



JECAM Taiwan TARI site

JECAM/GEOGLAM Science Meeting

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Investigators:

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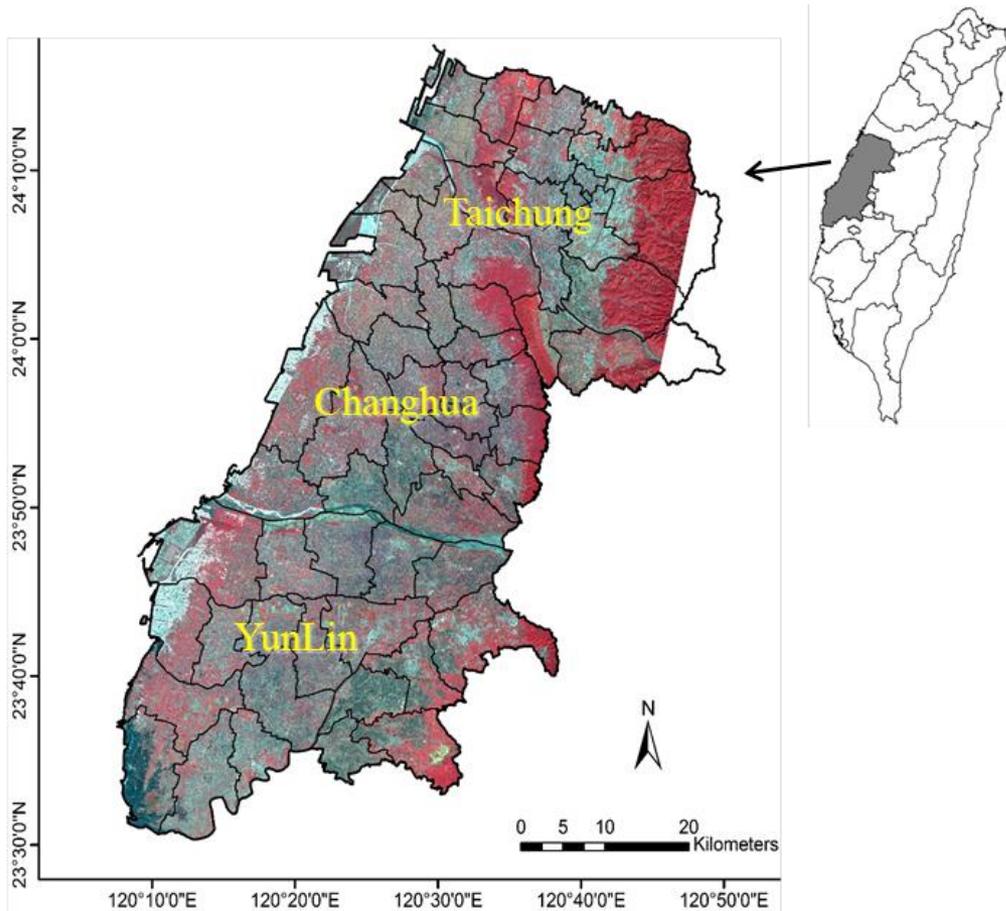
Mr. Horng-Yuh Gua, TARI, Taiwan

Dr. Nguyen Thanh Son, CSRSR, NCU, Taiwan

Dr. Cheng-Ru Chen, CSRSR, NCU, Taiwan

Mr. Tsz Feng Lin, TARI, Taiwan

Site description



- **Area: 3,070 km²**
- **64 townships**
- **Rice calendar:**
 - **1st crop: Feb – Jul**
 - **2nd crop: Jul – Dec**
- **Growing cycle: 110 – 130 days**

