



# JAXA Mission Updates

JECAM/GEOGLAM Science Meeting

Ottawa, Canada

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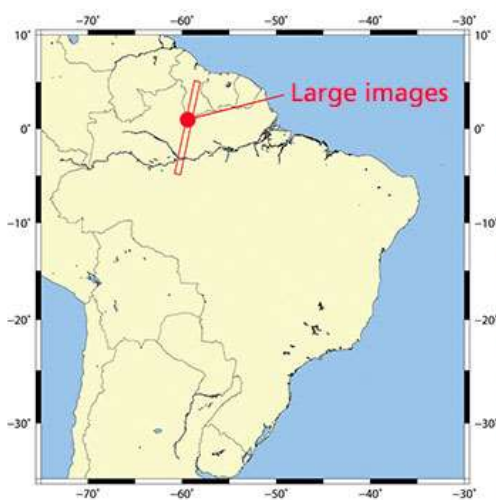
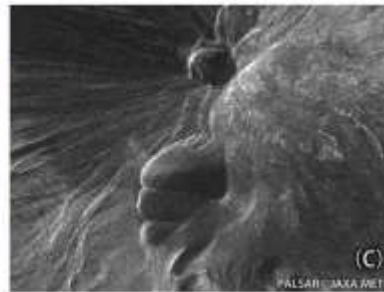
- Successfully launched from Tanegashima Space Center on 24 May 2014 (JST)



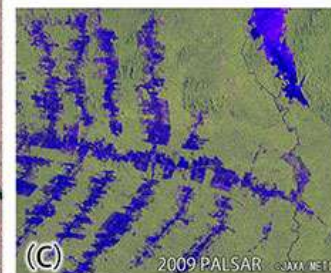
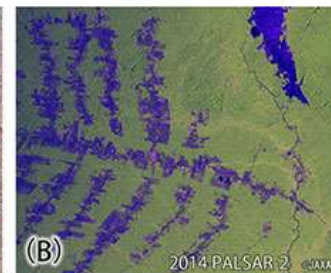
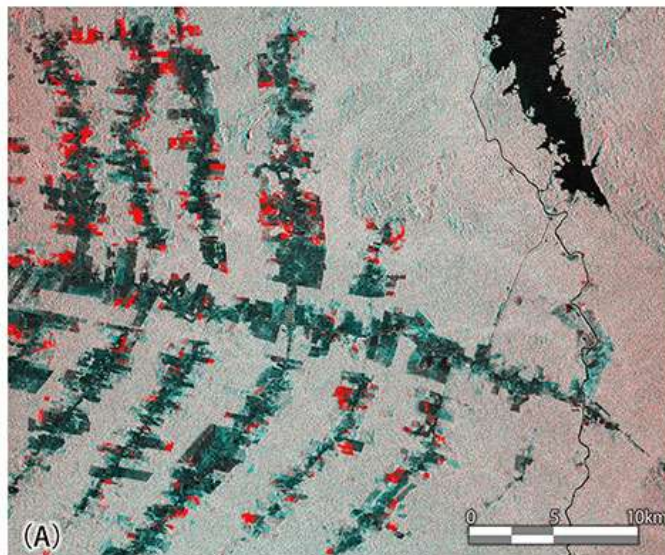
**ALOS-2 Launch**

