at the provincial level.


Technical Demonstration Sites for Asia-RiCE
Japan
China
Taiwan
India
Laos
Philippines
Thailand
Vietnam
Malaysia
Phase 1A: Jun 2013 - Nov 2014
Phase 1B: Apr 2014 - Mar 2015
Indonesia
US Dept of State Geographer
© 2013 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Mapabc.com
Google earth

Project outline and objectives

To develop the Asian rice crop estimation and monitoring. It is a component of the GEO Global Agricultural Monitoring (GEOGLAM) initiative to enhance regional and global agricultural production estimates through the use of Earth observations.

About 100 × 100 km/single province Technical Demonstration Sites (TDS) in Asia-RiCE members' countries. There are currently 10 Asia-RiCE TDS in 9 countries in Asia.

ALOS-2 ScanSAR and other data over all Phase 1 TDSs is a key to estimate of rice crop area and production estimates at the provincial level.

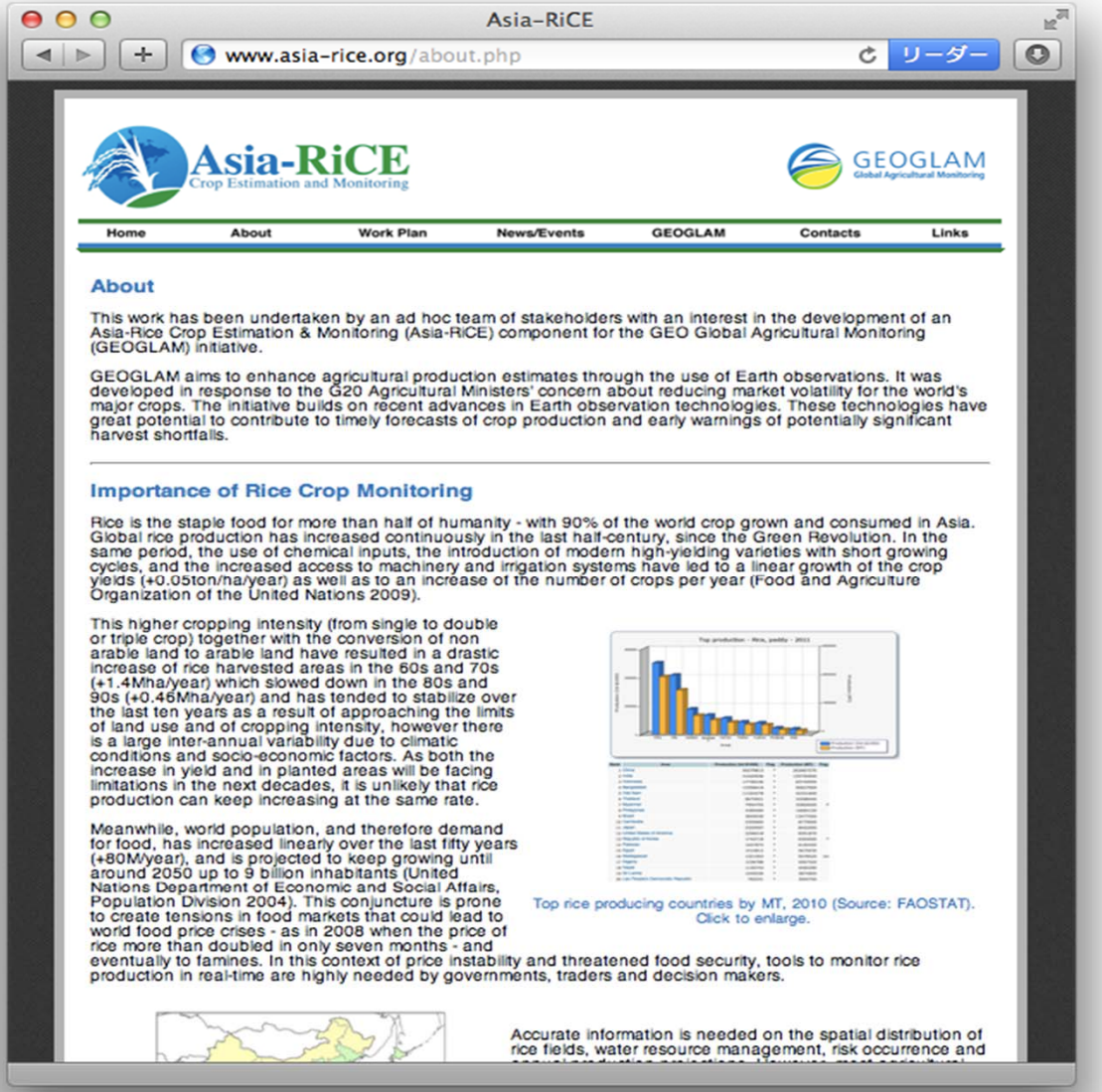
Supports **C**limate Change adaptation and Environmental **C**onservation with sustainable development in K&C theme

ALOS

K&C Initiative

An international science collaboration led by JAXA

Asia-RiCE Home Page



http://www.asia-rice.org

Asia-RiCE Components

Red color is related to K&C research

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**

Research Topic

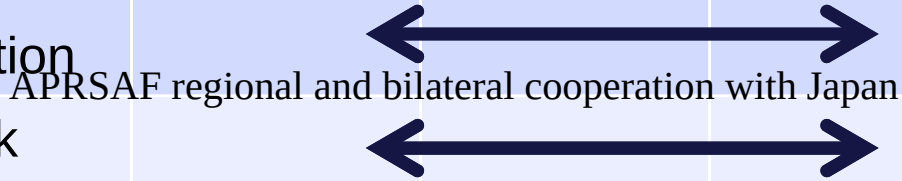
- Perform rice crop area and yield studies using ALOS-2 ScanSAR along with other polarimetric SAR (e.g. RADARSAT-2) new wide fine mode, European SAR (Sentinel-1), and DLR's TerraSAR-X with ground based observation systems (field routers) and rice crop models.

- Derive phenological information from SAR data (rice crop calendar and land use map) and perform a comparison with optical-based phenological information.

- Investigate the relation to rice crop growth stage; work on a correction method for incidence angle variations; and investigate the interoperability of optical and SAR data.

Asia-RiCE team phasing

CY	Target countries	Task	2013	2014	2015	2016-2018
Phase 1A	Indonesia, Vietnam, Thailand	Area estimation				
		Outlook				
Phase 1B	1A + Japan, Malaysia, Chinese Taipei, Philippine	Area estimation				
		Outlook (1A + Philippine)				
Phase 2						



APRSAF regional and bilateral cooperation with Japan and others

Cooperation with AFSIS and Japan

Cooperation with AFSIS and Japan

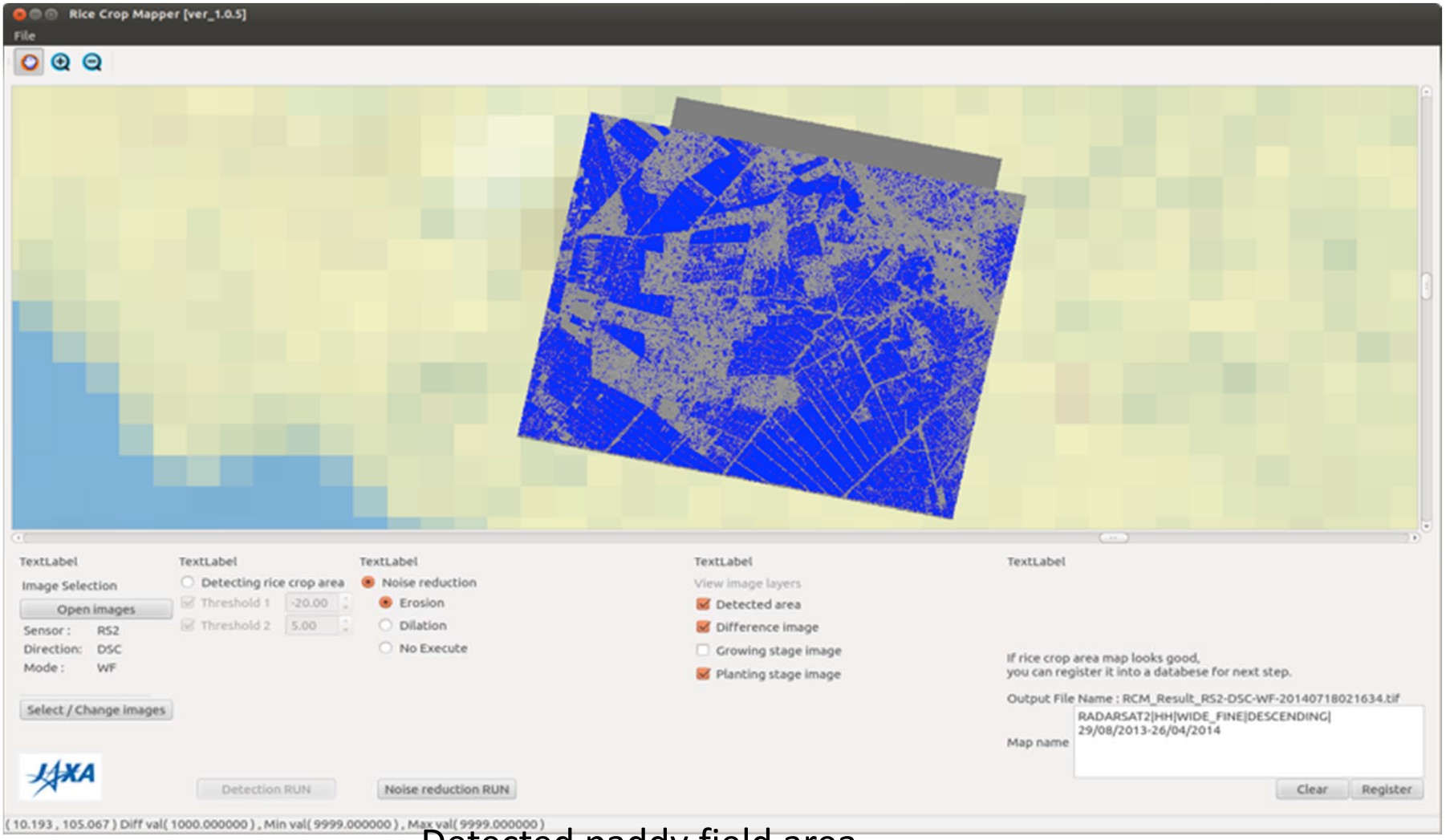
List ground truth data that will be shared with JAXA

