

# *JECAM Synthetic Aperture Radar (SAR) Cross Site Experiments*

JECAM Meeting, October 2016, Ukraine

**JECAM**

Joint Experiment for Crop Assessment and Monitoring

 **GROUP ON  
EARTH OBSERVATIONS**

# Recent (2016) Developments

- Preliminary roadmap for the JECAM SAR cross sites experiments presented at 2015 JECAM meeting, Belgium.
- Resulted in a proposal focusing on development, testing, application and capacity building of SAR-based crop type and crop productivity monitoring across a diverse range of agricultural systems.
- Proposal submitted to Canadian Space Agency in anticipation of future funding opportunities. Decision to come late 2016...

# Cross-Sites Experiments Proposal (2016)

## (i) Crop type identification (Notional, for discussion)

The general objectives of this work package are to: (a) better understand how the addition of SAR imagery add value to existing crop mapping efforts, and (b) to develop a strategy for optimizing its broader implementation.

Particularly, we propose to:

1. Evaluate how (i.e. when, where and by how much) the addition of C-Band SAR improves ability of current mapping efforts (usually optical-driven) to map crops with high accuracy over simple to unusual and complex agricultural systems.
2. Assess incremental benefits of using multi-frequency SAR (C-, L-, and X-band) for crop mapping using SAR-optical or SAR-only approaches.
3. Develop a capacity-building strategy to transfer knowledge so that partners (JECAM, Asia-RICE, others?) are prepared to strategically target and incorporate SAR data within their crop mapping operations.

# Cross-Sites Experiments Proposal (2016)

## (ii) Biophysical Monitoring (2015 Roadmap, 2016 Proposal)

The general objective of this work package is to improve the performance of existing SAR-driven models of crop productivity and extend their application to a wider range of crops (Canada and internationally).

Particularly, we propose to:

1. Develop and validate the ability of a SAR-based model (Water Cloud Model, WCM) to estimate crop biomass and LAI over diverse cropping systems established via inter-comparisons among JECAM sites.
2. Test the WCM for use with simulated RADARSAT Constellation Mission data, a Canadian constellation of 3 satellites to be launched in 2018.
3. Develop a capacity-building strategy to transfer knowledge so that partners (JECAM, Asia-RICE, others?) are prepared to strategically target and incorporate SAR data within their crop monitoring operations.

# SAR Acquisitions, 2012 - 2015

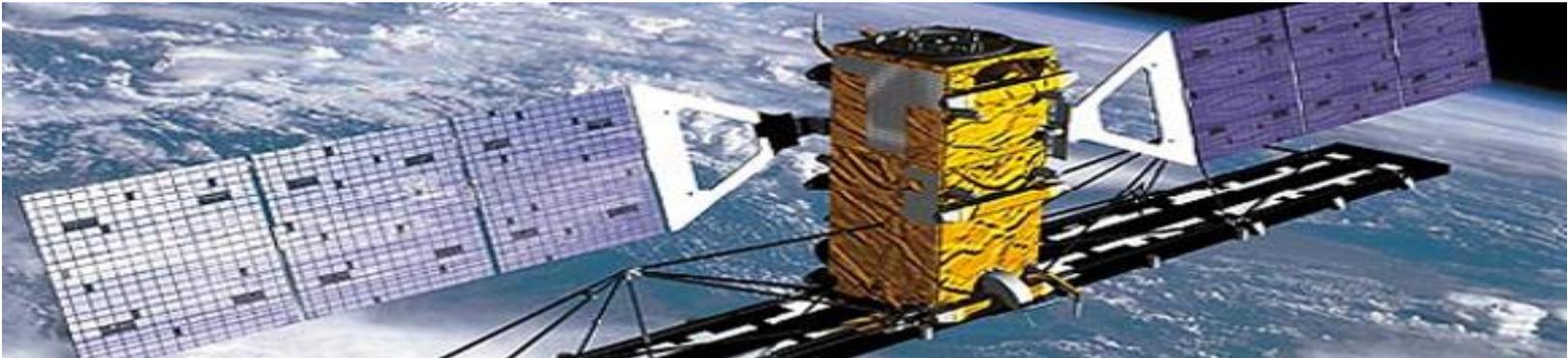
Site	Year	X-Band		L-Band	C-Band	
		Cosmo Skymed	TerraSAR-X	ALOS-2 PaISAR	RADARSAT-2	Sentinel-1
Argentina	2012					
	2013					
	2014					
	2015					
Belgium	2013					
	2014					
Burkina Faso	2015					
Canada (Red River)	2012					
	2013					
	2014					
Canada (South Nation)	2012					
	2013					
Canada (CFIA)	2014					
	2015					
China (Guangdong)	2013					
	2014					
China	2012					
China (Anhui)	2014					
China (Heilongjiang)	2012					
	2013					
China (Shandong)	2012					
	2013					
France	2014					
	2015					
Italy	2014					
	2015					