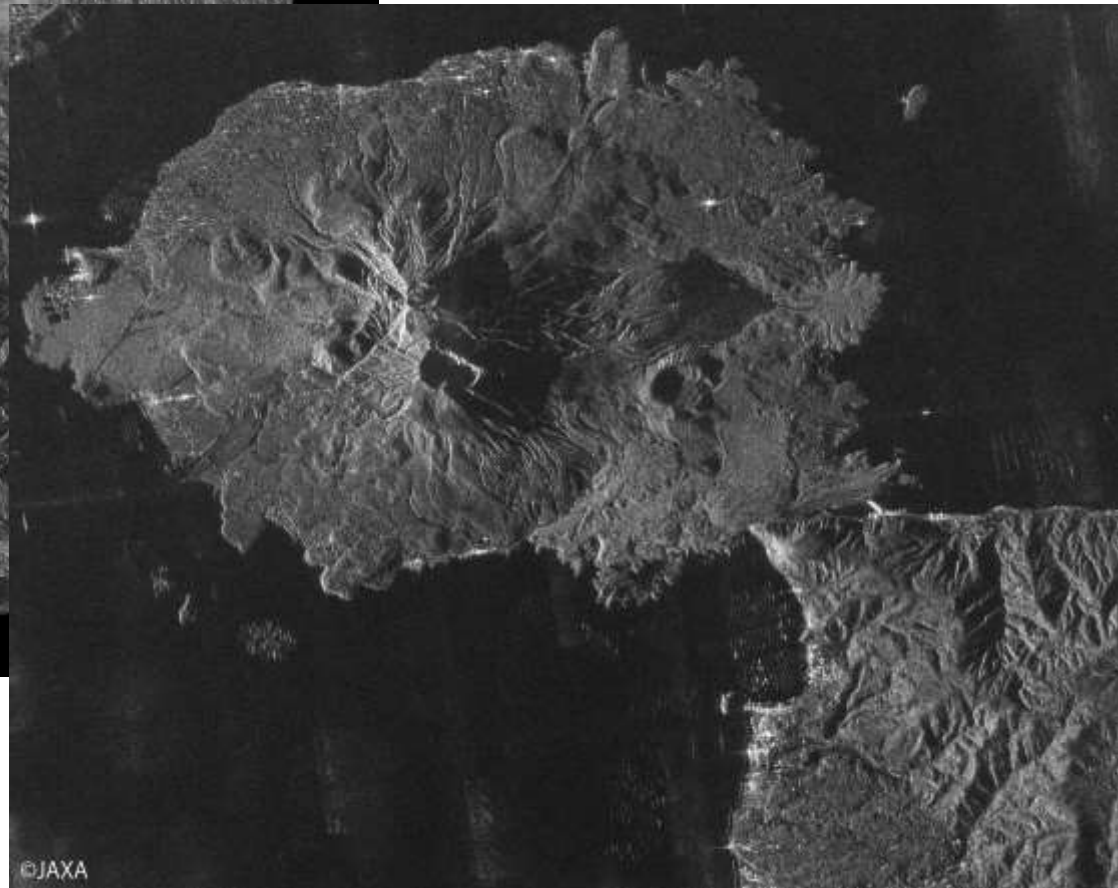
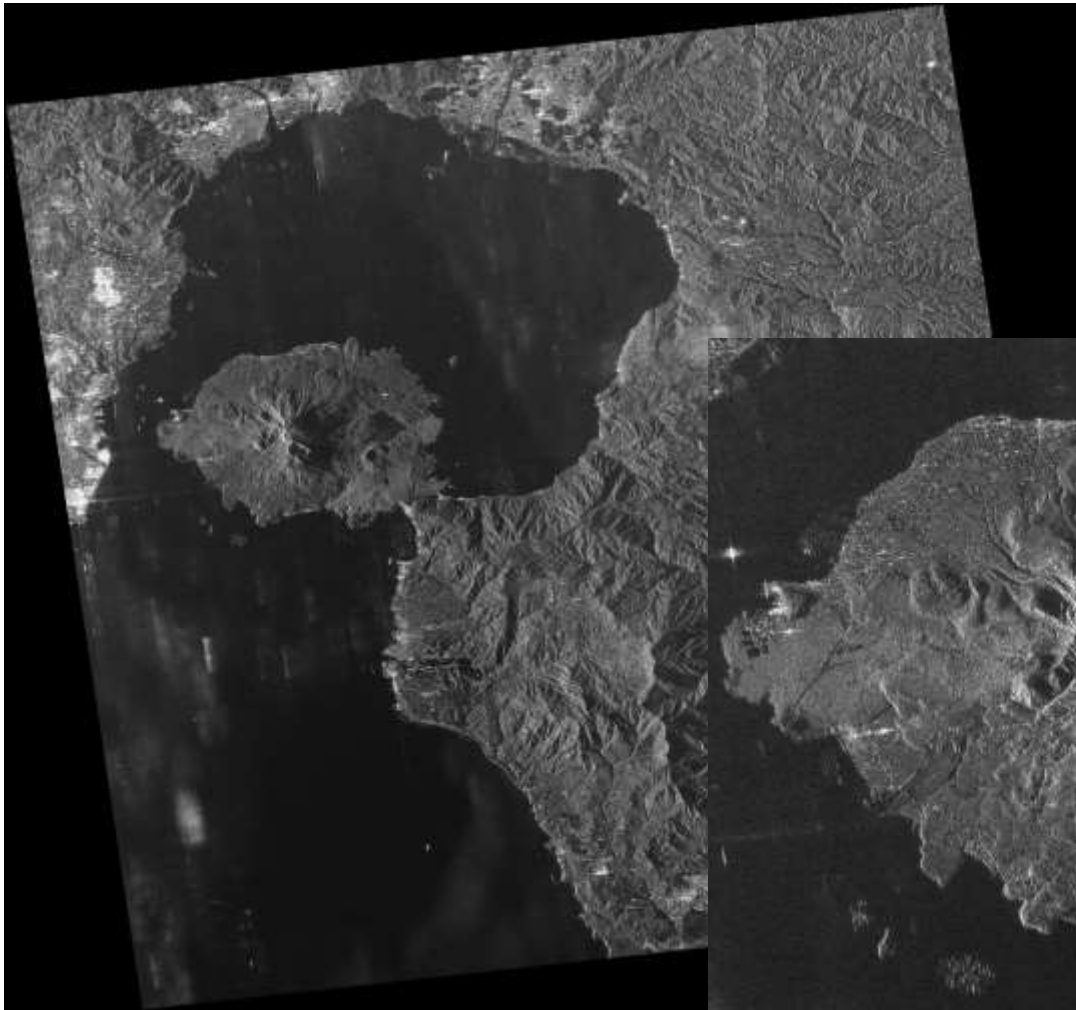


# First Images (19-21 June 2014)



Observation Area





# JECAM

Joint Experiment for Crop Assessment and Monitoring

**GEO** GROUP ON  
EARTH OBSERVATIONS

# ALOS-2



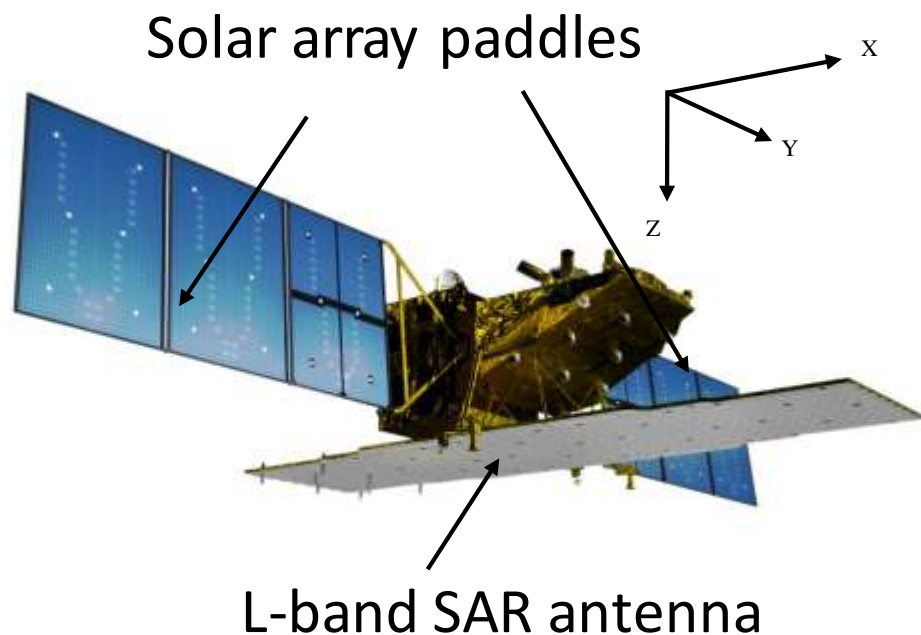
- Successor mission of the ALOS, the mission objectives include disaster monitoring, monitoring of global forests, land, and **agriculture (rice)**, as well as natural resources exploration.
- The critical operation phase1 (the deployment of antennas for direct communications and mission instruments) was completed on May 27, 2014.
- Move to the phase2 to verify the function of the satellite onboard instruments for about two and half months
- Observation data will be provided to the public in the late November.