Technical Demonstration Site	Field Photos	Field Measurements	High-resolution EO data	Other	Restrictions
Indonesia Subang, West Java Province Batola, South Kalimantan Province	*– Photo of reference fields when available*	*– Coordinates, rice season (eg, timing of sowing and harvest, crop growth stage (vegetative, reproductive, maturity)*			*Based on data Acquisition, in 2014 field data are planned to be collected until Oct 2014. Due to our fiscal year, for next ground survey will be conducted in 2015.* *The number of reference fields will depend on the available funding*
Thailand Suphan Buri Province	*– Daily photos using field server with AWS*	*– Coordinates, rice season (e.g. timing of sowing and harvest), crop growth stage (vegetative, reproductive, maturity)*			Need to coordinate with ADB project to share data
Vietnam Thai Binh (North)	*– Photo of reference fields when available*	*– Dates, coordinates, rice variety, growth stage (vegetative/flowering), crop age, crop vigor, plant density, height, orientation, expected crop duration (in excel file format).*	*– Limited number of VNREDSat-1 scenes*	*– Monthly rice monitoring reports from Thai Binh Provincial Department of Agriculture and Rural Development*	Need to coordinate with ADB project to share data
Vietnam An Giang (South)	*– Photo of reference fields when available*	*– Coordinates, rice season (e.g. Autumn-Winter, Winter-Spring, Summer-Autumn), crop*			*The number of reference fields will depend on the available funding.* *The ground data will be released after analysis and reporting of the study team.*

List ground truth data that will be shared with JAXA

Lao P.D.R. Savannakhet Province	– *Photo of reference fields when available*	*– Coordinates, rice season (e.g. timing of sowing and harvest), crop growth stage (vegetative, reproductive, maturity)*		Need to coordinate with ADB project to share data
Philippines Nueva Ecija (RIICE)	*- Photo of reference fields when available*	*Coordinates, rice season (e.g. timing of sowing and harvest), crop growth stage (vegetative, reproductive, maturity)*		Need to coordinate with IRRI/RIICE and ADB project to share data
India Bardhaman District, West Bengal State	*Field photos where available*	*– Coordinates, rice season (e.g. timing of sowing and harvest), crop growth stage (vegetative,*	Limited scenes of high EO data (TBD)	
Japan Tsuruoka, Yamagata Prefecture	*– Daily photos using field server with AWS*	*– Coordinates, rice season (e.g. timing of sowing and harvest), crop growth stage (vegetative, reproductive, maturity)*		
Malaysia Barat Laut Selangor Province	*– Photo of reference fields when available*	Coordinates of study area. Crop calendar giving the various stages.		Need to coordinate wth IADA Barat-Laut Selangor Rice Project
Chinese Taipei (Taiwan) Chang Hua,	*– Photo of reference fields when available*	*– Coordinates, rice season(First Crop and Second Crop) ,timing of*	*Limited number of Formsat-2 scenes (TBD)*	

P1: Expected product (deliverables) - Paddy Field Area Detection by temporal series SAR



Detected paddy field area

Data : Descending images with JAXA's software (INAHOR)

Sentinel-1 and ALOS-2 data for Asia-RICE

Thuy Le Toan
CESBIO, France

SAR data for rice monitoring from 2014

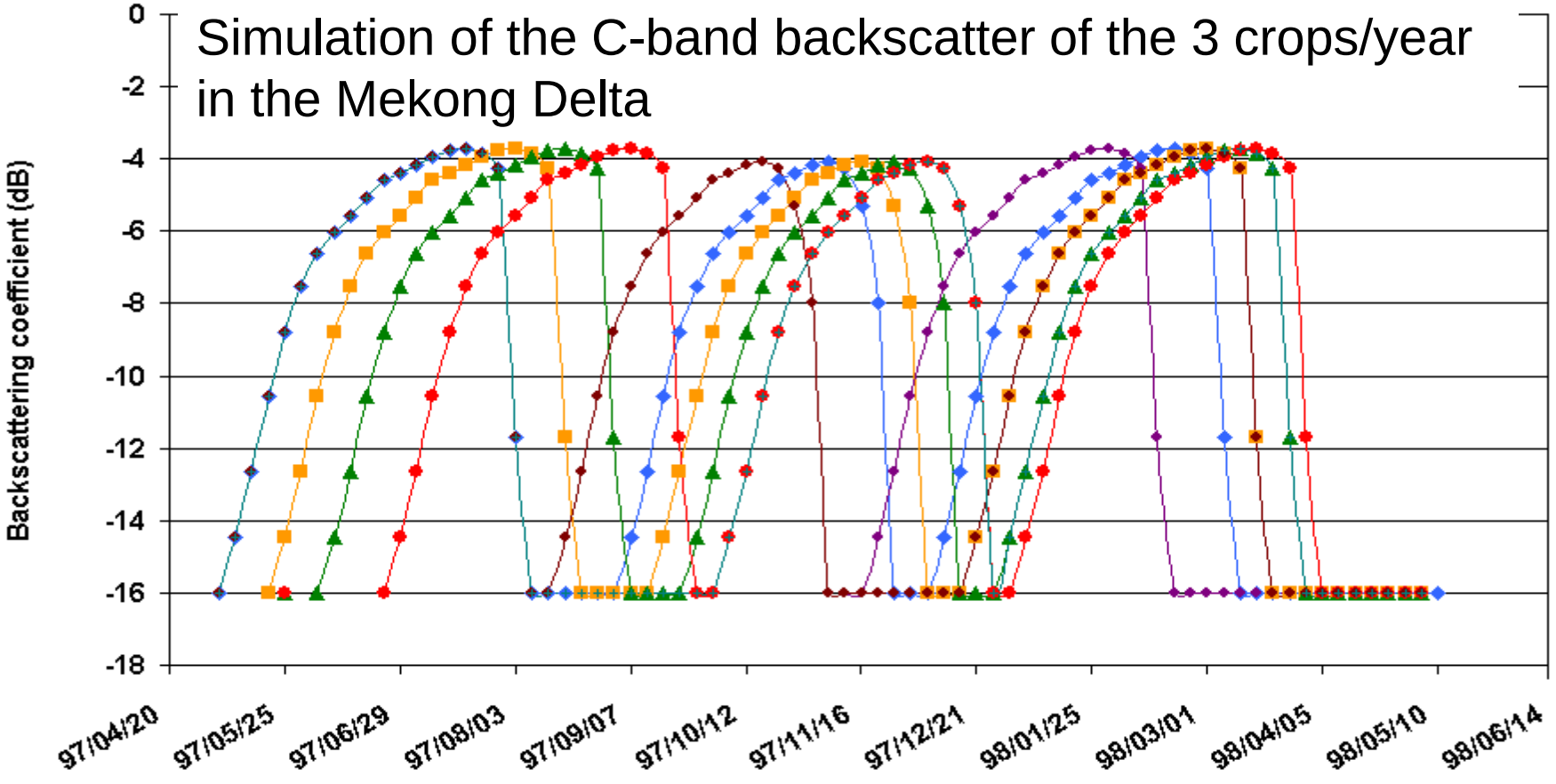
Mission	Instrument	Data adapted to rice monitoring
RADARSAT-2 (CSA/MDA)	C-band SAR (5.405 GHz) 24 days repeat cycle	Wide Fine mode(150 km, 20m), F0W2, Incidence 31-39°, VV and VH
Sentinel-1 (2014) (ESA)	C-BandSAR (5.405 GHz) 12 days	Stripmap mode (80 km swath, 10 m resolution. Incidence range 30-40°, VV and VH
RISAT-1 (ISRO)	C-Band SAR (5.350 GHz) 25 days	MRS (115 km swath, 22-43 m), Incidence 23-49° HH and VV
TerraSAR-X (DLR)	X-Band SAR (9.65 GHz) 11 days	a) StripMap (SM), 15x50 km 1.2x 6.6 m resolution, HH&VV 20-40° b) Tandem X: StripMap, interferometric mode, alternating bistatic, HH,
COSMO SkyMed (ASI)	X-Band SAR (9.6 GHz) 4 satellites/ 16 days	StripMap pingpong (20m, 30 km swath) HH and VV, Incidence >40°
ALOS-2 (2014) (JAXA)	L-band (1,270 GHz) 14 days	StripMap (10m, 70 km) 14 days HH and VV

