

JECAM Site-India: Status

Earth Observation Technologies for Crop Monitoring: A
Workshop to Promote Collaborations among
GEOGLAM/JECAM/Asia-RiCE 2018

Taichung City, Taiwan
17-20 September, 2018

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Site: Vijayawada, India

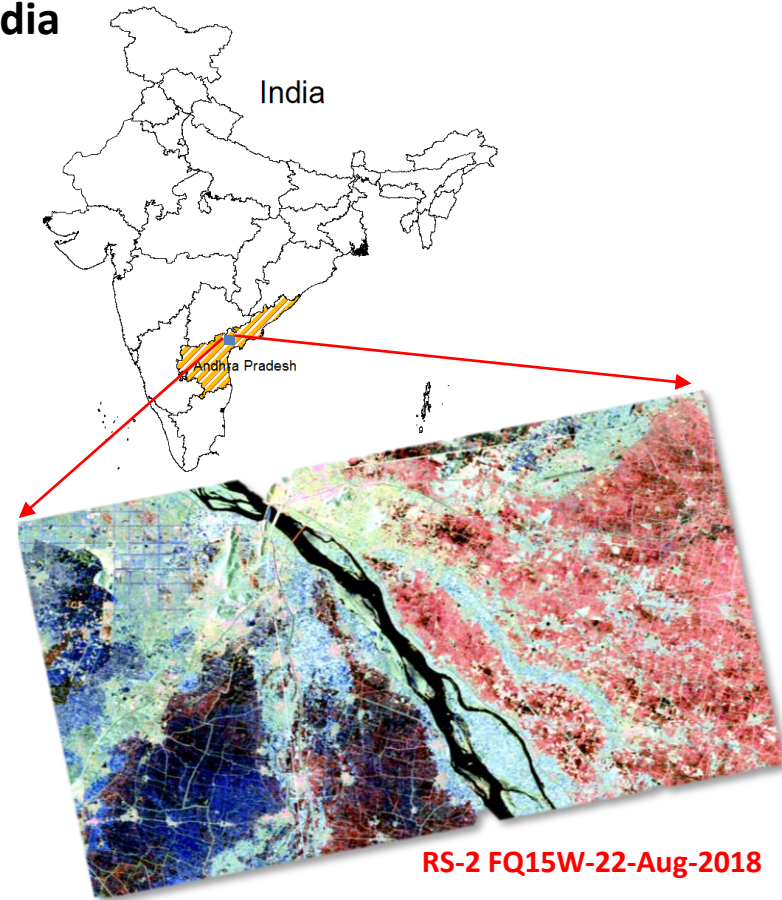
- Rice accounts > 40% of total grain production of India
- Cultivated and Consumed across the country

Why Andhra Pradesh state?

- Andhra Pradesh State: Rice bowl of India
- 11.6 million tonnes (2014-15): 11% of total India
- Yield: 3,036 kg/ha (2014-15)
- Cropping Area: 66% of total LULC
- Rice accounts: 28% of total cultivation area

Vijayawada, Andhra Pradesh site

- Covers Krishna and Guntur districts
- Availability of previous information
- Field campaigns - 2014 and 2015
- Rice dominated region



Site: Vijayawada, India

Purpose of project: Crop characterization, mapping and Monitoring

Duration: 2017-2019

- **Location: Southern State of India** ($16^{\circ} 24' 6.23''\text{N}$ and $80^{\circ} 41' 2.41''\text{E}$)