Site description

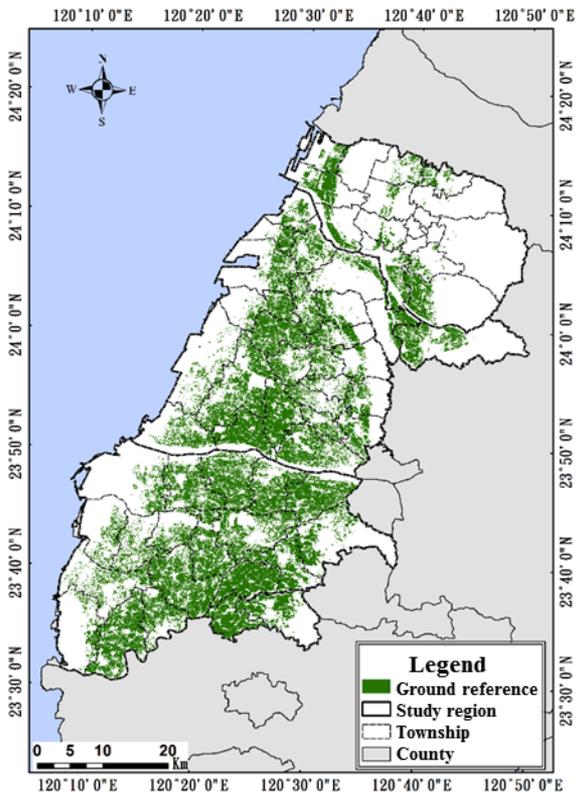
- Topography: Plain
- Soil type: Silt loam
- Drainage class/ irrigation: Moderate – imperfect
- Field size: 0.5 – 1.1 ha
- Climate: Subtropical monsoon / Typhoon/ Drought
- Agricultural method: Traditional farming

Crop identification and crop area estimation

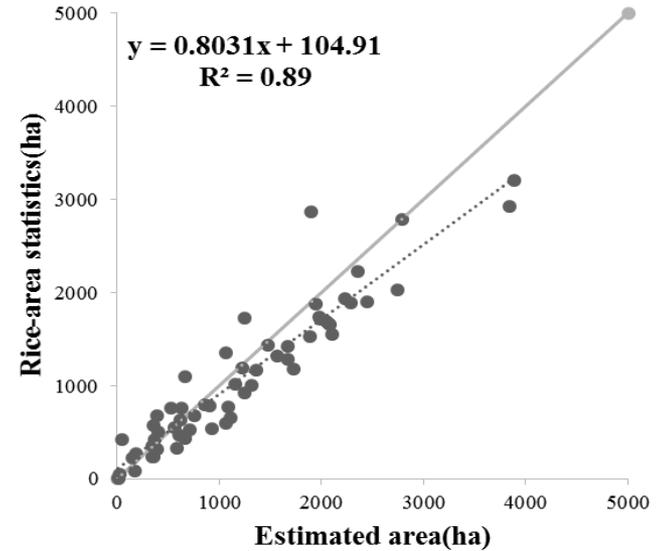
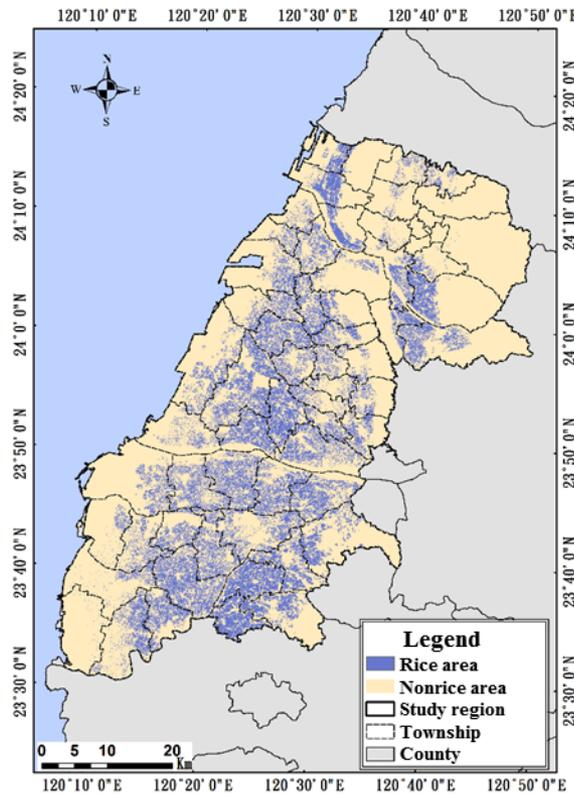
- Aerial photo
 - Rice field
- Optical satellite image
 - FORMOSAT-2, SPOT, Landsat and so on.
- Data fusion
 - SPOT/MODIS, Landsat/ MODIS
- SAR
 - Radarsat-2 2014 (SOAR-JECAM Project)