CESBIO

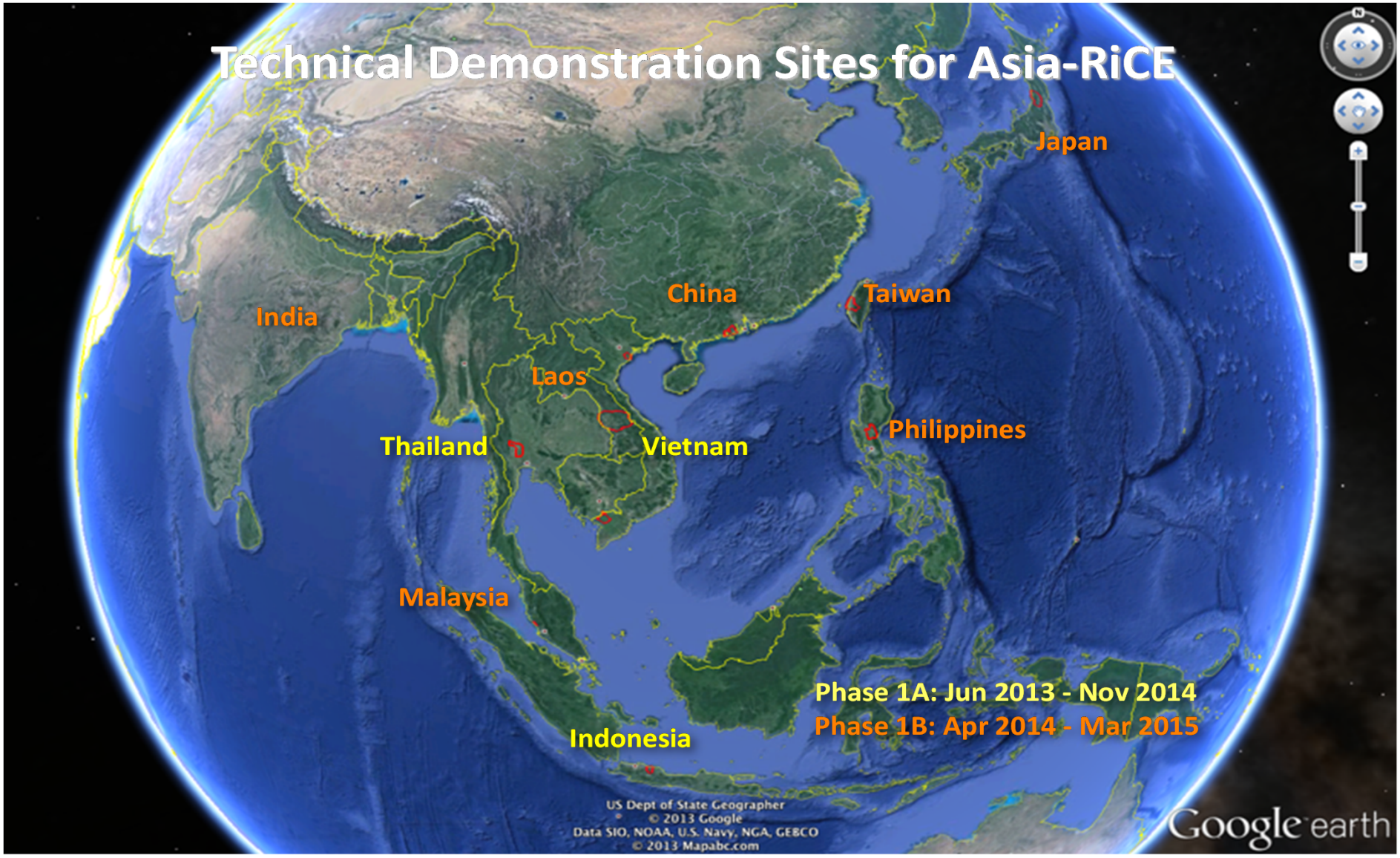
SAR Data Requirements

1. Strong temporal variation of the radar backscatter of rice fields
2. Non uniform crop calendar of adjacent fields

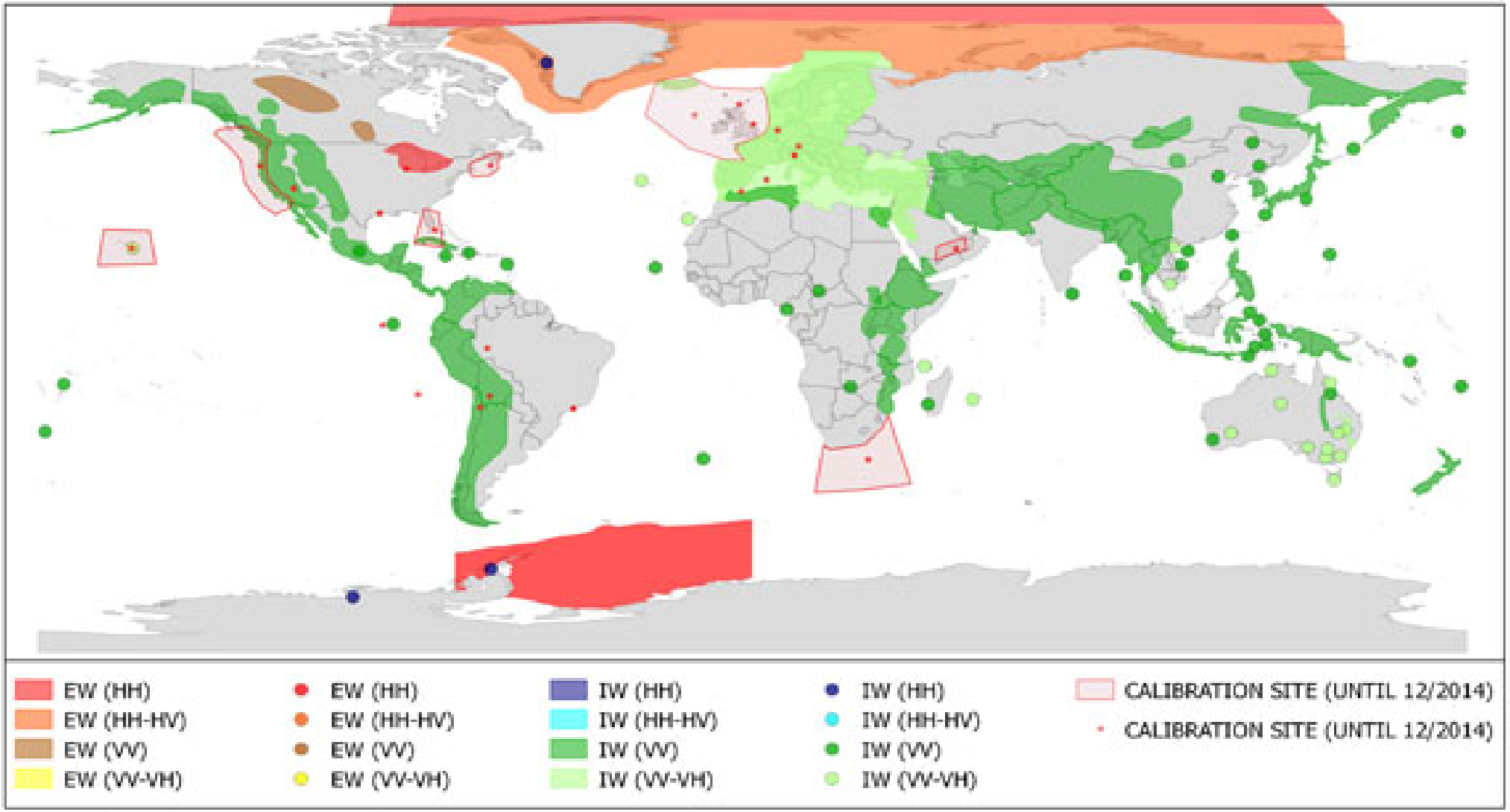
→ High temporal frequency data (Sentinel-1)



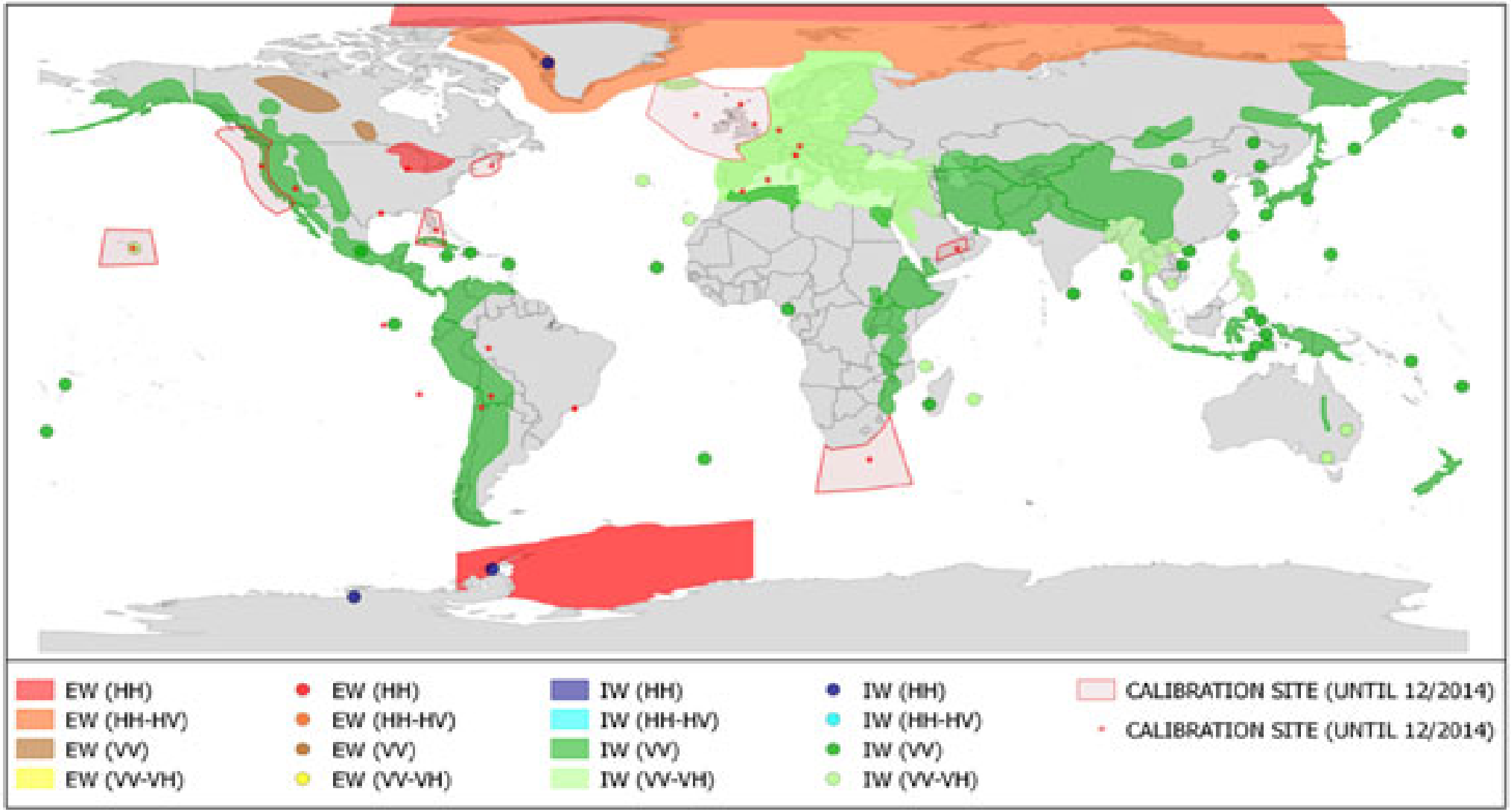
Asia-RiCE Technical Demonstration Sites



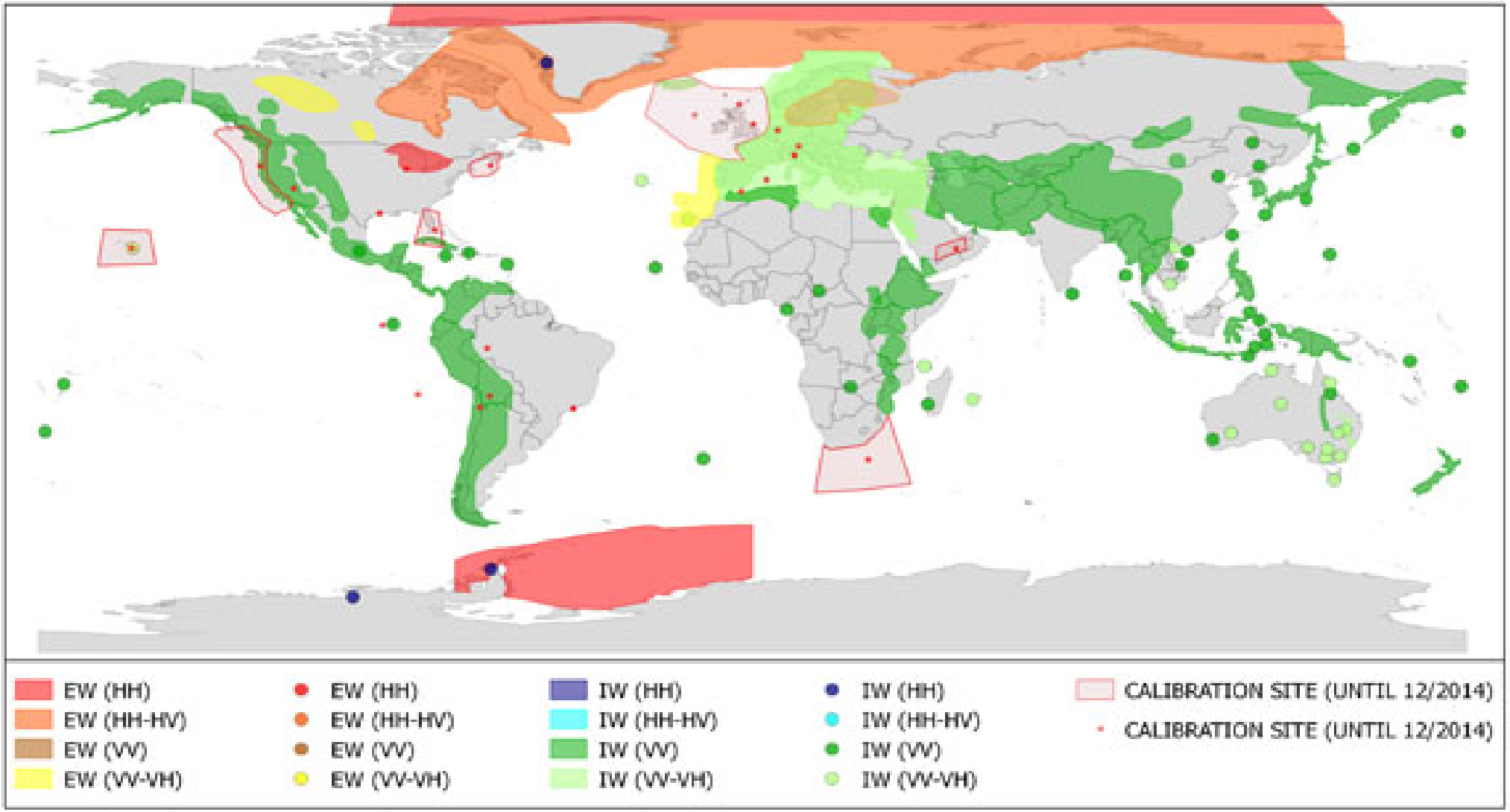
SENTINEL-1A - OBSERVATION SCENARIO 30.09.2014 - 12.10.2014 (CYCLE 29)