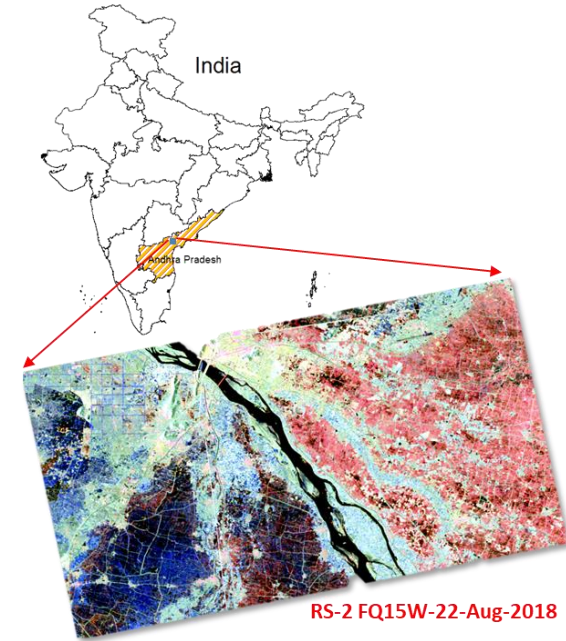
- Topography: Plain
- Soils: Black cotton and Red Soils
- Field size: 50 m X 50 m (approx.)
- Irrigation dominated/Canal/Tanks

- **Crops: Rice dominated**

- Others crops: Sugarcane, Corn, Turmeric
- Crop calendar: Rice (July-November)

- **Climate and weather:** Tropical, 20° - 35° C temp. range

- **Agricultural methods used:** Rice Transplanting as well harvesting by hand as well as by machines



Objectives

Research Topics:

- Crop identification and Crop Area Estimation
- Crop Cover Mapping
- Crop Growth Monitoring
- Biophysical parameter/Phenology Retrieval
- Soil Moisture and other condition assessment
- Yield Prediction

JECAM India group is also engaged in development of:

- Novel Biophysical parameter retrieval techniques,
- SAR vegetation indices
- Processing Chain for Differentiating Early and Late Transplanted Rice in Google Earth Engine
- Compact/Hybrid Polarimetric data potential for crops
- Phenology Based Multi-temporal Crop classification

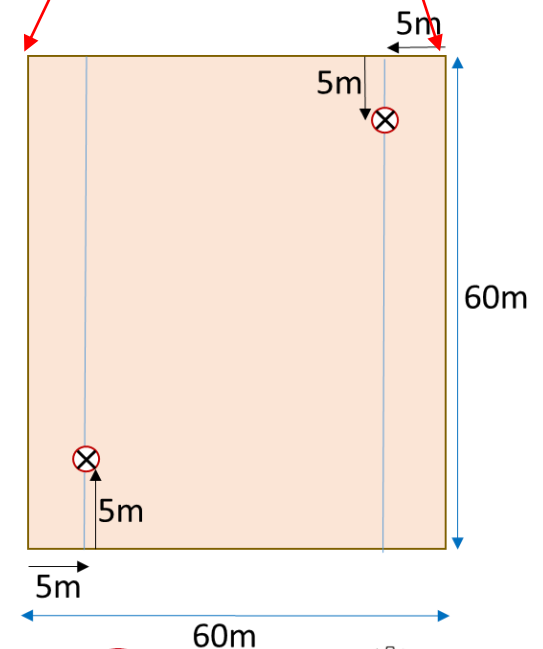
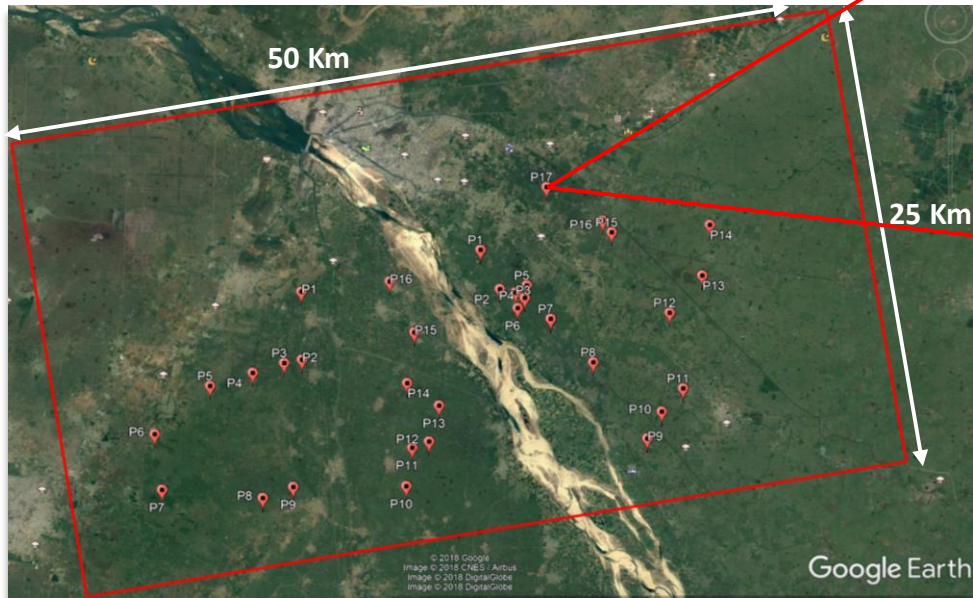
Earth Observation (EO) Data Received/Used