SVM classification result with Lansat 8/MODIS data fusion in 2013

Reference Map



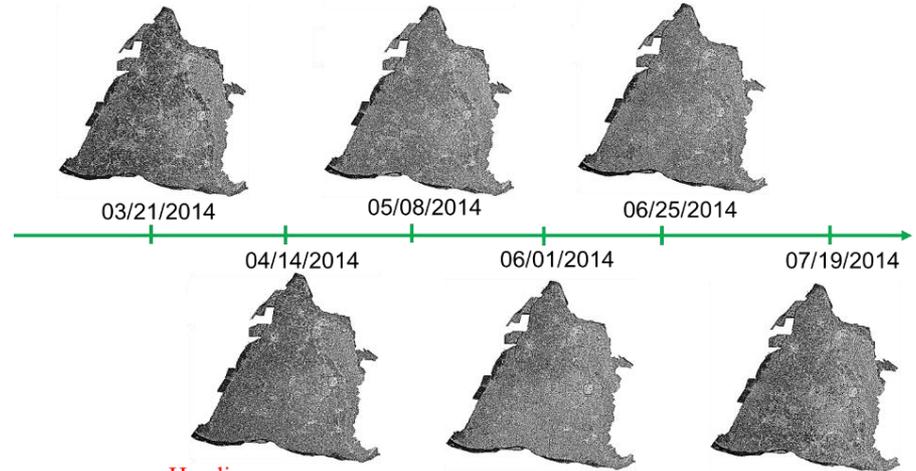
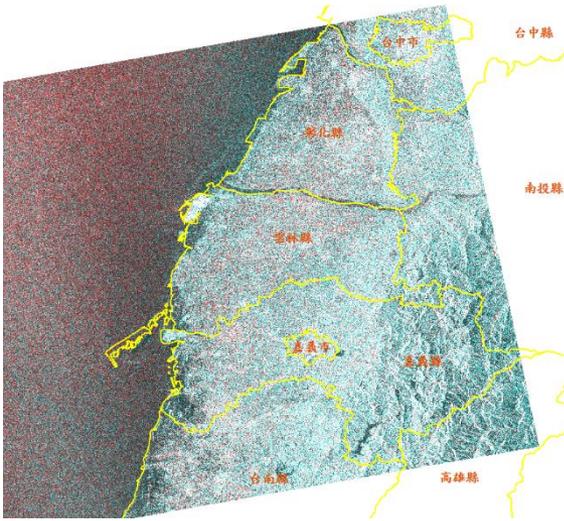
Classification map



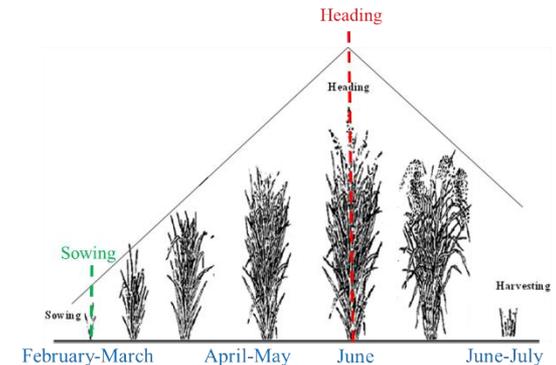
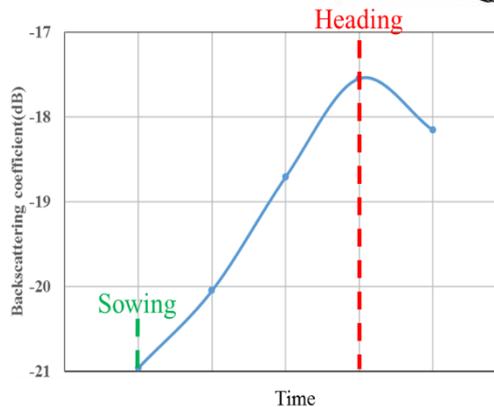
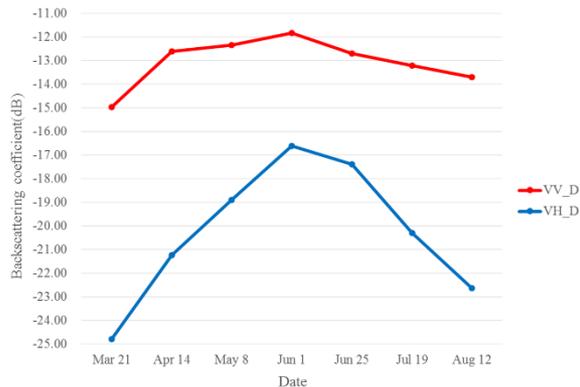
2013	Ground Reference		
	Rice	Non-rice	Total
<i>First rice crop mapping results</i>			
Rice	4,343	657	5,000
Non-rice	885	4,115	5,000
Total	5,228	4,772	10,000
PA (%)	86.86	82.30	
UA (%)	83.07	86.23	
OA (%)	84.58		
Kappa	0.69		