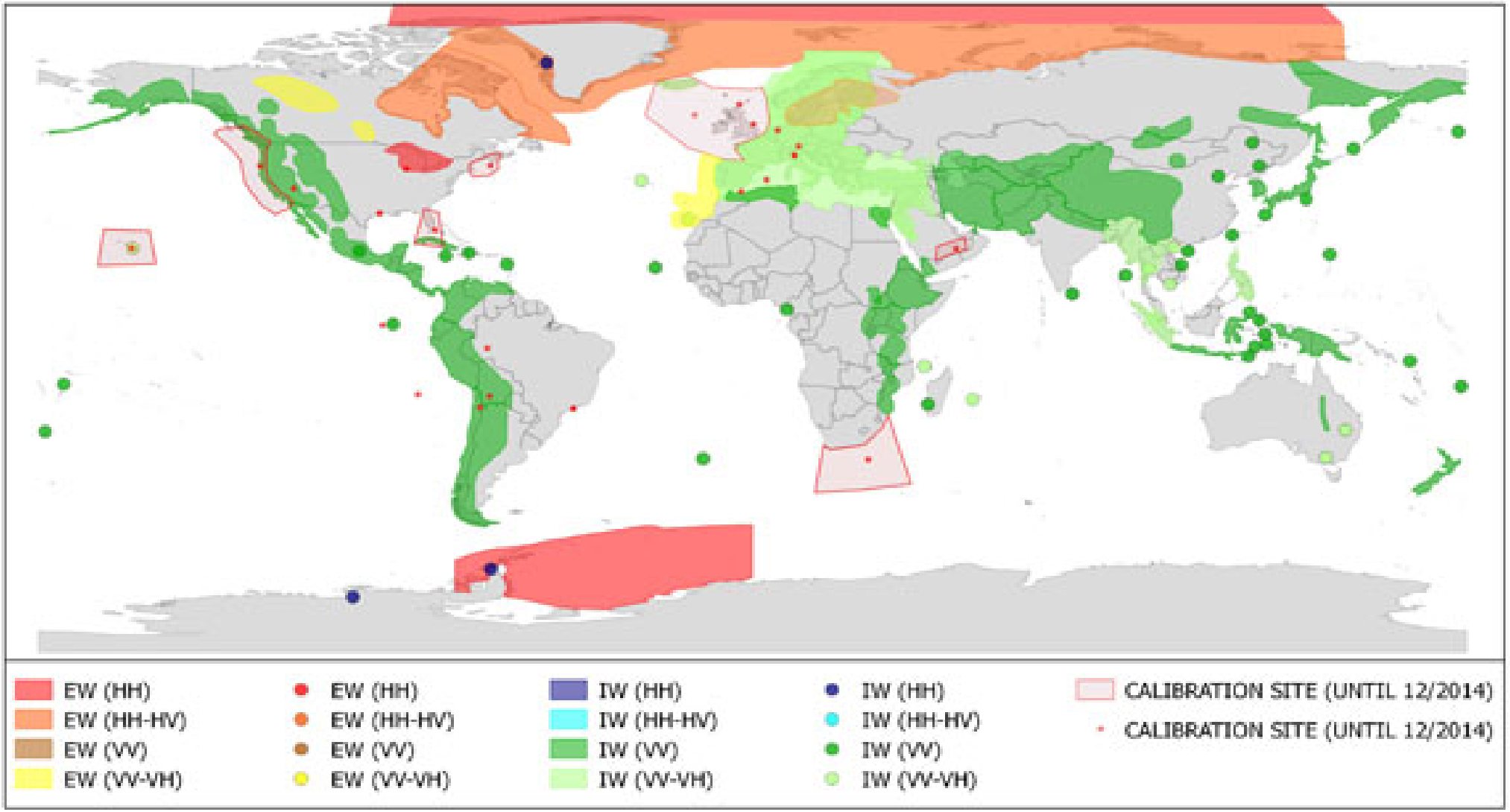
SENTINEL-1A - OBSERVATION SCENARIO 12.10.2014 - 24.10.2014 (CYCLE 30)



SENTINEL-1A - OBSERVATION SCENARIO 24.10.2014 - 05.11.2014 (CYCLE 31)

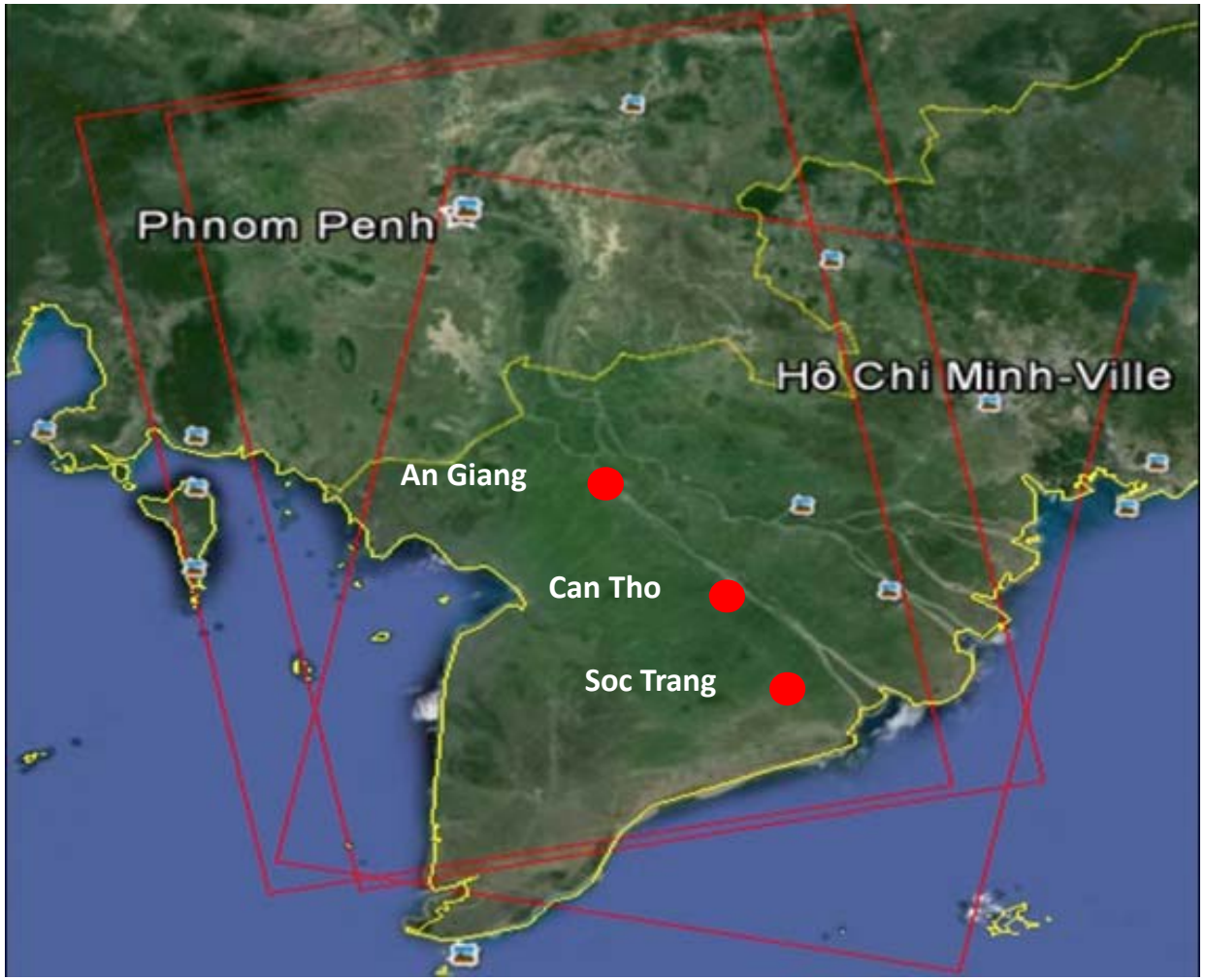


SENTINEL-1A - OBSERVATION SCENARIO 05.11.2014 - 17.11.2014 (CYCLE 32)