Data	Mission /Sensor	Space Agency /Supplier	Years of Acquisition	No. of Scenes	Polarization
SAR	Radarsat-2	MDA/(JECAM+SOAR) Canada	2013-2016, 2018 season	04	Quad-Pol
	RISAT-1	NRSC, ISRO, India	2013-2016	13	Compact-Pol
	ALOS-2	JAXA, Japan	2014, 2015	4	Quad/Compact
	Sentinel-1	ESA/ Openly available	2018 (June...)	11	Dual-pol
Optical	Landsat-8	NASA/USGS, USA	2018	Cloud free data	
	Sentinel-2	ESA, Europe	2018		

1. We prefer Kharif season for data acquisition (June to November)
2. RISAT-1 data is acquired in Hybrid-pol mode (RH+RV)
3. Optical data is hindered by cloud cover during Kharif season
4. As of now we did not face any major difficulty in data ordering and acquisition

In situ and Field survey Data

Parameters Collected: Plant Height, Soil Moisture, LAI (hemispherical photography), Phenology, management practices, water depth



In situ and Field survey Data

Field Photographs of JECAM, Vijayawada site: Current Status

05 July 2018



27 July 2018



22 Aug 2018



Challenges?

1. Crop cutting experiment: Biomass measurements
2. Inconsistent field shapes and sizes;
3. Difficult to design a common sampling strategy

Results

Highlights from work completed

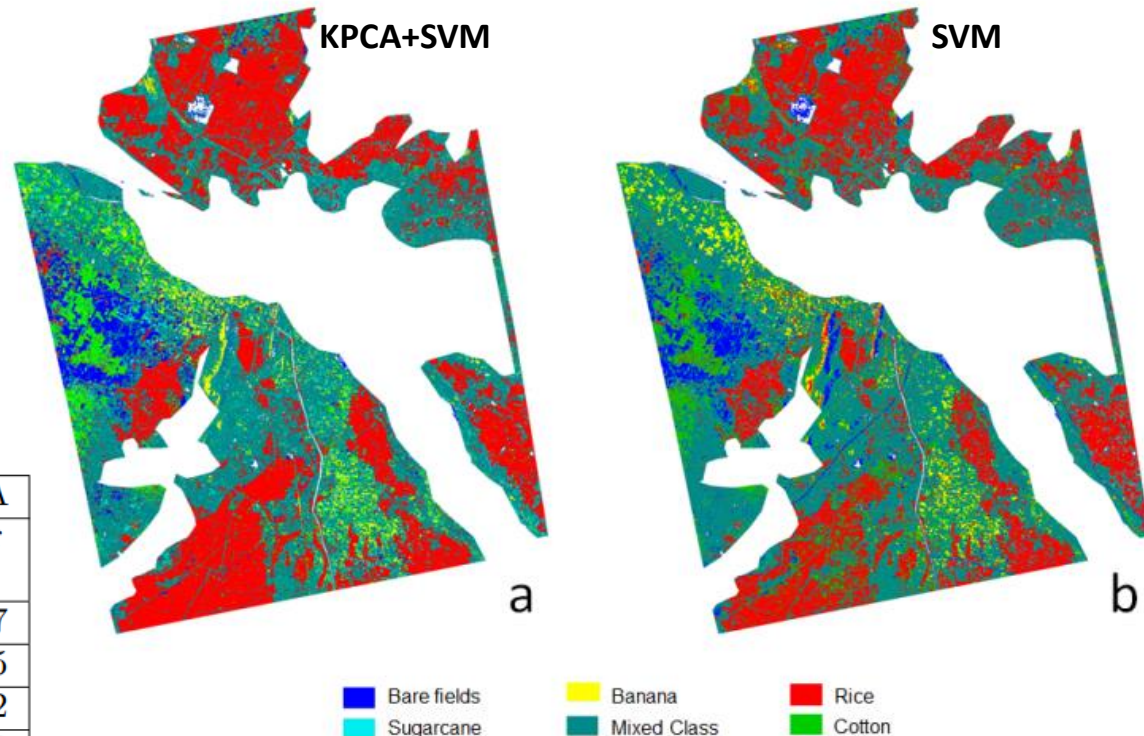
- **2014** Kharif season field data and satellite data shared with JECAM | AAFC
- **2018** JECAM data collection: FQ15W acquisition (June- September 2018)
- Synchronously field data collected
- Acquisitions are planned till **December-2018**
- Webpage created for India site description: field and satellite data details available