SAR data: Radarsat-2

- Provided by SOAR-JECAM project
- 1 February ~ 15 October, 2014
- Mode: VV + HV
- 1st rice cropping season (Feb.~ Jul.)
- Res. : 5 m



Rice backscattering characteristics



Normalized Difference Singma-0 Index

- **NDSI (Normalized Difference Sigma-naught Index, σ_0)** derives normalized different value of sigma-0 between two period images.
- The formula is as following and its value ranges from **-1 to +1**.

$$NDSI = \frac{\sigma_0^{\text{master}} - \sigma_0^{\text{slave}}}{\sigma_0^{\text{master}} + \sigma_0^{\text{slave}}}$$

- Based on rice phenology and backscattering characteristic, the images of **sowing** (**slave** image) and **heading** stage (**master** image) are selected to calculate NDSI value.

$$NDSI = \frac{\sigma_0^{0601} - \sigma_0^{0321}}{\sigma_0^{0601} + \sigma_0^{0321}}$$

Threshold-based classification results of the 1st crop in 2014

Rice referenced map

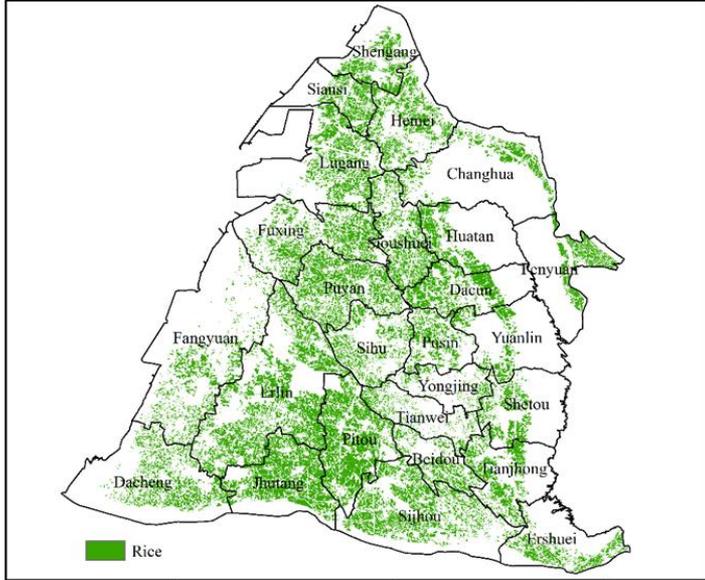
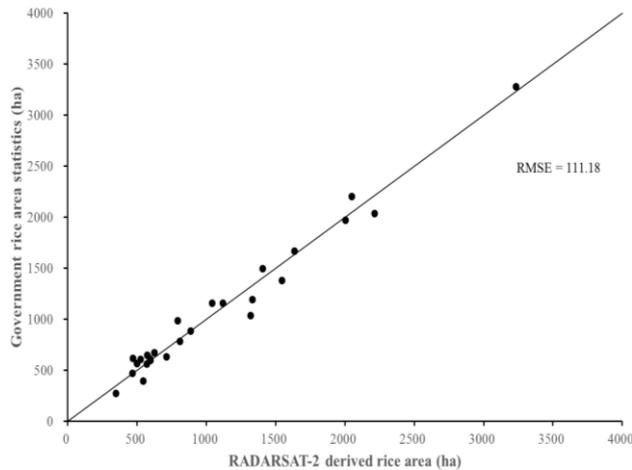
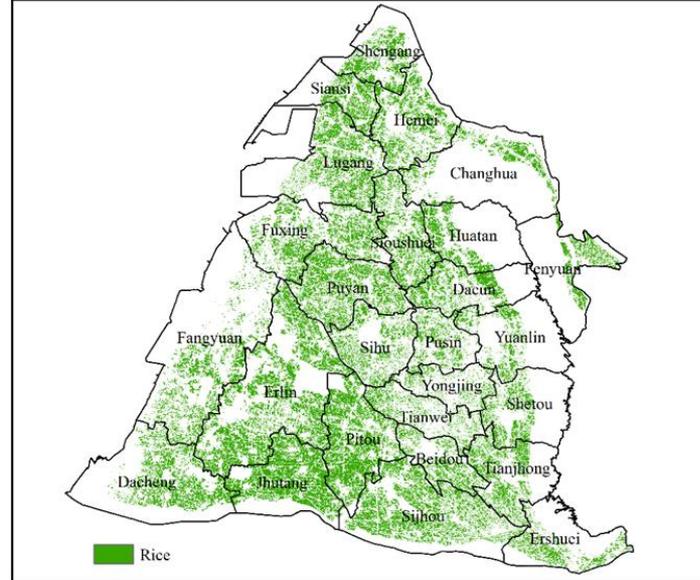