# ALOS-2 Specifications

## ALOS-2 satellite

■ <b>Launch</b>	<b>: 24th May 2014</b>
■ Orbit type	: Sun-synchronous
■ Altitude	: 628 km +/- 500 m (for reference orbit)
■ Revisit time	: 14 days
■ LSDN	: 12:00 +/- 15 min



## PALSAR-2

- **L-band Synthetic Aperture Radar**  
Active Phased Array Antenna type  
two dimensions scan (range and azimuth)
- Antenna size : 3m(El) x 10m(Az)
- Bandwidth : 14 – 84MHz
- Peak transmit Power : 5100W
- **Observation swath : 25 – 490km**
- **Resolution : Range: 3 m to 100 m**  
**Azimuth: 1 m to 100 m**

# ALOS-2 Observation Modes

		Spotlight	Ultra Fine	High sensitive	Fine	ScanSAR nominal		ScanSAR wide
Bandwidth		84MHz	84MHz	42MHz	28MHz	14MHz	28MHz	14MHz
Resolution		Rg × Az: 3 × 1m	3m	<b>6m</b>	10m	<b>100m</b>		60m
Swath		Rg × Az: 25 × 25km	50km	<b>50km</b>	70km	<b>350km</b> (5-scan)		490km (7-scan)
Polarization		SP	SP/DP	SP/DP/FP/CP		SP/DP		
NESZ		-24dB	-24dB	-28dB	-26dB	-26dB	-23dB	-23dB
S/A	Rg	25dB	25dB	23dB	25dB	25dB		20dB
	Az	20dB	25dB	20dB	23dB	20dB		20dB

SP : HH or VV or HV ,  
 DP : HH+HV or VV+VH ,  
 FP : HH+HV+VH+VV ,  
 CP : Compact pol

# ALOS-2 BOS

- A global systematic acquisition strategy (“Basic Observation Scenario” – BOS) has been developed.
- Continuous acquisitions with the acquisition strategy of ALOS (2006-2011), but with enhanced image characteristics (spatial resolution, polarizations, radiometric sensitivity).



[Rosenqvist and Shimada *et al.* RSE, in press]



# Observation Pattern for Annual Acquisitions\*

Season	N:Winter/S:Summer				N:Spring/S:Autum				N:Summer/S:Winter				N:Autum/S:Spring														
Week of year	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-30	31-32	33-34	35-36	37-38	39-40	41-42	43-44	45-46	47-48	49-50	51-52	
Desc	D+W+F		Arctic	D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F	Arctic	D+W+F	Glacier Antarctica		D+W+F	Glac. Antarc	Arctic	D+W+F	Global (1/3)		D+W+F	Global (1/3)		
	WB-350km		WB490	WB-350km	DP(5) 10m	DP(5) 10m	WB-350km	DP(6) 10m	DP(6) 10m	WB-350km	DP(7) 10m	DP(7) 10m	WB-350km	WB490	WB-350km		DP(6)L	DP(6)L	WB-350km	DP(6)L	WB490	WB-350km	SP(6) 3m	SP(7) 3m	WB-350km	SP(8) 3m	SP(9) 3m
Asc	North Pole	World 1			Glacier- Greenland		Global (1/5)					World 2			South Pole	N + S Pole	World 1					World 2			N + S Pole		
	WB350	DP(7) 10m	DP(6) 10m	DP(5) 10m	DP(6)	DP(6)	QP(6) 6m	QP(5) 6m	QP(4) 6m	QP(3) 6m	QP(7) 6m		DP(7) 10m	DP(5) 10m	DP(6) 10m		WB350	WB350L	WB350L	DP(7) 10m	DP(5) 10m	DP(6) 10m			DP(7) 10m	DP(5) 10m	DP(6) 10m



10m(HH+HV)28MHz Right



3m(HH)84MHz Right



6m(HH+HV+VH+VV)42MHz Right

(\*) \*Beam No.



Super sites (TBD)



ScanSAR350km(HH+HV)14MHz Right



ScanSAR350km(HH+HV)14MHz Left



ScanSAR490km(HH+HV)14MHz Right



10m(HH+HV)28MHz Left

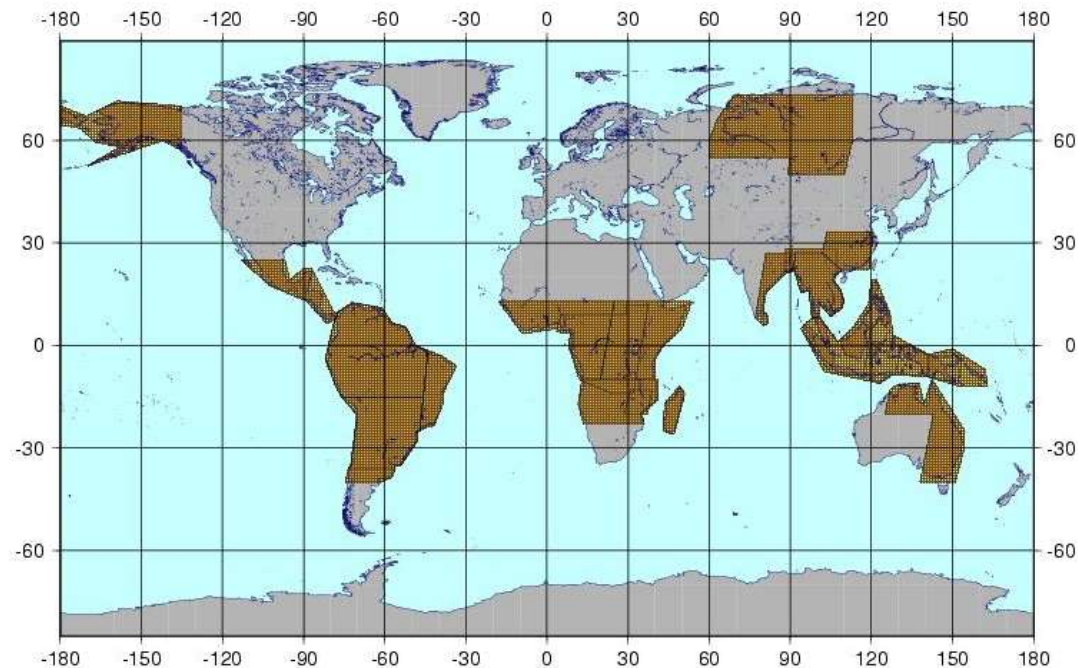
\* 3m SP and 6m QP modes require 3 and 5 years for global coverage

# ScanSAR regular monitoring:

Temporal repeat: 9 cov/year

GSD: 100 m (off-nadir  $26.2^{\circ}$  -  $41.8^{\circ}$  )

Mode: ScanSAR 350km Dual-pol (HH+HV)