Classification Assessment

2014 data Acquired over Vijayawada Test site

- Multi-temporal crop classification
- 5 Radarsat-2 Images

Class	SVM		SVM+KPCA	
	Prod. acc.	User acc.	Prod. acc.	User acc.
Banana	92.84	49.0	84.27	97.17
Cotton	45.54	80.63	82.87	94.05
Bare Soil	92.88	99.66	96.52	94.62
Sugarcane	57.48	60.86	43.77	93.12
Rice	89.24	88.98	96.87	84.18
Mixed	77.39	76.41	95.09	86.19
Overall acc.	82.026		89.919	
Kappa coef.	0.775		0.875	

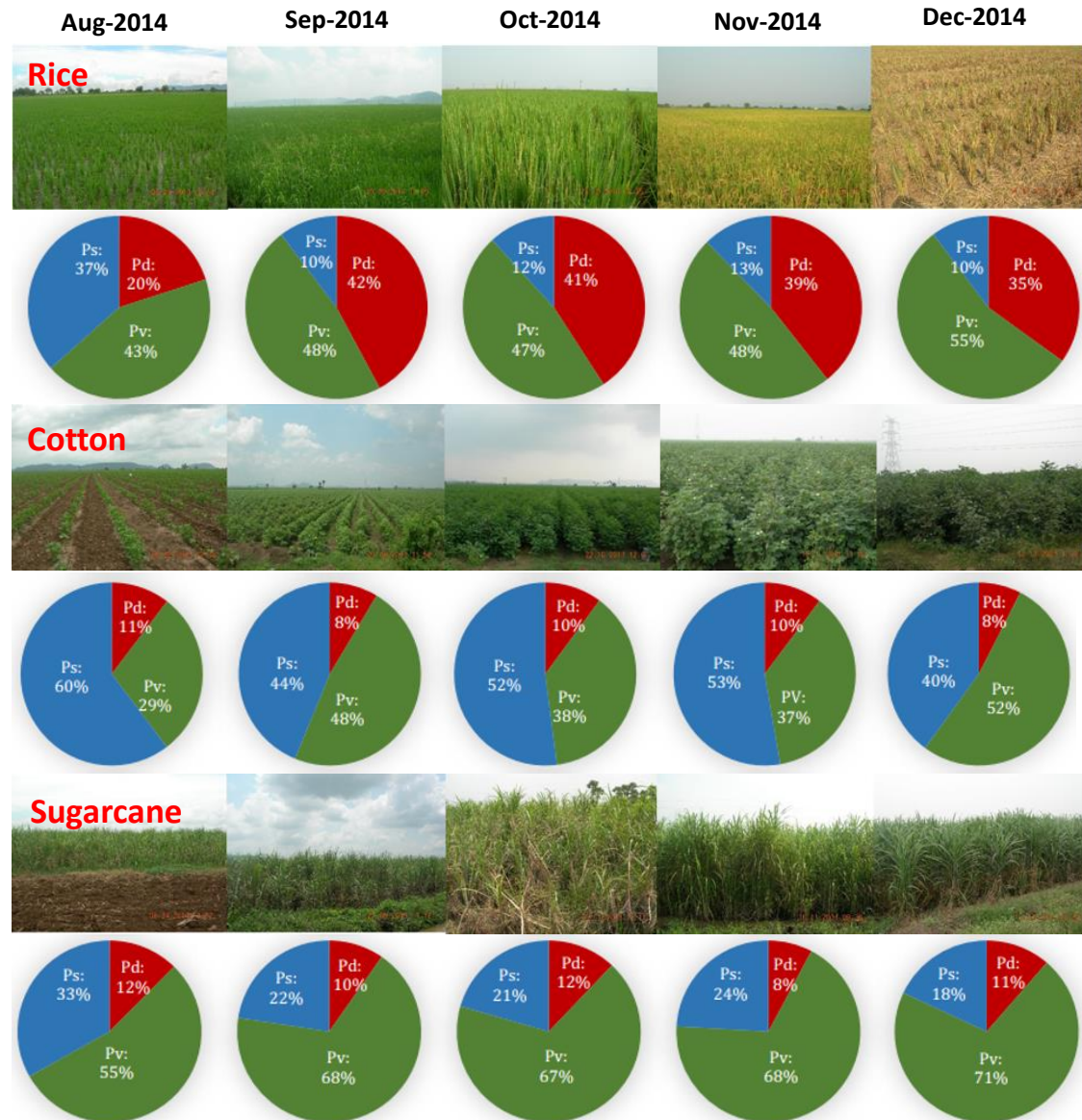


Source: Dipankar Mandal, Vineet Kumar, Y. S. Rao, (2016) “Kernel-PCA based Support Vector Machine approach for