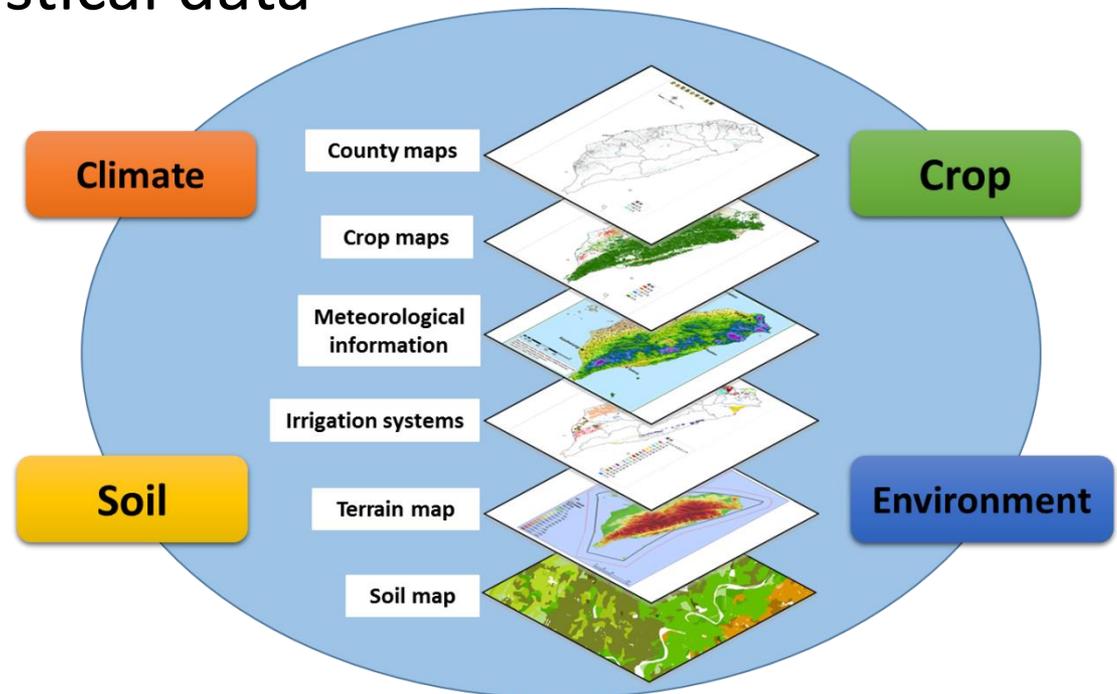
Image classification result



		Classification result		
		Rice	Non-rice	Total
Refer enced data	rice	861	139	1000
	non-rice	106	894	1000
	total	967	1033	2000
Producer Accuracy (%)		86.1	89.3	
User Accuracy (%)		89.0	86.5	
Overall Accuracy (%)		87.7		
Kappa coefficient		0.75		

In situ Data

- Land cover map
- Soil database
- Government statistical data
- Yield sampling



Record form

104年農地土地覆蓋現地調查-記錄表

第 頁，共 頁

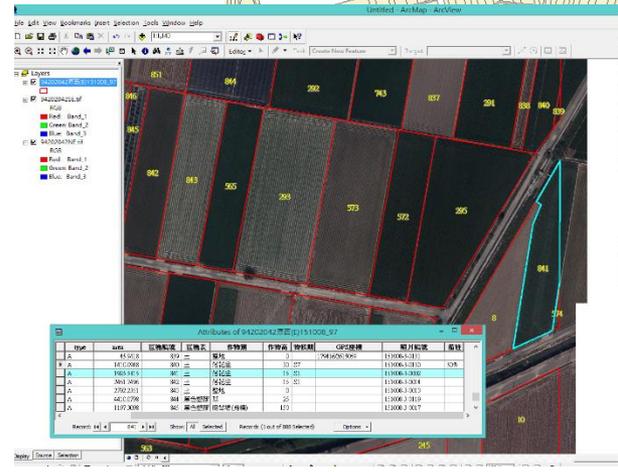
圖號圖名：		調查日期：			調查員：		
區塊編號	區塊表面	作物別 (利用情況)	作物 高度	物候期	GPS座標	照片編號	備註