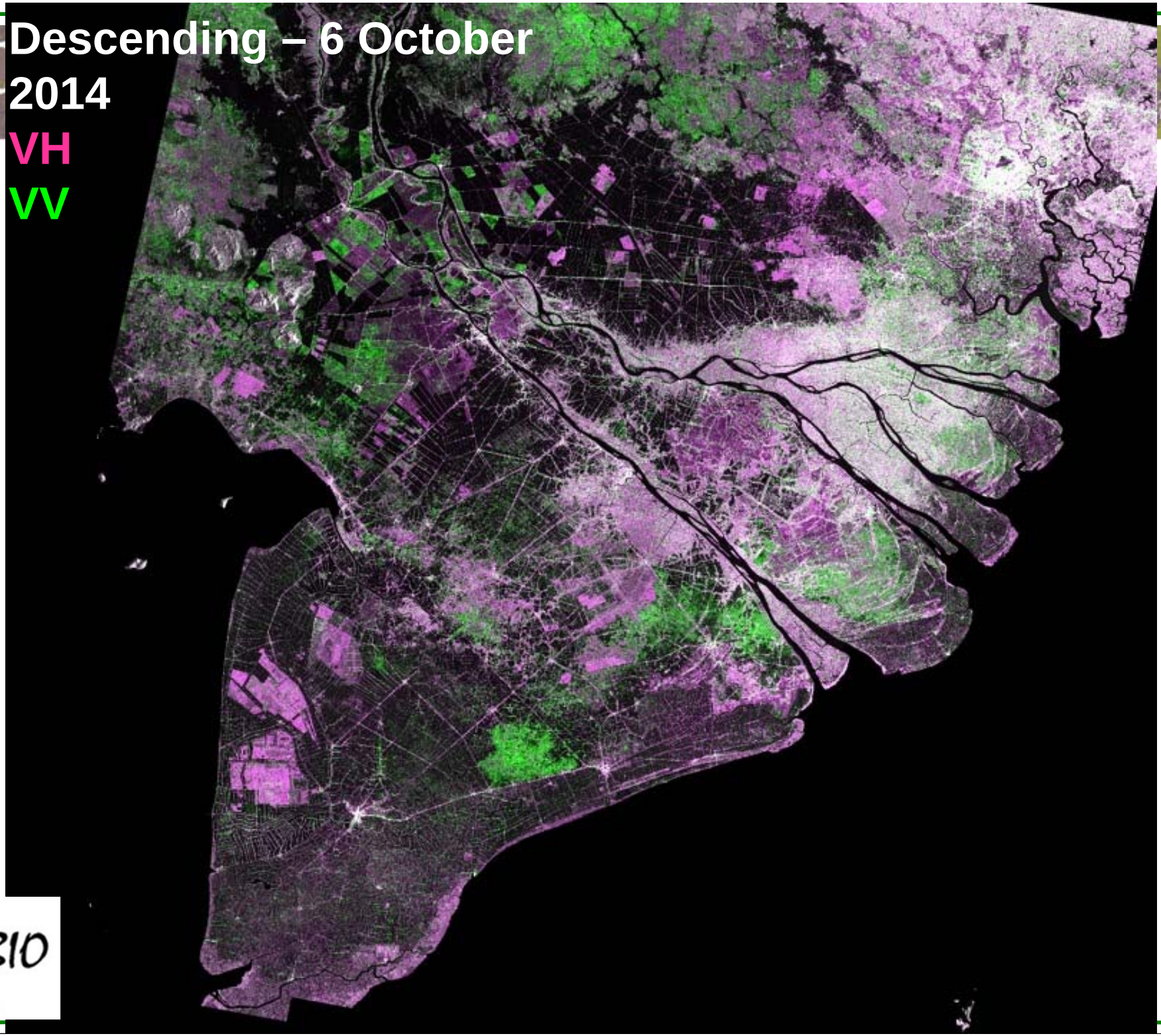


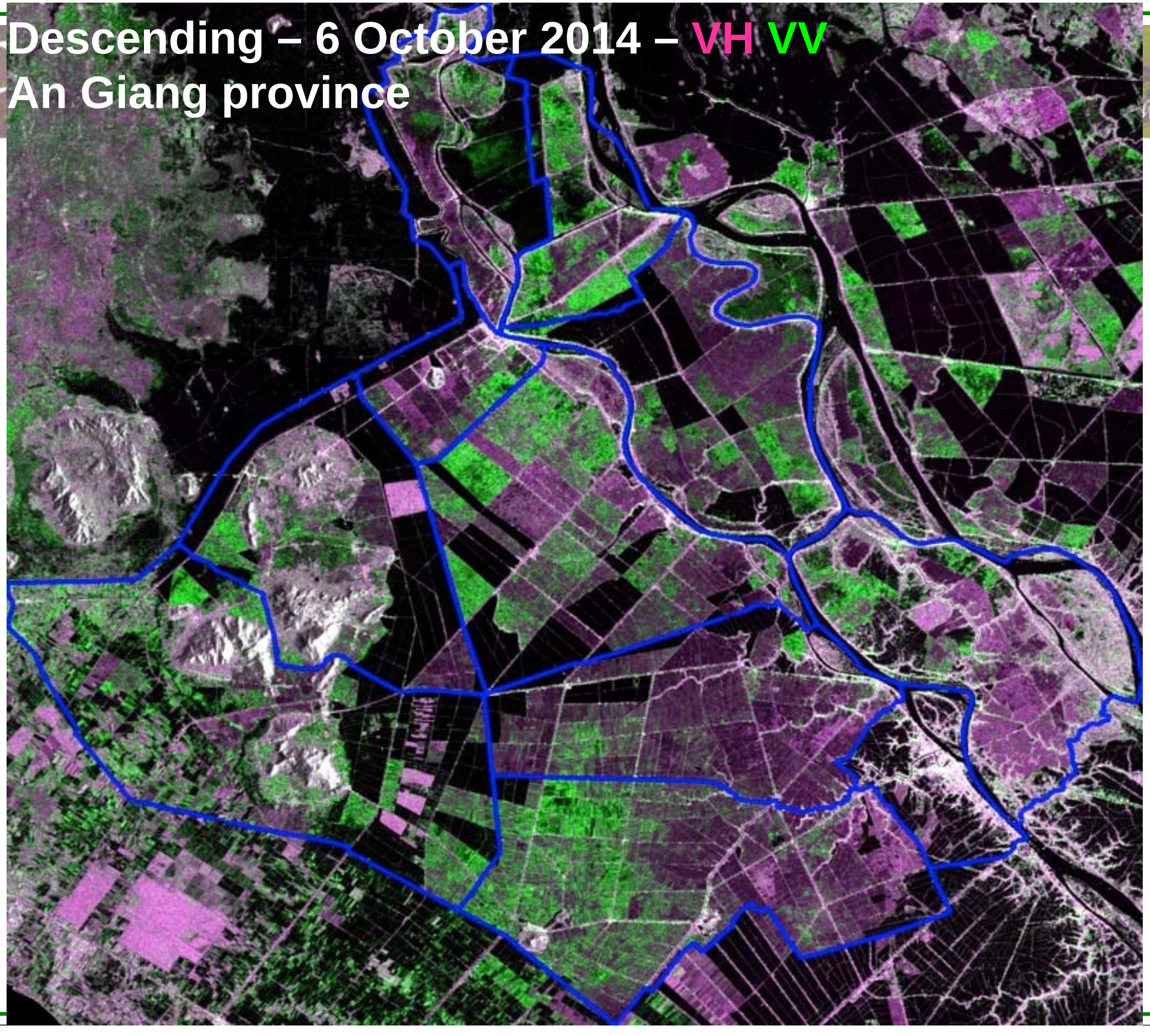
The Sentinel-1 Reference Site

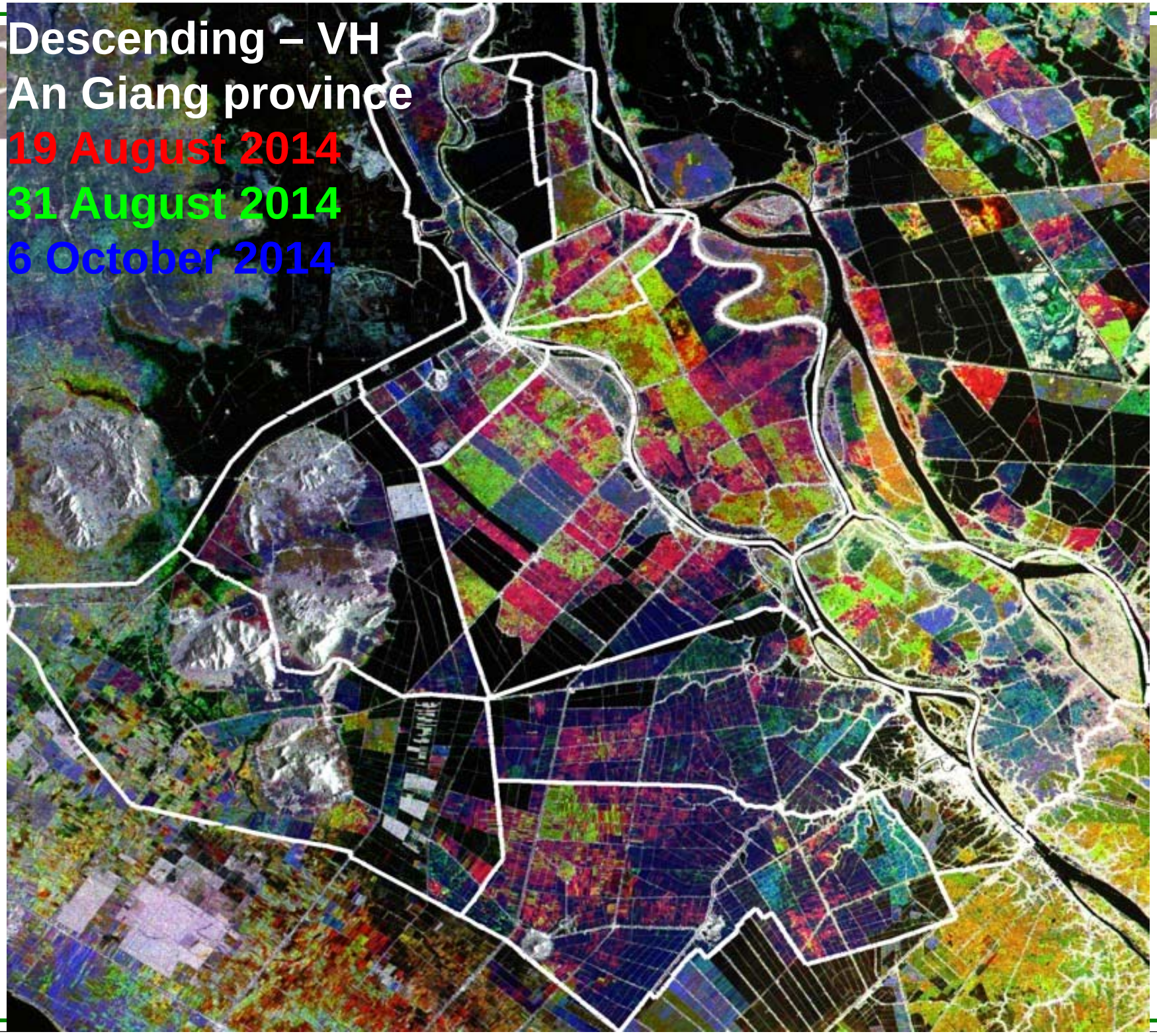
Agreed in consultation with the Asia Rice -GEOGLAM CEOS adhoc working group.