Multi-Temporal Crop Classification using RADARSAT-2 Data” ISRS National Symposium, 07-09 December 2016, Dehradun, India.

Time series analysis

Crop growth changes: Hybrid-Polarimetric $S\text{-}\Omega$ Decomposition

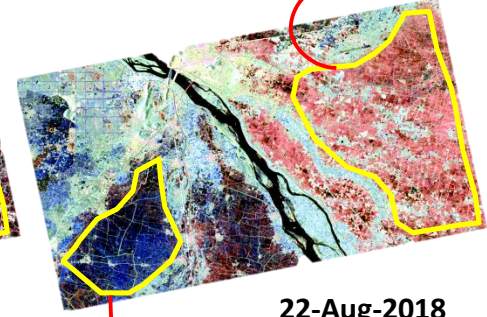
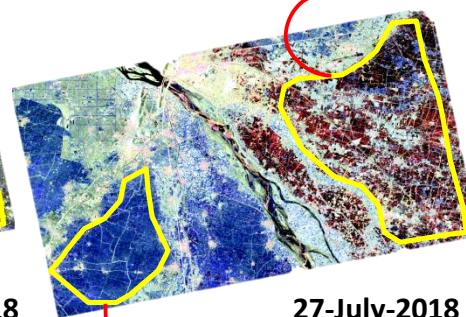
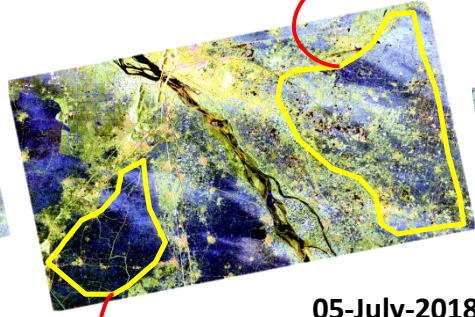
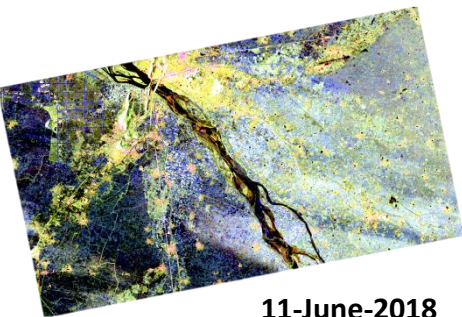
- $S\text{-}\Omega$ differs from Raney m-chi and m-delta decompositions
- Takes care of transmitted ellipticity in hybrid-pol
- Simulated Hybrid-pol
Radarsat-2 data is used here
- 2014 Radarsat-2 data of Vijayawada