record

Microsoft Excel - 94202042 潭西(E)-土地覆蓋野外調查表

	A	B	C	D	E	F	G	H
	區塊編號	區塊表面	作物別(利用情況)	作物高度(cm)	物候期(S)	GPS座標	照片編號	備註
2	574	土	落花生	15	S3	1794052614844	151008-3-0001	
3	841	土	落花生	15	S3		151008-3-0002	
4	8	土	毛豆	25			151008-3-0003	
5	295	土	落花生	30	S7		151008-3-0004	
6	572	土	甘藷	15			151008-3-0005	
7	715	土	太陽麻	8			151008-3-0006	
8	276	土	整地	0			151008-3-0007	
9	573	土	落花生	15	S3		151008-3-0008	
10	293	土	整地	0			151008-3-0009	
11	277	土	太陽麻	10			151008-3-0010	
12	713	土	落花生	30	S7	1791742614880	151008-3-0011	
13	565	土	草	10			151008-3-0012	
14	843	土	整地	0			151008-3-0013	
15	842	土	落花生	15	S3		151008-3-0014	
16	562	土	落花生	15	S3		151008-3-0015	
17	564	土	甘藷	15			151008-3-0016	
18	845	黑色塑膠布	樹苗場(尚植)	150			151008-3-0017	
19	846	土	落花生	30	S7		151008-3-0018	
20	847	土	落花生	30	S7		151008-3-0019	
21	714	黑色塑膠布	樹苗場(含溝壩)	160			151008-3-0020	
22	278	土	草	5		1790572614901	151008-3-0021	
23	431	土	蒜	5			151008-3-0022	
24	424	土	落花生	30	S7		151008-3-0023	
25	411	土	毛豆	20			151008-3-0024	
26	852	土水	毛豆	20			151008-3-0025	
27	788	土	毛豆	20			151008-3-0026	
28	425	土	落花生	30	S7		151008-3-0027	
29	757	土	草	8			151008-3-0028	
30	853	土	毛豆	40			151008-3-0029	
31	645	土	毛豆	20			151008-3-0030	
32	426	土	蒜	8		1788022614944	151008-3-0031	
33	429	土	落花生	30	S7		151008-3-0032	
34	433	土	毛豆	25			151008-3-0033	
35	410	土	落花生	30	S7		151008-3-0034	



Excel join to shapefile

Soil database derived from soil survey programs



高山土壤剖面



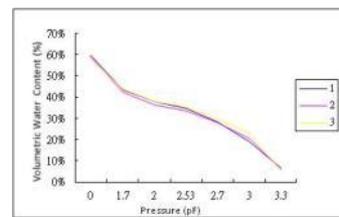
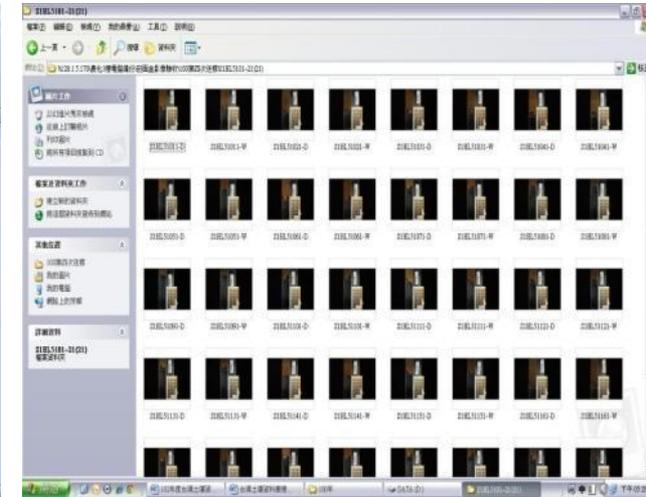
丘陵土壤剖面