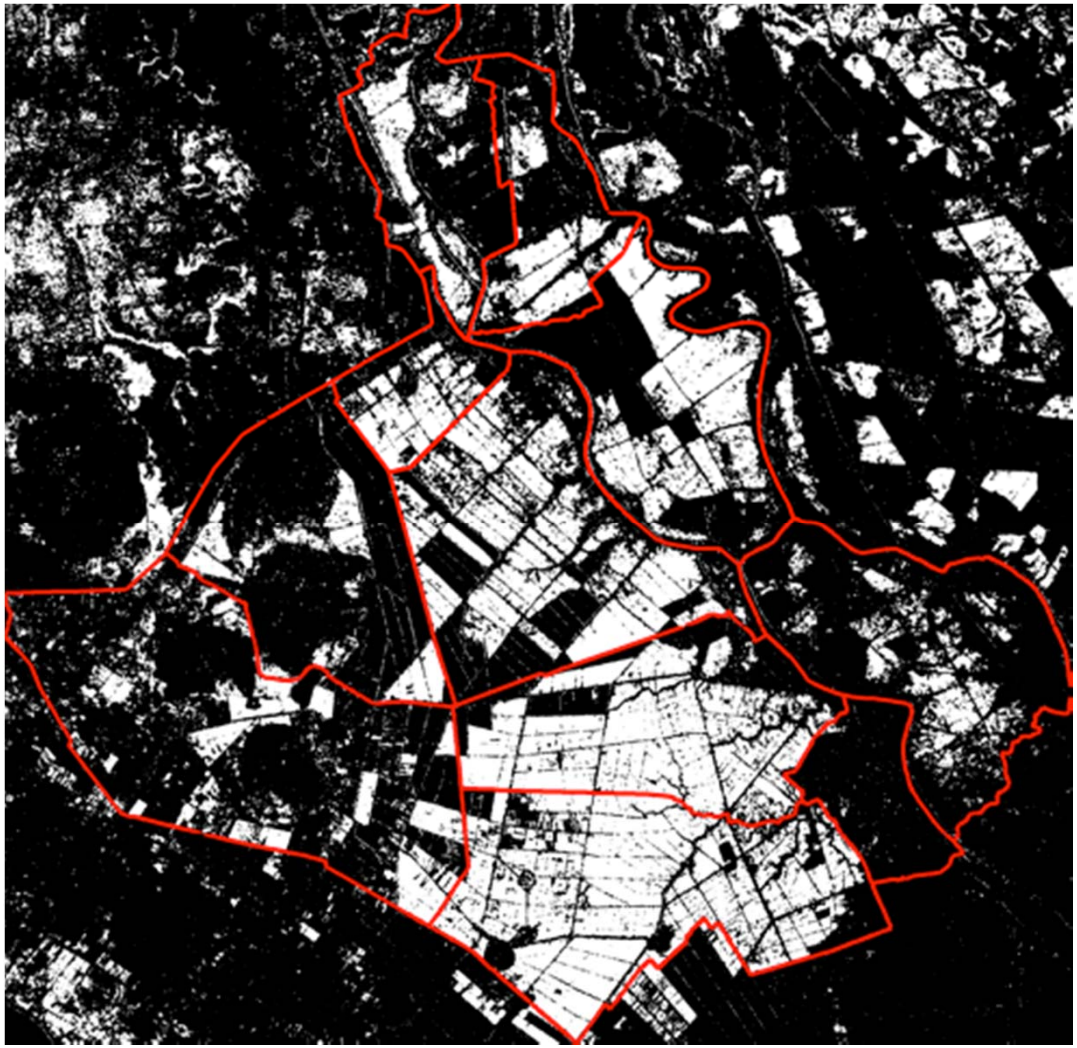


Coordination of ground data collection for 3 sites
(Asia-Rice meeting, August 2014, Taiwan)


Descending – 6 October 2014
VH
VV


Descending – 6 October 2014 – VH VV
An Giang province

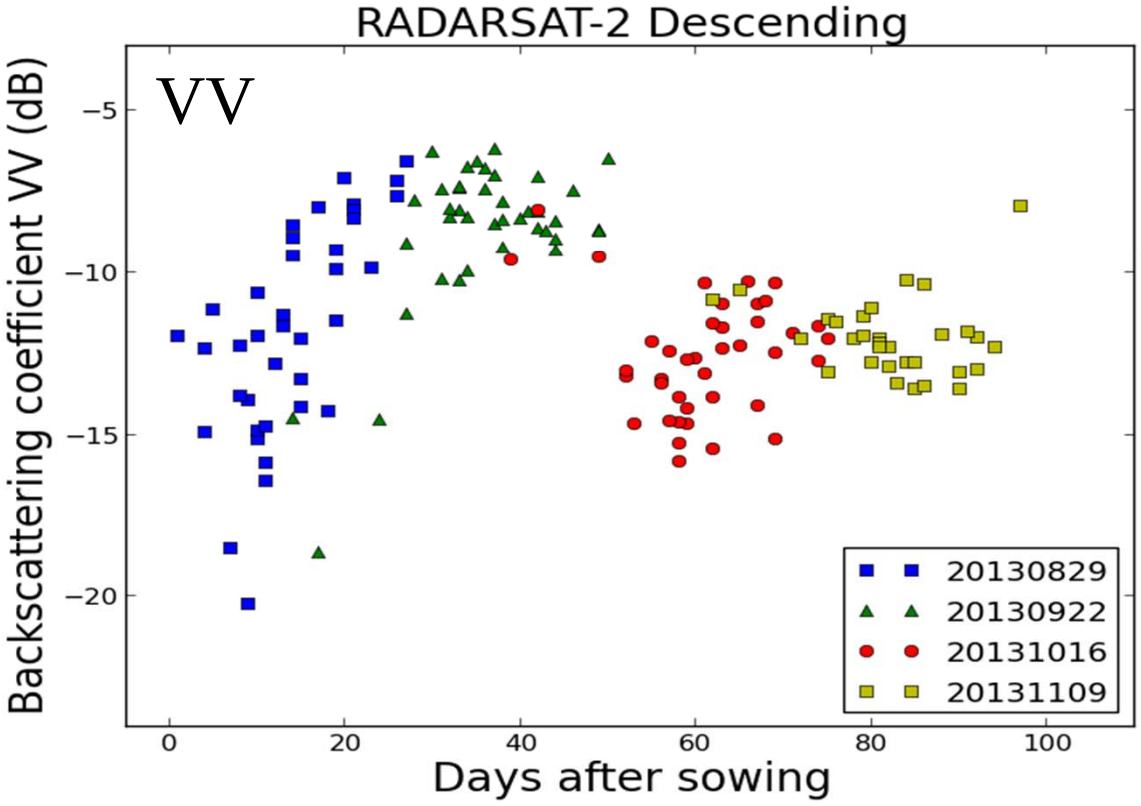

Descending – VH
An Giang province
19 August 2014
31 August 2014
6 October 2014

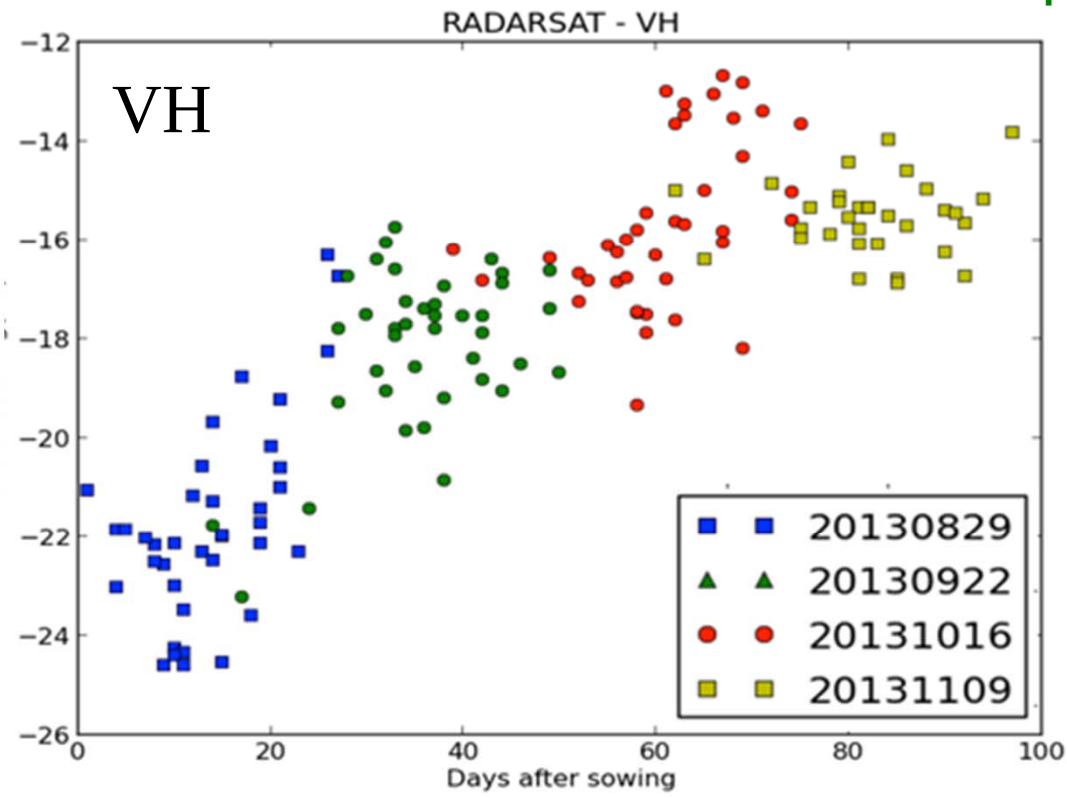


Autumn-Winter Rice in An Giang province, 6 October 2014
Using Sentinel-1 data

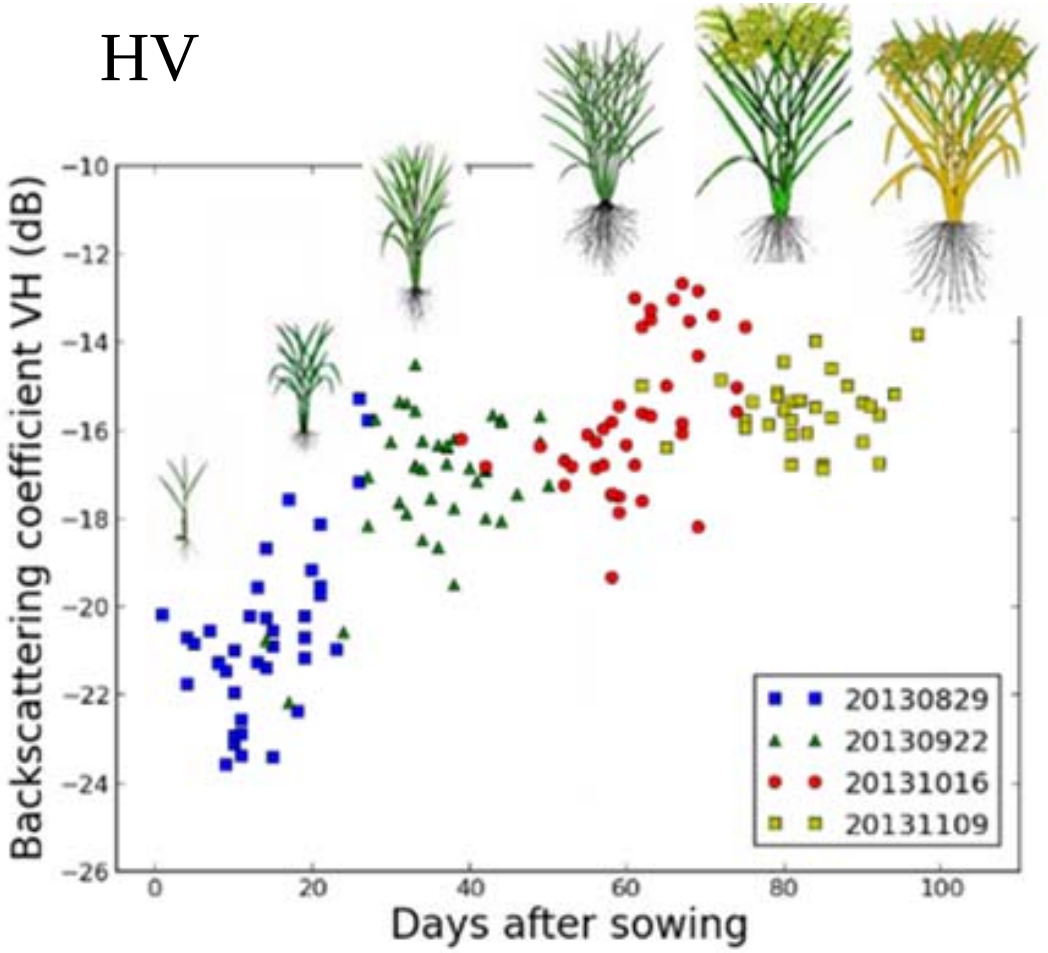
Data understanding for rice field mapping and monitoring rice growth