Source: Bhattacharya, A., De, S., Muhuri, A., Surendar, M., Venkataraman, G., & Das, A. K. (2015). A new compact polarimetric SAR decomposition technique. *Remote Sensing Letters*, 6(12), 914-923.

JECAM: Vijayawada, India, 2018

June --> Aug -- > -- > Dec. 2018



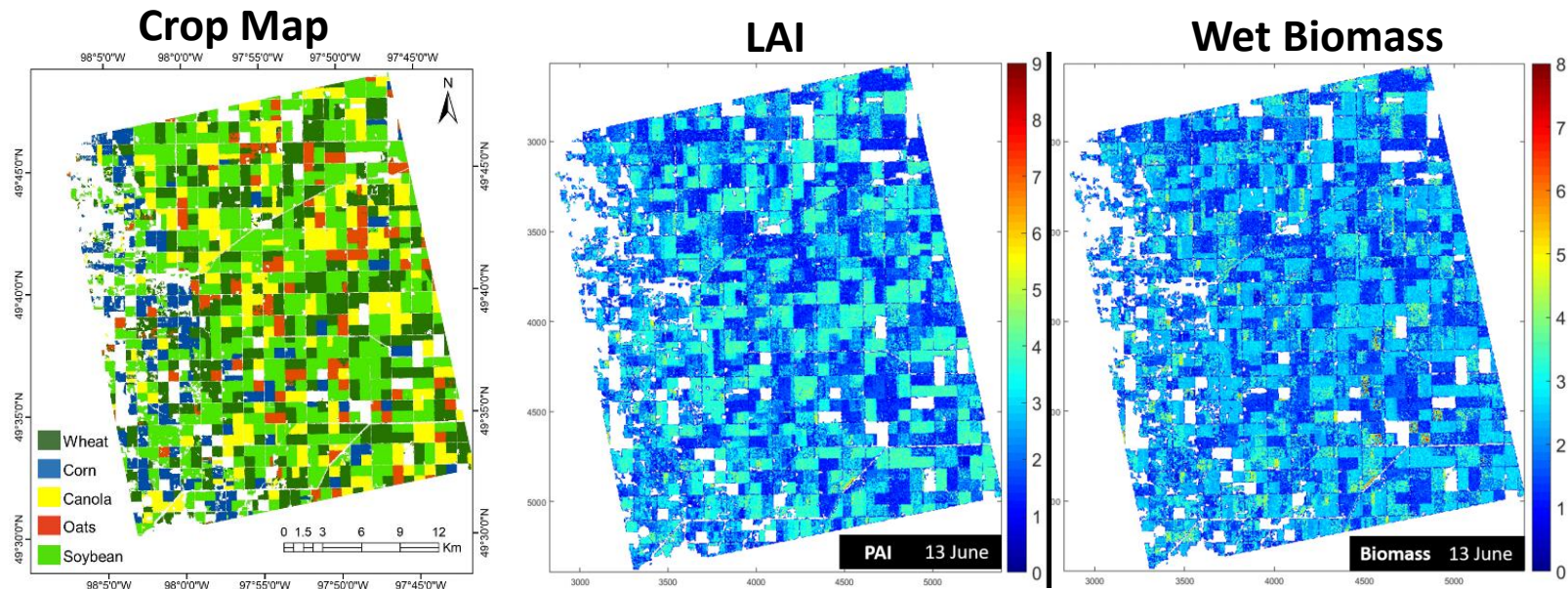
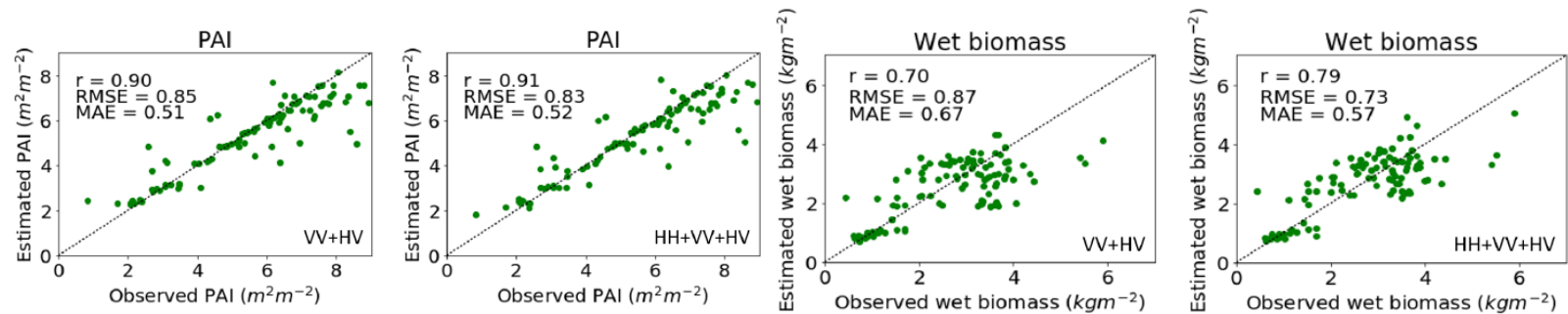
Next Steps:

- Data acquisition till December
- Pre-Processing steps: JECAM protocol
- Classification Assessment
- Biophysical Parameter retrieval: Our approach as well as JECAM methods

Multi-target Biophysical Parameter Retrieval

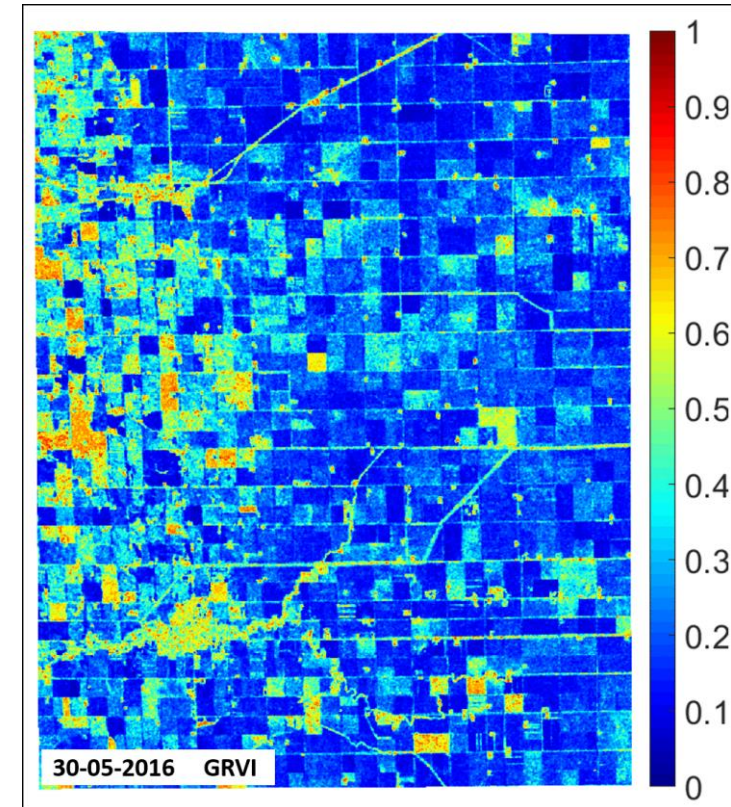
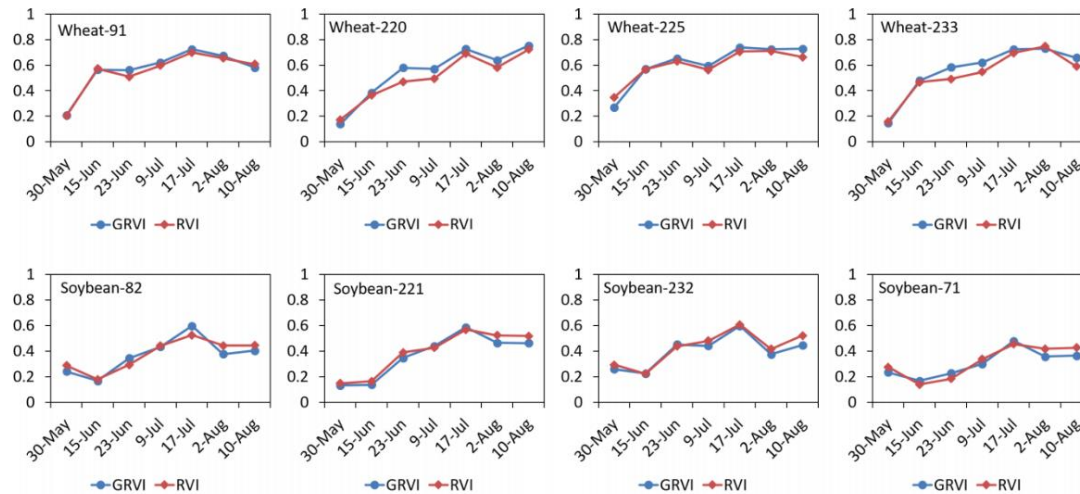
- Manitoba, Canada site using RADARSAT-2 2016 images
- Muti-target Random Forest Retrieval