平原土壤剖面



序	樣本編號	土壤類型	有機碳	砂	粉砂	粘土	砂土	粘土	L.砂%	L.粉砂%	L.粘粉%	粘粉%	粘粉%	校正粘粉%	校正粘粉%
1	S398N18012	B43	9.39	3.21	3.44	4.75	1.02	6.18	3.72	79.85	16.43	36.63	59.60	10.01	30.49
2	S398N27012	B50	8.95	1.36	1.49	6.07	1.29	7.59	1.72	81.31	16.98	16.65	67.77	14.40	53.02
3	S398N28021	013	9.08	1.47	1.58	6.04	1.47	7.61	1.39	79.34	19.27	17.35	66.49	16.15	52.01
4	S398N30015	945	9.44	0.85	0.98	6.49	1.97	8.59	1.51	75.57	22.92	10.38	68.76	20.86	53.80
5	S398N30021	003	9.22	1.60	1.71	6.01	1.50	7.62	1.49	78.88	19.63	18.59	65.19	16.22	50.99
6	S398N37022	H37	9.20	3.57	3.68	4.38	1.14	5.63	1.98	71.78	20.25	40.01	47.60	12.39	34.81
7	S398N37024	H39	9.24	3.25	3.30	4.68	1.26	5.99	0.87	78.10	21.03	35.74	50.63	13.64	39.52
8	S398N38021	B51	9.72	1.16	1.39	6.37	1.78	8.56	2.69	76.46	20.85	14.30	65.52	18.36	51.25
9	S398N38022	B34	9.37	3.69	3.95	3.92	1.32	5.68	4.50	72.24	23.25	42.11	41.82	14.10	30.26
10	S398N38023	B40	9.22	1.10	1.32	5.98	1.76	8.12	2.66	75.70	21.64	14.28	64.89	19.05	50.75
11	S398N49011	A20	9.48	1.11	1.31	6.32	1.86	8.37	2.35	75.47	22.18	13.78	66.64	19.58	52.13
12	S398N49012	B36	9.30	1.72	1.78	6.14	1.38	7.58	0.80	80.96	18.24	19.15	65.99	14.87	51.61
13	S398N49014	B38	9.38	0.98	1.14	6.55	1.69	8.40	1.89	78.02	20.09	12.14	69.87	17.99	54.67
14	S398N49015	G49	9.35	0.57	0.66	7.22	1.47	8.78	1.01	82.23	16.76	7.05	77.21	15.74	60.46
15	S398N49023	G44	9.04	1.07	1.07	6.24	1.73	7.97	0.00	78.31	23.69	11.84	69.04	19.12	54.02
16	S398N49026	G08	9.21	1.02	1.04	6.49	1.68	8.19	0.23	79.29	20.48	11.28	76.51	18.21	52.48
17	S398N49027	G28	9.12	1.01	1.09	6.39	1.65	8.11	0.94	78.74	23.31	11.91	70.02	18.86	54.79
18	S398C86011	B52	9.27	4.17	4.33	3.54	1.28	5.10	3.14	71.75	25.11	46.71	38.24	13.81	27.43
19	S398C86012	B17	9.01	4.34	4.36	3.26	1.38	4.67	0.36	70.07	29.57	48.35	36.19	15.33	25.83
20	S398C86016	B49	9.39	6.15	6.29	2.22	0.77	3.24	4.44	71.64	23.02	67.03	23.62	8.25	15.91
21	S398C87021	G20	9.29	0.65	0.74	7.10	1.45	8.64	1.07	82.16	16.77	7.99	78.41	15.60	58.82



Characteristic Curve



Sand micro-photo



Wet/dry colour

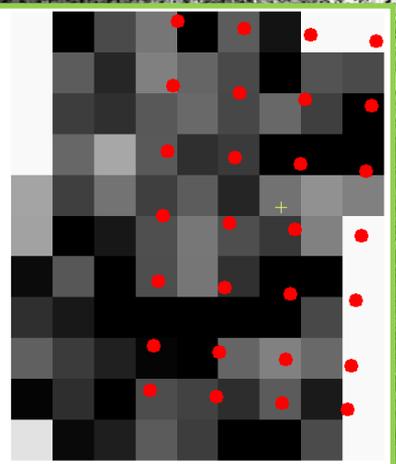
Yield survey



Sun Dried

Sample DW
($\omega < 15\%$)

Prediction of paddy rice yield by multi-temporal radar images



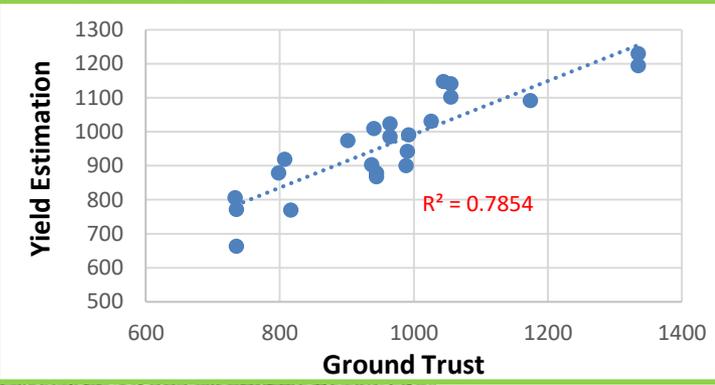
5 temporal radar images (Radarsat-2)