Using Radarsat 2, Wide fine 1 in 2013 (Asia-Rice-CEOS)





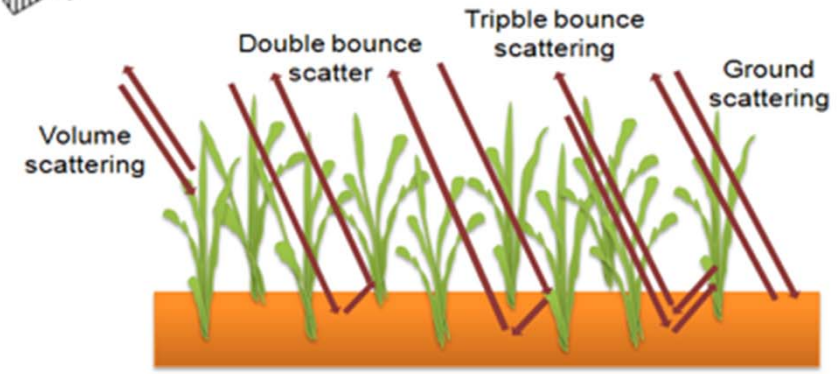
HV



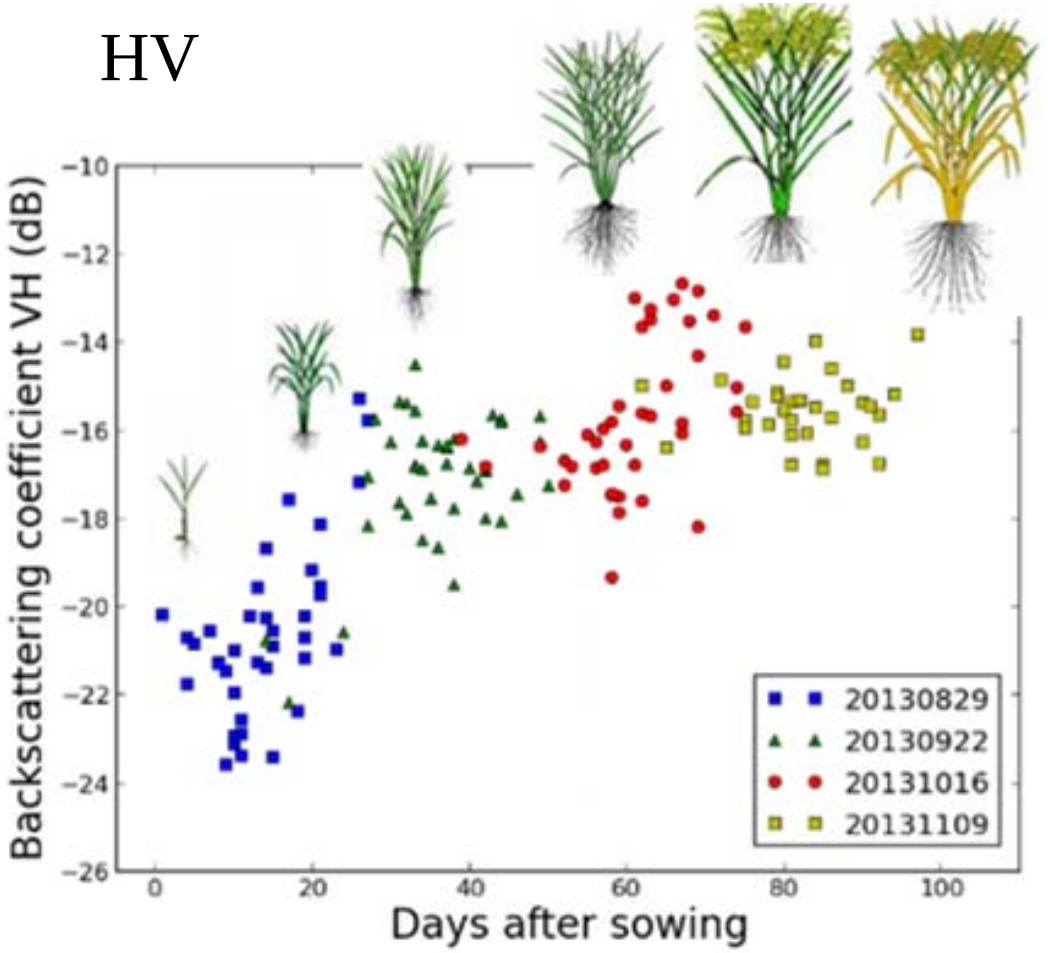
Increase of VH backscatter
8-10 dB during the cycle

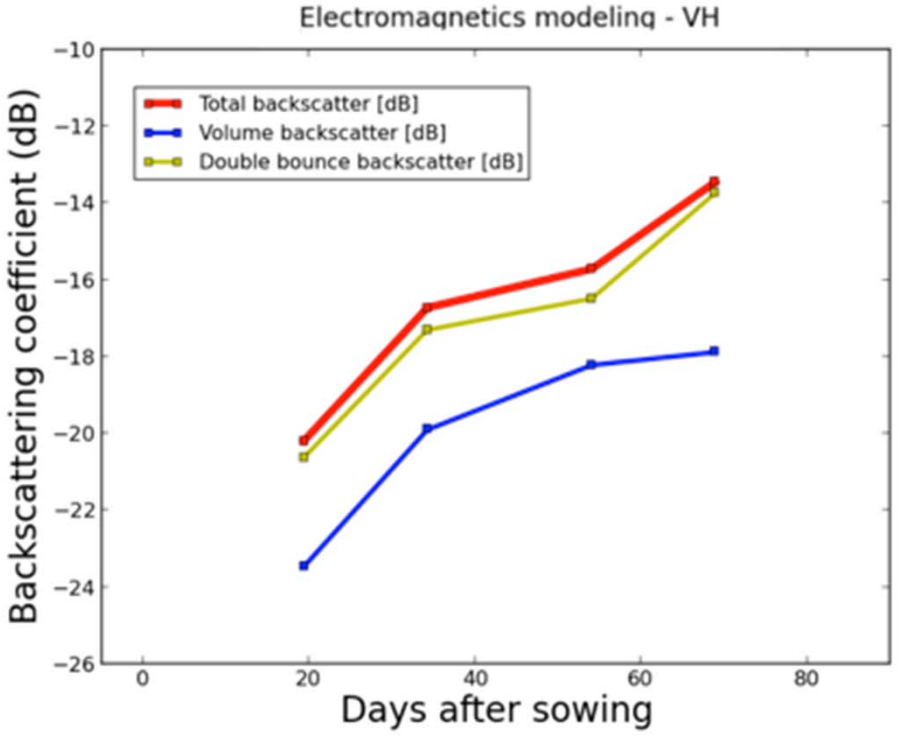
→ ***Use temporal change for rice mapping***