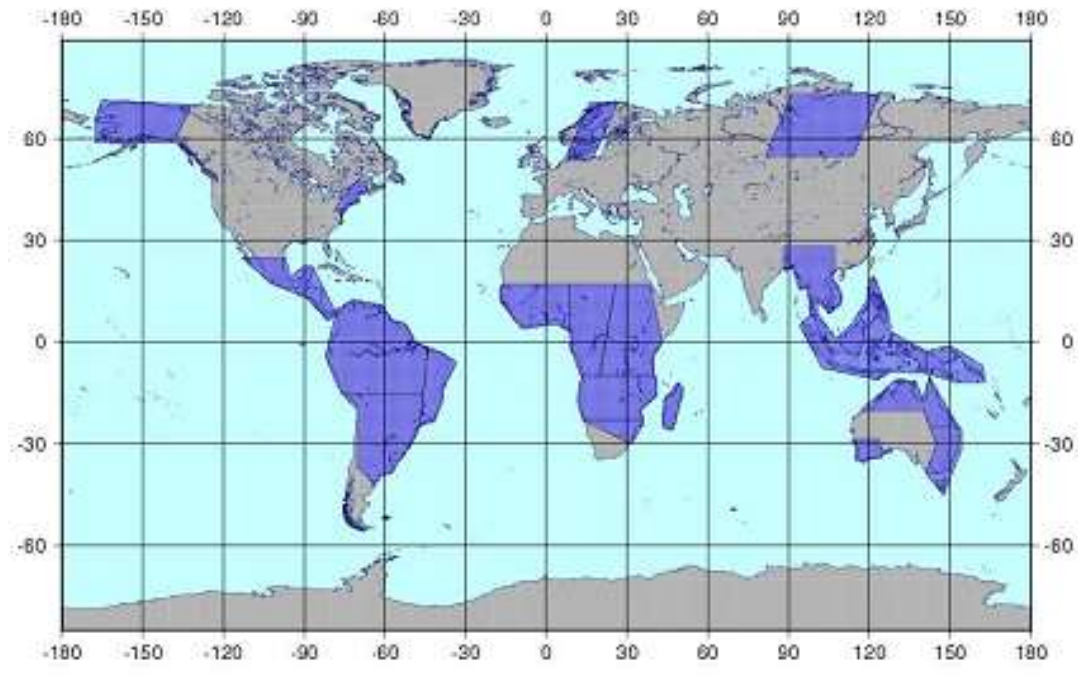


# Forest monitoring:

Temporal repeat: 6 cov/year

GSD: 10 m (off-nadir  $28.2^{\circ}$  -  $36.2^{\circ}$  )

Mode: Stripmap Dual-pol (HH+HV/28MHz)



# Global Quad-pol baseline:

Temporal repeat: 1 cov/ 5 years

GSD: 6 m (off-nadir  $25.0^{\circ}$  -  $34.9^{\circ}$  )

Mode: Stripmap Quad-pol (HH+HV+VV+VH)



1<sup>st</sup> year



2<sup>nd</sup> year



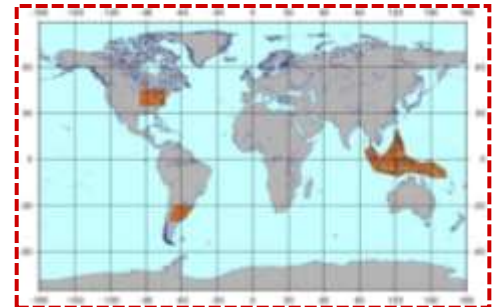
3<sup>rd</sup> year



4<sup>th</sup> year



5<sup>th</sup> year



Areas observed every year

\* 5 years required for global coverage in 6m QP mode



# Summary : ALOS-2 Observation for Asia-RiCE

		Spotlight	Ultra Fine	High sensitive	Fine	ScanSAR nominal		ScanSAR wide
Bandwidth		84MHz	84MHz	42MHz	28MHz	14MHz	28MHz	14MHz
Resolution		Rg × Az: 3 × 1m	3m	6m	10m	100m		60m
Swath		Rg × Az: 25 × 25km	50km	50km	70km	350km (5-scan)		490km (7-scan)
Polarization		SP	SP/DP	SP/DP/FP/CP		SP/DP		
NESZ		-24dB	-24dB	-28dB	-26dB	-26dB	-23dB	-23dB
S/A	Rg	25dB	25dB	23dB	25dB	25dB		20dB
	Az	20dB	25dB	20dB	23dB	20dB		20dB

SP : HH or VV or HV ,  
 DP : HH+HV or VV+VH ,  
 FP : HH+HV+VH+VV ,  
 CP : Compact pol

**FP**  
**1 cov/5yr**

**HH+HV**  
**6 cov/yr**  
**(SE Asia)**

**HH+HV**  
**9 cov/yr**  
**(SE Asia)**

## ALOS-2 Data for GEOGLAM/Asia-RiCE

- ALOS-2 data will be provided and utilized among the Asia-RiCE team under the framework of the **Kyoto and Carbon 4 (K&C 4)** Initiative, which is the scientific program lead by JAXA.
- K&C 4 is scheduled to start from the end of this year (or early next year).
- Shin-ichi coordinated and submitted the proposal for K&C 4 initiative and will serve as the representative PI, and each participating country also needs co-PI for the initiative.

## Technical Demonstration Sites



Phase 1A: Jun 2013

Phase 1B: Apr 2014



# Paddy Field Identification Software



- ❖ **INAHOR : INternational Asian Harvest mOnitoring system for Rice**  
(稻穂)