Site	Year	X-Band		L-Band	C-Band	
		Cosmo Skymed	TerraSAR-X	ALOS-2 PaISAR	RADARSAT-2	Sentinel-1
Morocco	2015					
Senegal	2015					
Taiwan	2015					
Tunisia	2013					
	2014					
	2015					
Ukraine	2012					
	2013					
	2015					

Source: JECAM Annual Reports (2013, 2014, 2015, 2016)

# SAR Acquisitions, 2016-17

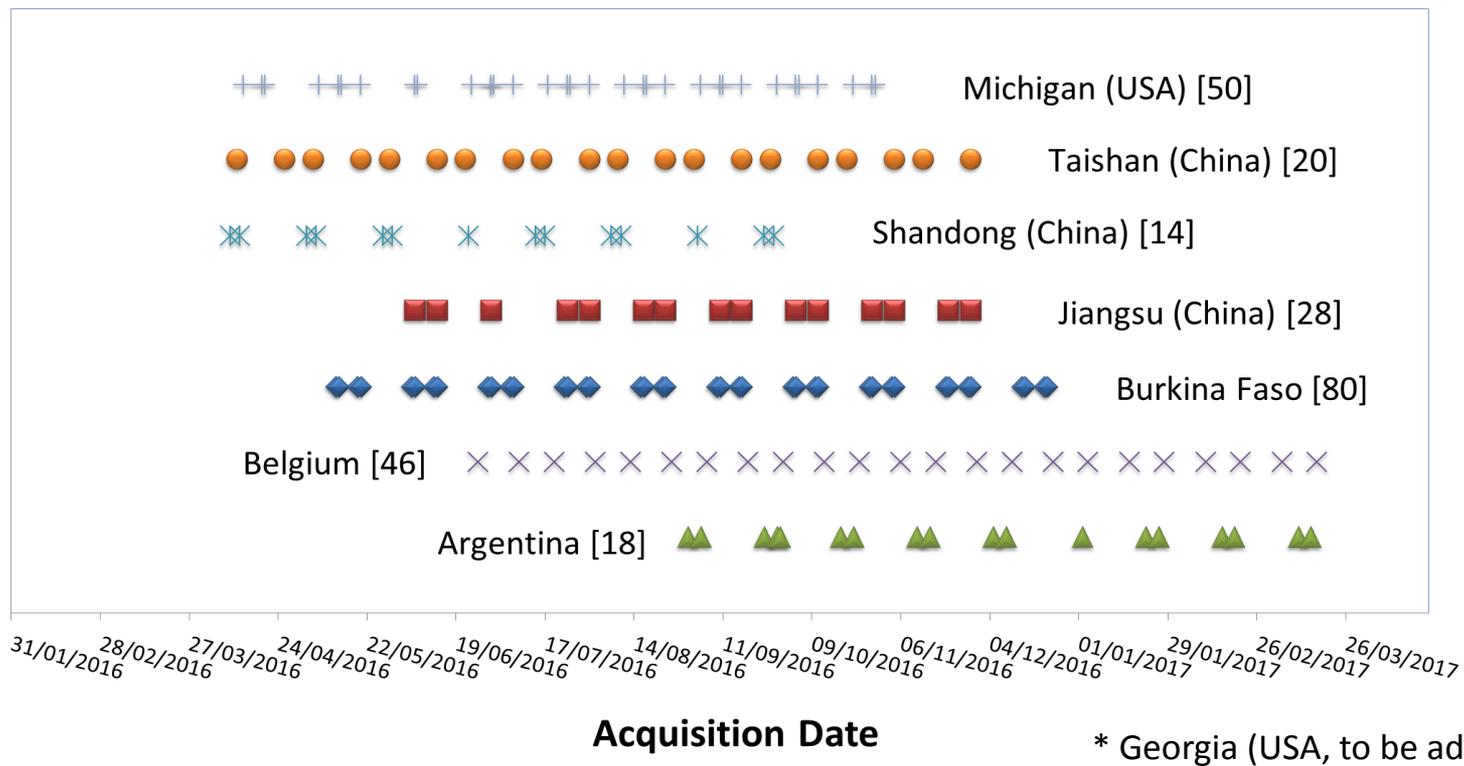
- In 2016, RADARSAT-2 data acquired over JECAM sites (Canada, Argentina, Belgium, Burkina-Faso, China (3 sites), US (Michigan)).
- Data can be processed to AAFC specifications.
- Need to inventory other SAR data acquired in 2016-17. E.g.
  1. Sentinel-1;
  2. ALOS-2 PALSAR (L-Band SAR); and
  3. TerraSAR-X (X-band SAR).