Preprocessing

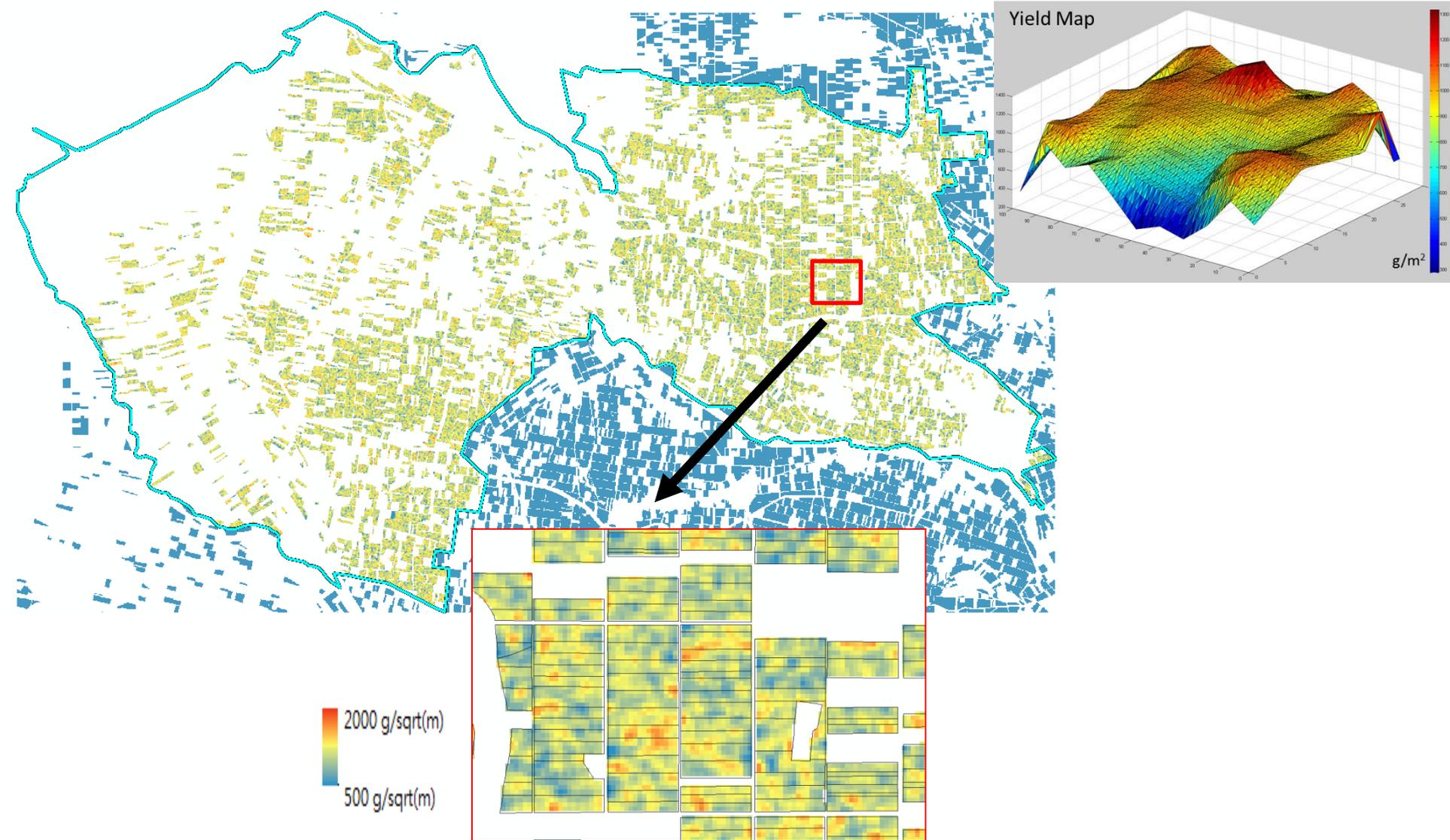
Geometry correction for investigating data

Multiple regression analysis

Yield Estimation Accuracy 85-90%



Estimating the yield of a township



Research plan and collaboration

- Use UAV , VGIS (volunteer geographic information system) and IOT/sensor network to collect field data.
- Method validation.
- New data: ALOS 2, Sentinel 1 / 2
- Crop yield model comparison
- The methods are still improved for mapping other short-term crops.
- We have participated in a collaborative project with scientists from other study sites.

***Thank you
for your attention***