1. Main Window



2. Select SAR data for Processing



3. Rice Cultivated Area Mapping



4. Calculate Mapping Area

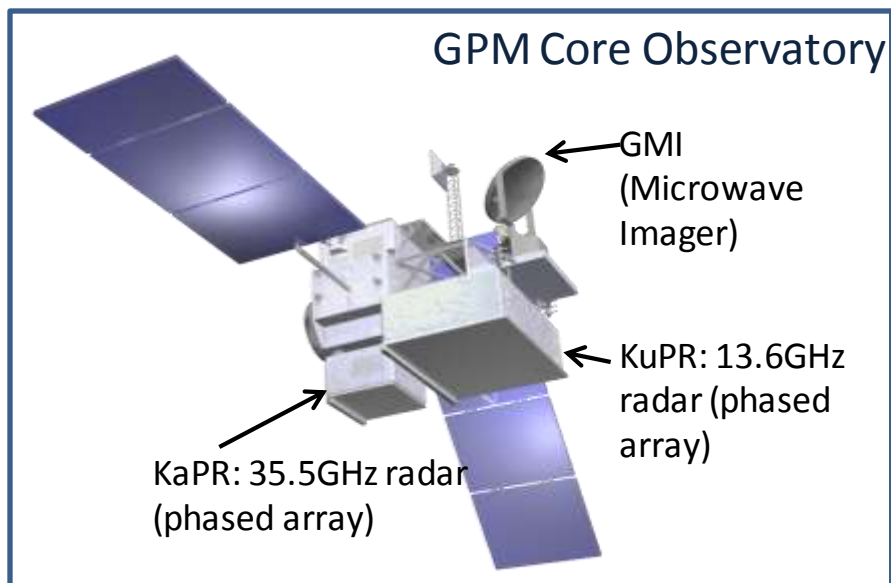


**This software enable us to easily map rice cultivated area from time-series SAR data.**

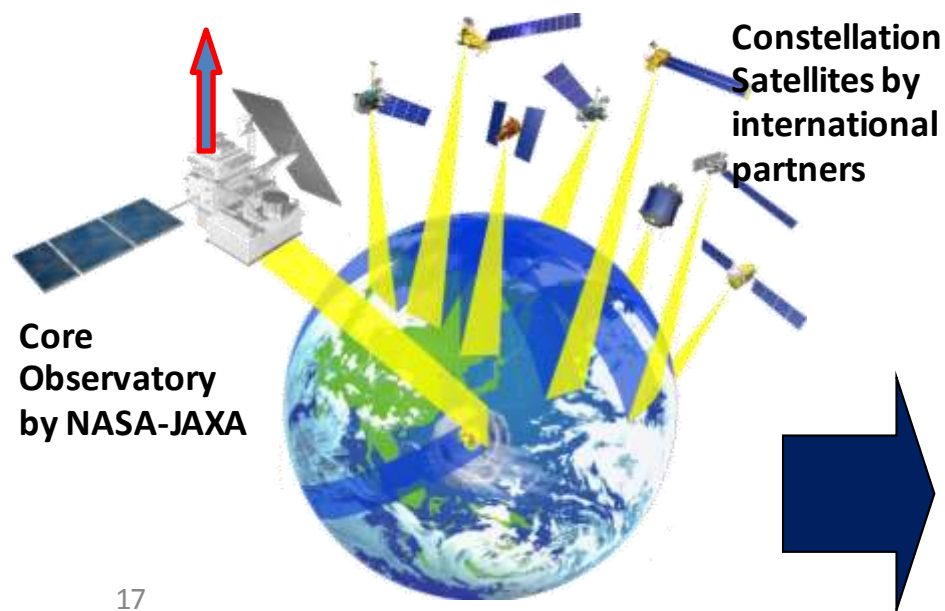


# Global Precipitation Measurement (GPM)/ Dual-frequency Precipitation Radar (DPR)

Lunched on 28 Feb 2014



- GPM is an international mission consisting of the GPM Core Observatory and Constellation Satellites for high accurate and frequent global rainfall observation.
- Core Observatory: developed under NASA and JAXA equal partnership.
- **Dual-frequency Precipitation Radar (DPR)**
- developed by JAXA and NICT in Japan
- the most sophisticated precipitation radar
  - **3D structure of rainfall**
  - simultaneous dual-frequency observation to detect **even weak rainfall and snowfall**.



# Satellite Based Global Rainfall Product

## Rain RADAR



TRMM PR/TMI  
GPM DPR/GMI

## Microwave Radiometer



GCOM-W1  
AMS2



DMSP  
SSM/I, SSMIS

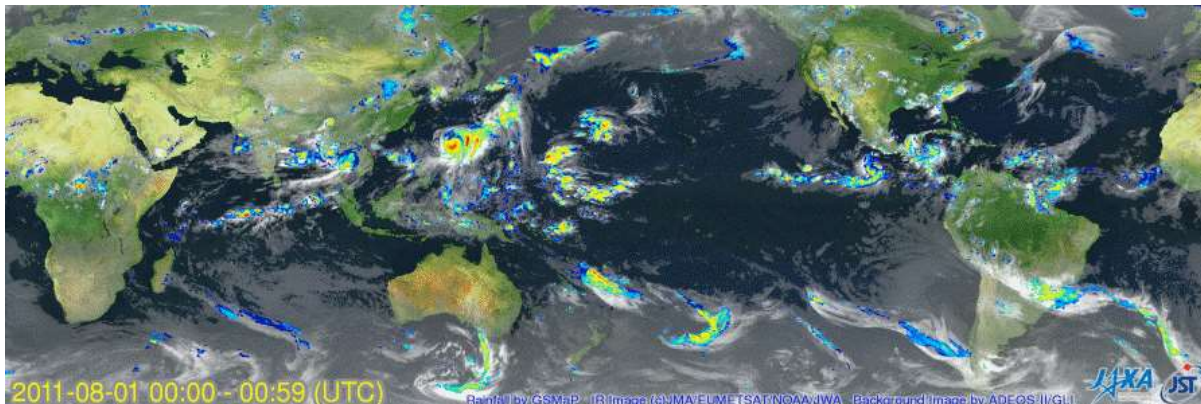


NOAA  
& MetOp  
AMSU-A/MHS

## Geostationary



MTSAT, GOES,  
Meteosat



Rain 0.1 0.5 1.0 2.0 3.0 5.0 10.0 15.0 20.0 25.0 30.0 [mm/hr]

Hourly 0.1-deg  
grid rainfall



GSMaP

**JECAM**

Joint Experiment for Crop Assessment and Monitoring

<http://sharaku.eorc.jaxa.jp/GSMaP/index.htm>



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# GCOM-W1 AMSR2

Lunched on 5 May 2012



- Successor of AMSR-E on Aqua and AMSR on ADEOS-II.
- Deployable main reflector system with 2.0m diameter (1.6m for AMSR-E).
- Frequency channel set is identical to that of AMSR-E except 7.3GHz channel for RFI mitigation.

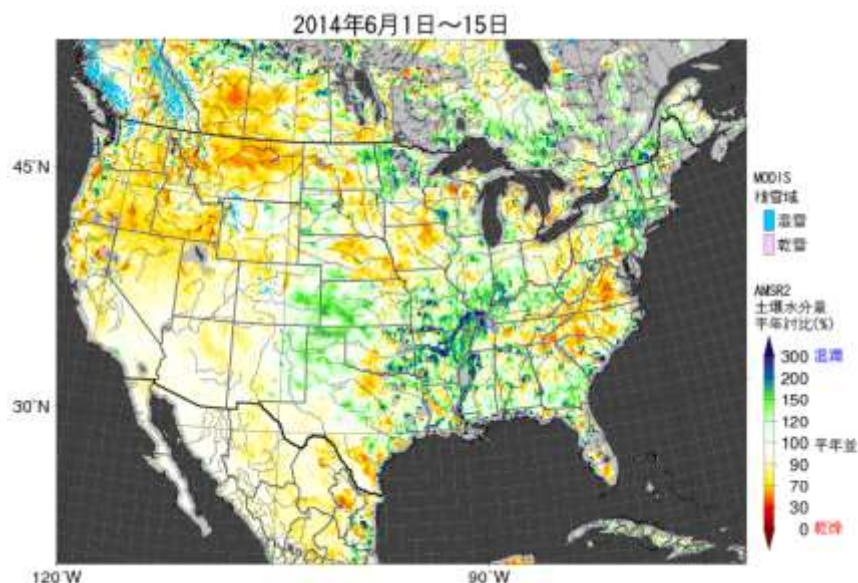
GCOM-W1/AMSR2 characteristics	
Scan and rate	Conical scan at 40 rpm
Antenna	Offset parabola with 2.0m dia.
Swath width	1450km
Incidence angle	Nominal 55 degrees
Digitization	12bits
Dynamic range	2.7-340K
Polarization	Vertical and horizontal