Electromagnetic modelling



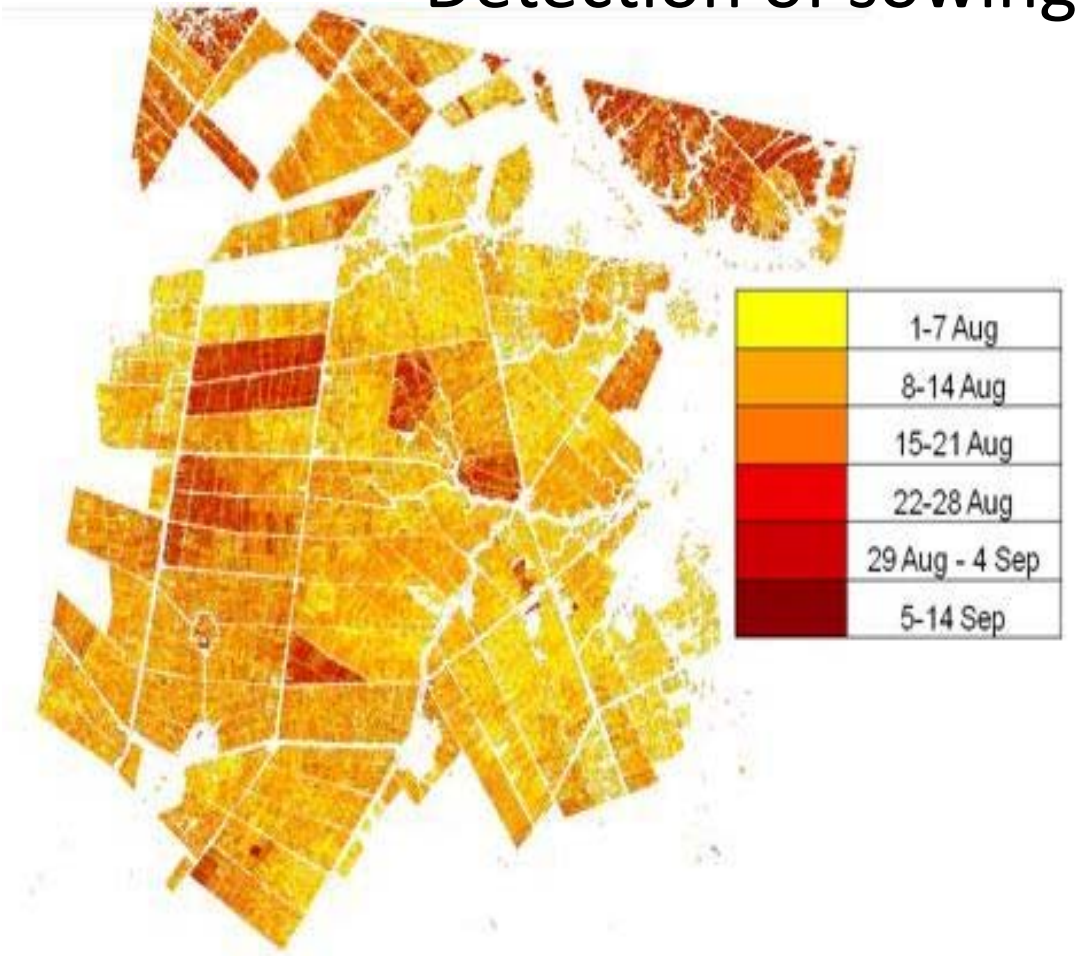
HV

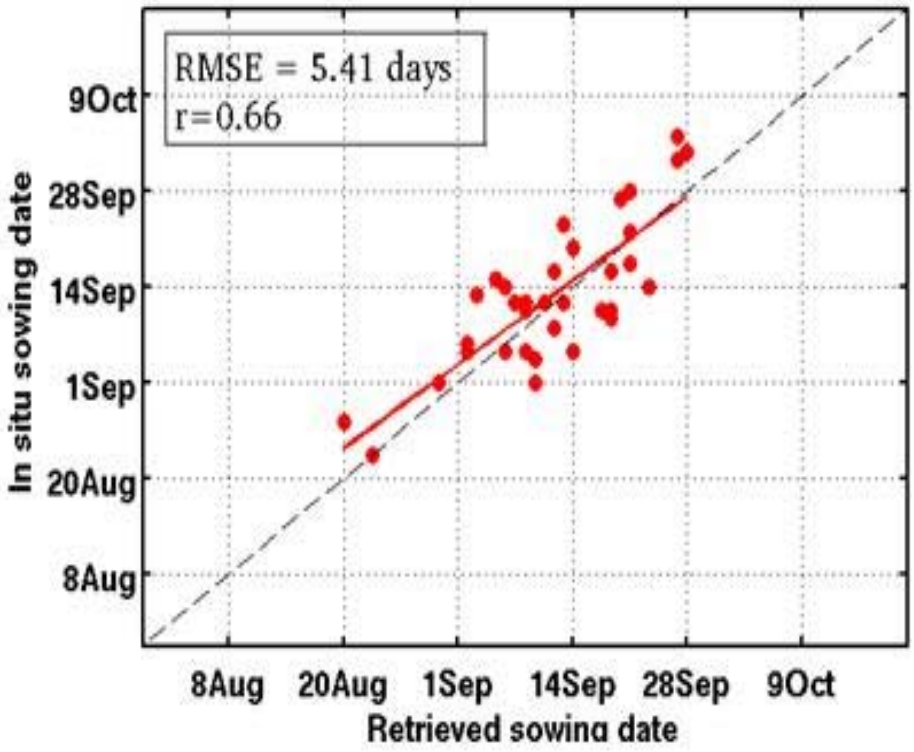




→ ***Use temporal change for rice mapping***
Derivation of sowing date, rice biomass

Detection of sowing date with 3 RS-2 data, 2013





Improvement expected with 12 day repeat cycle of S1A

CESBIO

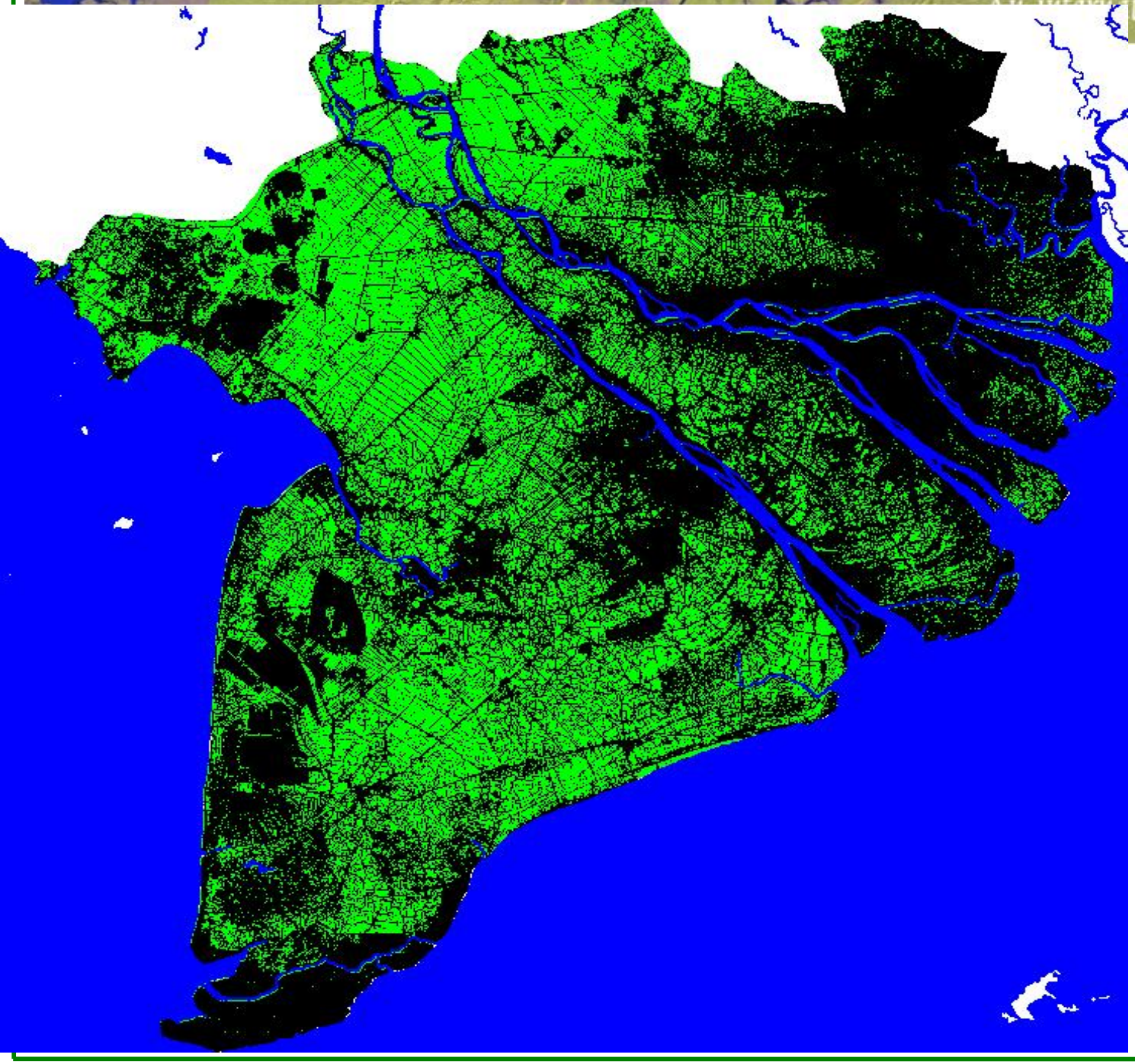
Sentinel-1A and ALOS-2

Sentinel-1A scheduled in 2015 on Asia Rice Technical Demonstration Sites

- For RS research at Asia-RICE demonstration sites
  → ALOS-2 stripmap data

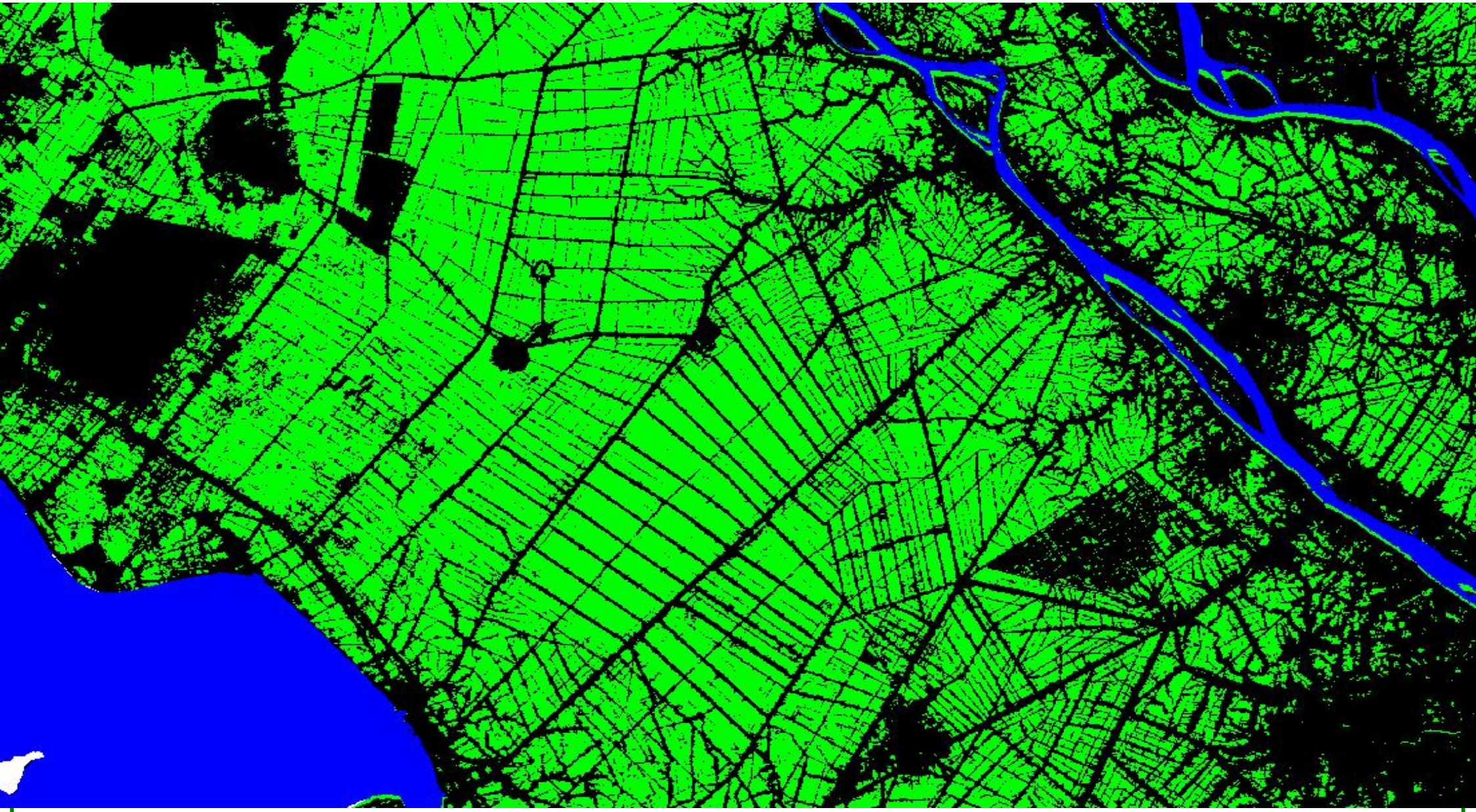
- For large scale rice and wetland mapping
  → We expect to have ScanSAR ALOS-2 data

Towards an entire Asia Rice mapping?



From PALSAR mosaic

2007



From PALSAR mosaic

Rice area in green
Trees or built areas in black