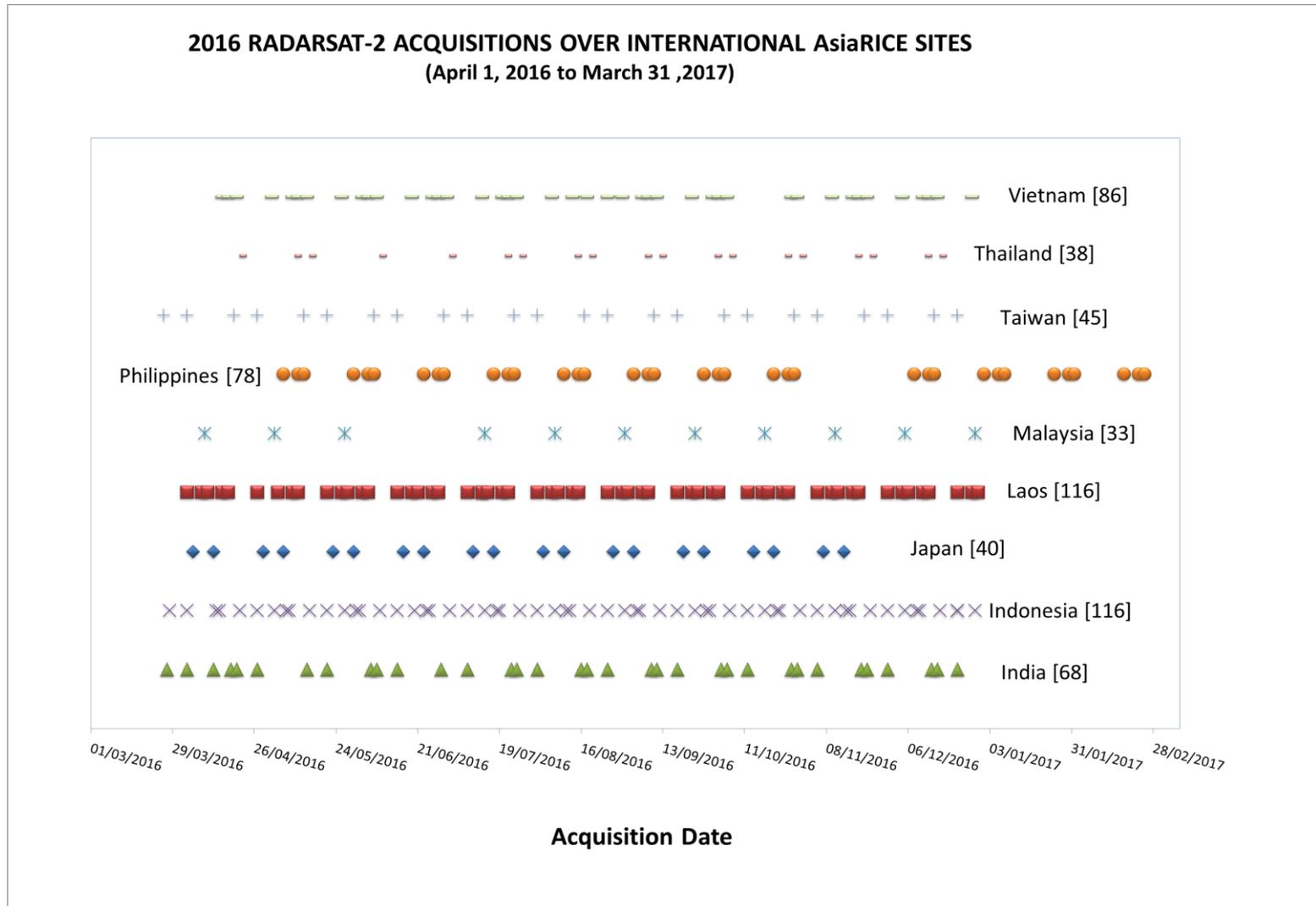
Source: Canadian Space Agency

# RADARSAT-2 Acquisitions, 2016-17 (JECAM)

**2016 RADARSAT-2 ACQUISITIONS OVER INTERNATIONAL JECAM SITES**  
(April 1, 2016 to March 31, 2017)



# RADARSAT-2 Acquisitions, 2016-17 (AsiaRICE)



# In Situ Observations, 2015 -

## In situ observations drive SAR cross-site experiments

- In situ data are crucial for cross-site experiments.
- Must evaluate suitability of sampling protocols for SAR-based experiments and confirm which test sites have in situ data that meet these requirements.

### (i) Crop Type Mapping

- Sampling protocols defined by [JECAM](#) / SIGMA.
- Datasets should exist from 2015 (see Waldner et al, 2016).

### (ii) Biophysical (LAI, Biomass) Monitoring

- Sampling protocols defined in 2015 roadmap with some modification.
- Datasets for some sites exist from 2012 (see [JECAM Annual Reports](#)).

# Next Steps / For Discussion

## (i) Project-wide

- Formation of international working group to develop final work plans.
- Inventory of available SAR, in situ and ancillary data for 2015 and 2016.

## (ii) Crop Type Mapping

- Identification of collaborative sites (partners).
- Discussion and articulation of objectives and development of final work plan.

## (iii) Biophysical (LAI, Biomass) Monitoring

- Implementation of defined objectives and project work plan... PLUS... some new suggestions (e.g. Addition of integrated NDVI-SAR methods development and application; Addition of rice to 3 crops being modeled (corn, soybeans, wheat)).