AMSR2 Channel Set				
Center Freq. [GHz]	Band width [MHz]	Pol.	Beam width [deg] (Ground res. [km])	Sampling interval [km]
6.925/ 7.3	350	V and H	1.8 (35 x 62)	10
10.65	100		1.2 (24 x 42)	
18.7	200		0.65 (14 x 22)	
23.8	400		0.75 (15 x 26)	
36.5	1000		0.35 (7 x 12)	
89.0	3000		0.15 (3 x 5)	5

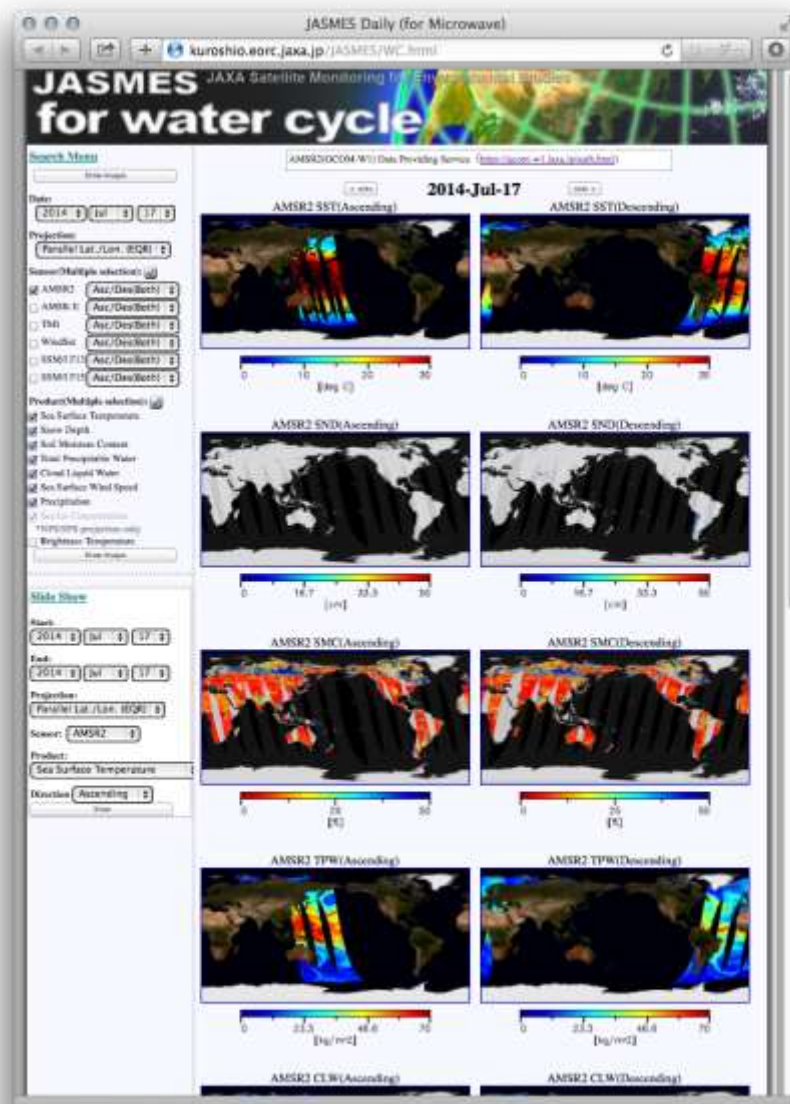


# GCOM-W1 AMSR2 Products for Agriculture

- Relevant to Agriculture Monitoring
  - Soil moisture
  - Snow depth
  - Precipitation etc.