Wheat



Source: Dipankar Mandal, Vineet Kumar, Heather McNairn, Avik Bhattacharya, and Y. S. Rao, Joint Estimation of Crop Biophysical Parameters from Polarimetric SAR data using Multi-target Random Forest Regression, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing. (Under Review)

Generalized Volume Scattering Model Based Vegetation Index



Source: Debanshu Ratha, Dipankar Mandal, Vineet Kumar, Heather McNairn, Avik Bhattacharya, and Alejandro Frery (2018)
 "A Generalized Volume Scattering Model Based Vegetation Index from Polarimetric SAR data" **IEEE Geosciences and Remote Sensing Letters**. (Under review)

Collaborations

- Describe the nature of any collaboration with other JECAM / Asia-RiCE sites or other relevant partners (i.e. who, objective, brief status).

Partners made:

- Andhra Pradesh State Remote Sensing Center (APSAC)
- Agri-Universities (Bidhan Chandra Krishi Vishwavidyalaya)
- Supports in field data collection, local knowledge, weather information

Plans for Next Growing Season


- Will you hold the course, or modify the approach?
 - Will follow the same course
 - JECAM India developed algorithms and methodology can be tested for other JECAM test sites also
- Do you anticipate using the same type/quantity of EO data next year?
 - Yes, we anticipate same type of EO data next year

Thank You!



Strengthen Global Agricultural Monitoring

HOME TEST SITE FIELD MEASUREMENT STRATEGIES SATELLITE OVERPASSES RESOURCES



Experimental Field Campaigns |
Vijayawada Test Site

[SASYA](#) | [TSVIJ](#)

Agricultural resources are important dynamic natural resources and a major contributor to Indian economic growth. Accurate crop condition assessment, acreage estimation and on time yield assessment helps in providing a crucial information about the crops and leads to proper management of agricultural resources. In long term perspective, it is related to national and global food security. With large area synoptic coverage and timely measurements, remote sensing technology is able to fulfill all these requirements for crop related assessments. Remote sensing satellites are regularly used for crop acreage and production estimation, crop

Latest News
[SASYA](#) | [TSVIJ](#)

JUL 01	The 2nd field visit has been planned for 04-06th July 2018.
MAY 21	The 1st field visit has been planned for 09-11th June 2018.



JECAM India Group

http://home.iitb.ac.in/~dipankar_mandal/FieldCampaign/TS2/index.html