Soil Moisture  
1-15 June 2014

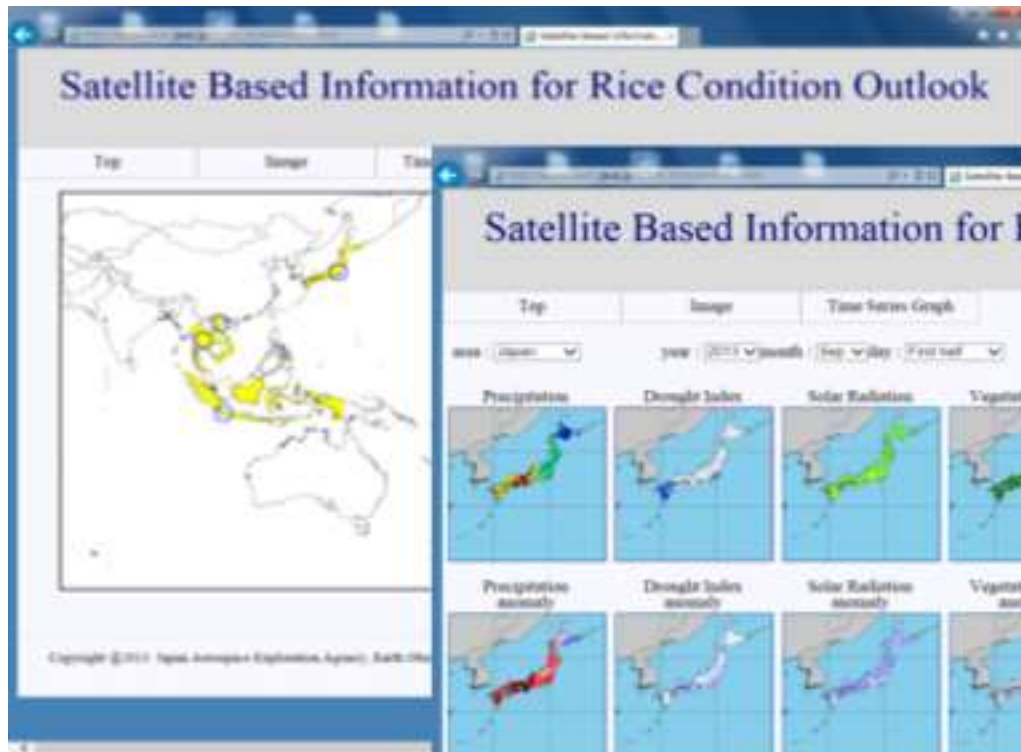


<http://kuroshio.eorc.jaxa.jp/JASMES/WC.html>



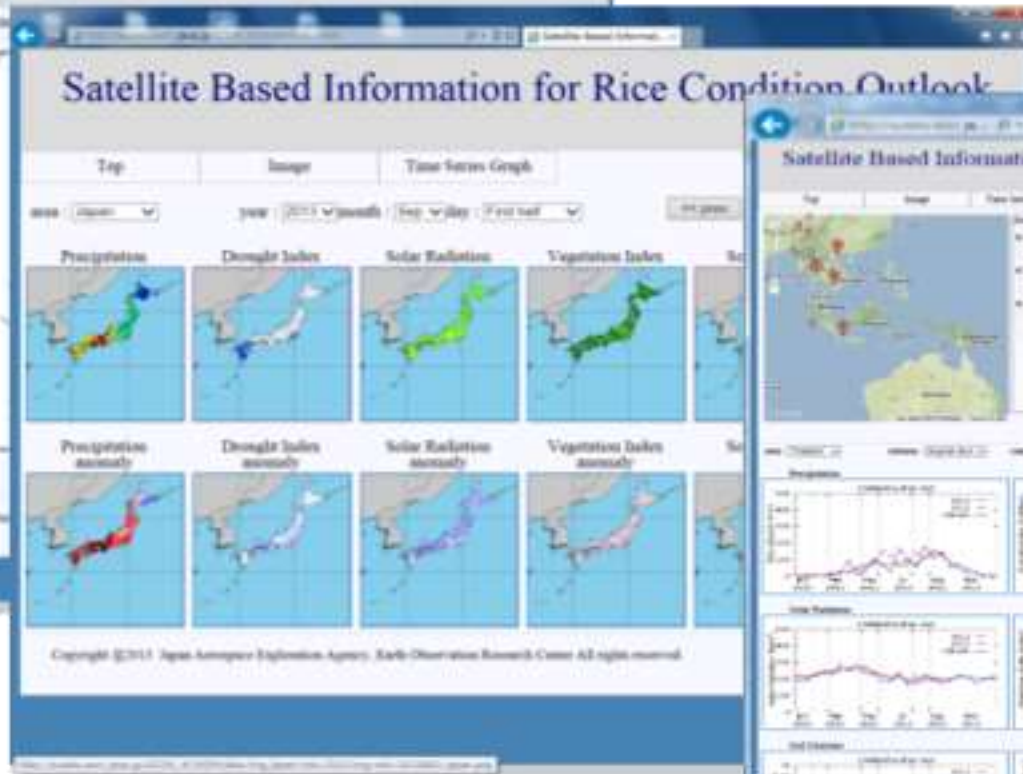
# Agro-met Data Distribution System (JASMIN)

- Provides agro-met information of GEOGAM/Asia-RiCE Phase1a countries (Thailand, Vietnam and Indonesia) for FAO/AMIS outlook



**Spatial Distribution**

**Time-Series**



**Top**

**JECAM**

Joint Experiment for Crop Assessment and Monitoring

# Examples of Agro-met Information

- Each parameter is updated twice a month and users can access and get latest data any time.

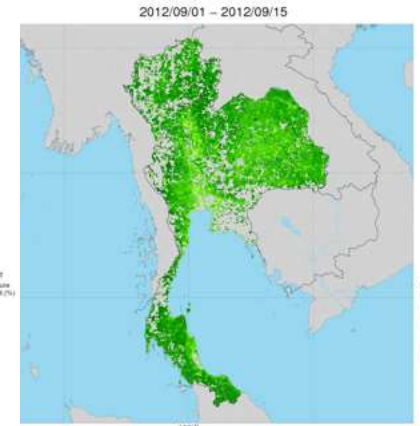
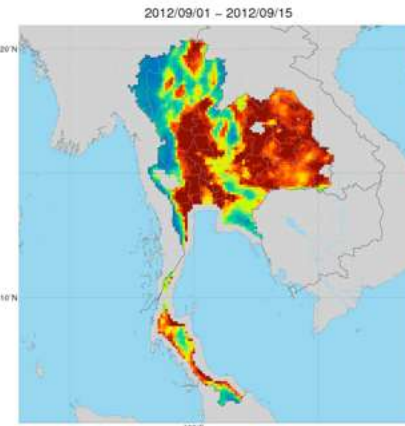
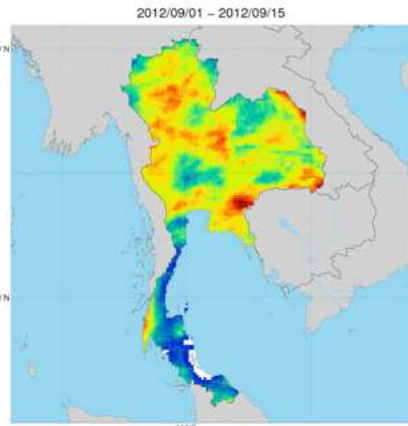
Precipitation

PAR

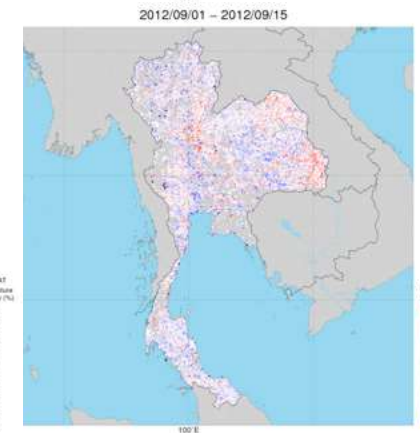
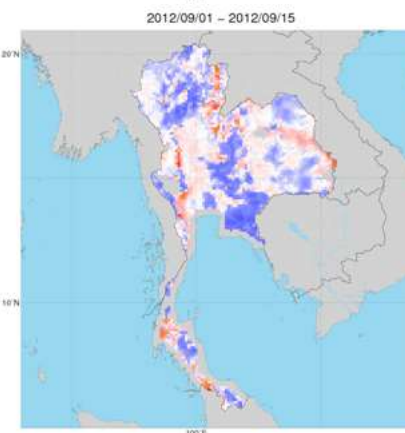
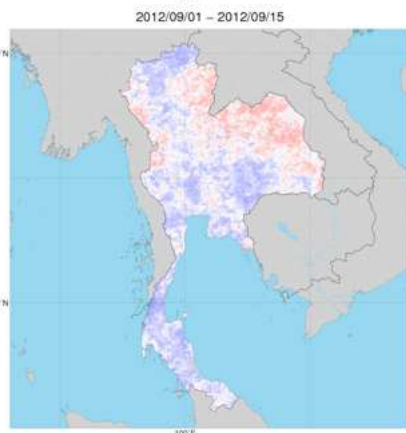
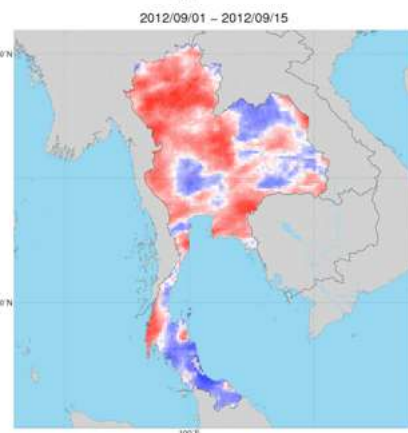
Soil Moisture

NDVI

Current Condition



Anomaly





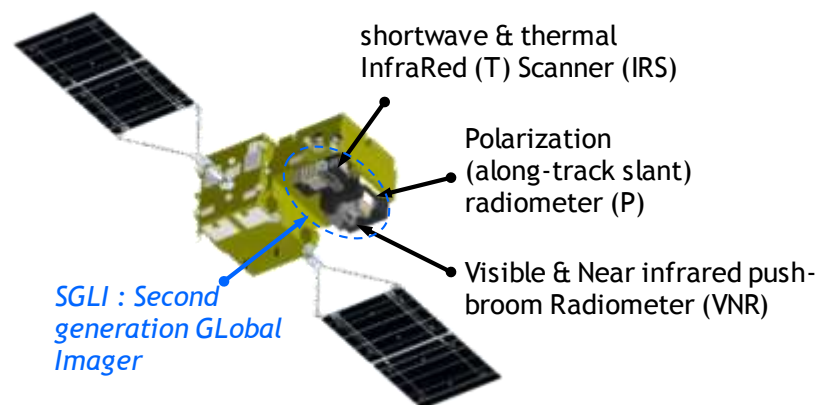
# GCOM-C1 SGLI

## (Launch: FY2016)

- Targets are **carbon cycle and radiation budget** relating to the global environmental change.
- SGLI' ll observe aerosols, cloud, vegetation, ocean color, sea/land surface temperature, snow/ice, and so on for more than 13 years.
- The SGLI features are **finer spatial resolution** (250m (VNI) and 500m (T)) and **polarization/along-track slant view** channels (P), which will improve land, coastal, and aerosol observations.

### GCOM-C SGLI characteristics (baseline of GCOM-C1 BBM design)

Orbit (TBD)	Sun-synchronous (descending local time: 10:30) Altitude: 798km, Inclination: 98.6deg
Launch Date	2016 (target)
Mission Life	5 years (3 satellites; total 13 years)
Scan	Push-broom electric scan (VNR: VN & P) Wisk-broom mechanical scan (IRS: SW & T)
Scan width	1150km cross track (VNR: VN & P) 1400km cross track (IRS: SW & T)
Digitalization	12bit
Polarization	3 polarization angles for P
Along track direction	Nadir for VN, SW and T, +45 deg and -45 deg for P
On-board calibration	VN: Solar diffuser, Internal lamp (PD), Lunar by pitch maneuvers, and dark current by masked pixels and nighttime obs. SW: Solar diffuser, Internal lamp, Lunar, and dark current by deep space window T: Black body and dark current by deep space window All: Electric calibration



		Channel	Center Wavelength	Band width	IFOV
			VNR, SWI: nm TIR: $\mu\text{m}$		m
Visible and Near Infrared Radiometer (SGLI-VNR)	Non-polarization Channel	VN1	380	10	250* <sup>1</sup>
		VN2	412	10	
		VN3	443	10	
		VN4	490	10	
		VN5	530	20	
		VN6	565	20	
		VN7	673.5	20	1000
		VN8	673.5	20	
		VN9	763	12	
		VN10	868.5	20	
		VN11	868.5	20	
	Polarization Channel	P1	673.5	20	1000
		P2	868.5	20	
Infrared Scanner (SGLI-IRS)	SWI Channel	SW1	1050	20	1000
		SW2	1380	20	
		SW3	1630	200	250* <sup>1</sup>
		SW4	2210	50	1000
	TIR Channel	T1	10.8* <sup>2</sup>	0.74* <sup>2</sup>	500* <sup>1</sup>
		T2	12.0* <sup>2</sup>	0.74* <sup>2</sup>	

# Summary

- ALOS-2 have been successfully launched and the data will be utilized among the Asia-RiCE team under the framework of K&C.
- ALOS-2 ScanSAR mode would be a promising tool to monitor rice in the country-level.
- Other agro-met information (e.g. rainfall, soil moisture) is also available and currently utilized for the development of monthly rice outlook for the FAO/AMIS.
- International programs including Asia-RiCE are ongoing.



# Thank You for Your Attention !

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# Appendix

# PALSAR-2 Observation for Asia-RiCE/GEOGLAM

- **Pan-tropical, incl. Asia-RiCE regions**
- ScanSAR (100 m HH+HV) 9 times/year (every 42 days)
  - **Desc:** Jan + Feb + Mar/Apr + May + Jun + Jul + Aug/Sep + Oct + Nov
- Fine Beam (10 m HH+HV) 6 times/year
  - **Asc:** Jan/Feb + Jun/Jul + Aug/Sep + Nov/Dec
  - **Desc:** Mar-Jun (14-day InSAR pair)
- Quad-pol (6 m QP) 1 time/year
  - **Asc:** Mar-May window

# Assessment Source for Rice Growth Outlook

- Provides “Current Condition” and “Anomaly” information

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 with JAXA's algorithm
<b>Land Surface Temperature</b>	15-day Average	5 km	2002- (2002-2012)	MODIS Product
<b>Soil Moisture</b>	15-day Average	50 km	2009- (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	2002- (2009-2012)	MODIS with JAXA's algorithm



# Agricultural Monitoring and Research Programs

- Asia-RiCE (Asia-Rice Crop Monitoring & Estimation)
- SAFE (Space Applications for SAFE) Initiative
  - Indonesia (2013-14) : Dr. Rizatus Shofiyati
  - Vietnam (2013-14) : Dr. Lam Dao Nguyen,  
Dr. Thuy Le Toan
- ADB Technical Assistance Project (2014-15)
  - Lao PDR, Vietnam, Philippines, Thailand

